Acorn Bioenergy Operations Ltd Odour Management Plan (OMP) Horse Close AD Plant

V1 Issue 1 – June 2025

1 Version Control

Issue	Date	Revision Details / Summary of Changes	Author	Approved by
V1 Issue 0	21/02/25	First Issue	Earthcare Technical Ltd	
V1 Issue 1	11/06/25	Revised First Issue	Earthcare Technical Ltd	

Document owner
Earthcare Technical Ltd

Management approval
XXXXX (Acorn Bioenergy Operations Limited)

Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

AD	Anaerobic digester/ digestion
ABL	Acorn Bioenergy Operations Limited
AMP	Accident Management Plan
BUU	Biogas upgrade unit
CH_4	Methane
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
DMS	Dimethyl sulphide
DSEAR	The Dangerous Substances and Explosive Atmospheres Regulations 2002
EA	Environment Agency
EMS	Environmental Management System
EWC	European Waste Catalogue
GFS	Global Forecast System
H_2S	Hydrogen Sulphide
LDAR	Leak detection and repair
LDPE	Low density polyethylene
mAOD	Metres Above Ordnance Datum
NGR	National Grid Reference
NH_3	Ammonia
NO_x	Oxides of nitrogen
OMP	Odour Management Plan
PRV	Pressure relief valve
PVRV	Pressure and vacuum relief valve
SCADA	Supervisory Control and Data Acquisition
TCM	Technically Competent Manager
UV	Ultraviolet
VOC	Volatile Organic Compound

1. Introduction

1.1. Site description

This Odour Management Plan (OMP) (**HRCL-ETL-OMP-RPT-P1**) is produced to support an application for a new bespoke Installation Environmental Permit for an anaerobic digestion (AD) plant including the use of resultant biogas for Horse Close AD Plant, located on agricultural land at Courteenhall, Northamptonshire, NN7 2QF centred on National Grid Reference (NGR): SP 77438 52588, herein termed 'the Site'. The plant will be operated by Acorn Bioenergy Operations Limited (ABL), herein termed 'the Operator'.

The facility will treat around 94,900 tonnes per annum (TPA) of liquid and solid feedstocks comprising livestock waste (poultry litter, farmyard manures and slurry), energy crops and crop residues; and as well as dirty water, several non-hazardous liquid wastes, to supplement process water use. With specific regard to emissions to air,

outlines the key infrastructure.

The site location is shown in Figure 1 - Map of Site location and receptors.

The Site is located within the administrative area of West Northamptonshire Council. The Site is situated approximately 170m west of the M1. Land use in the immediate locale is agricultural; the 6.2ha of Site area was previously arable land and is adjacent to a poultry unit, the manures from which will be treated within the AD Plant.

Human receptors within 2km of the site are listed in Table 2 and shown in Figure 1. Following a review of Site personnel attendance hours, the poultry unit has been dismissed as a potential sensitive receptor; employees are typically present on Site for short periods (<6 hours at a time) with the exception of approximately 2 days out of every 7 weeks when the units are cleaned out.

The nearest sensitive receptors include commercial premises at East Lodge, Courteenhall approximately 211m to the north of the proposed site boundary, and a residential property at East Lodge, Courteenhall located 270m north of the Site. The village of Roade lies over 1.4km west of the Site.

The operation of the proposed AD plant is outlined in Section 3.3. The proposed AD plant will operate 24-hours per day and will be open to deliveries only when site personnel are present from 07:00 to 19:00 (Monday to Sunday), thus avoiding night-time operations. 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.

1.2. Infrastructure

The proposed site layout is provided in Appendix A. The site infrastructure is listed in Table 1.

Table 1 List of site infrastructure

Item.	Working capacity
3 No. Silage clamps	Clamp 1: 19,900 m^3
	Clamp 2: 17,000 m^3
	Clamp 3: 11,760 m^3
	Total: 48,660 m^3
1 No. Silage Effluent Tank	54 m^3
1 No. Manure Reception Building	
Centriair abatement plant to manure building	
1 No. Straw Processing Building	
1 No. Straw set down bay	
2 No. Silage feed hoppers	120 m^3 each
2 No. Pre-treatment Hammer Mills	75 kW each
1 No. Solid Manure Feed System	65 m^3
1 No. Straw Feed System	65 m^3
1 No. Liquid Feedstock Tank	402 m^3
2 No. Water Tanks (Dirty)	402 m^3 each
Primary Digester-I	9,000 m^3
Secondary Digester-I	4,512 m^3
Primary Digester-II	9,000 m^3
Secondary Digester-II	4512 m^3
Tertiary Digester	7,444 m^3
1 No. Gas Dome above tertiary digester	3,800 m^3
2 No. Desulphurisation plant with oxygen injection	
Supervisory Control and Data Acquisition (SCADA) System	
3 No. Pasteurisation Tanks	25 m^3 each
1 No. Hygienized Digestate Tank	80 m^3
1 No. Digestate separation fully enclosed bunker	
2 No. Borger RC75	Up to 75 m^3/hr
1 No. Digestate Buffer Tank	402 m^3
1 No. Fire Water Tank	250 m^3
1 No. Digestate Lagoon (750mm freeboard)	12,350 m^3
1 No. Digestate offtake bay	5.1m^3
1 No. Clean Water lagoon (300m freeboard)	511.57 m^3
1 No. Dirty Water Lagoon (750mm freeboard)	510 m^3

2 No. Gas Valve/ Condensate Chambers (Condensate sump 1 & 2)	
Gas Booster and carbon filter	
2 No. Quanto Dual fuel CHPs with heat exchangers	2 No. 1200 kW each
1 No. Emergency boiler	500/ 560 kWtho
1 No. Emergency Flare	50-2,600 Nm^3/hr
1 No. Emergency Generator (Back up)	616 kW (770 kVA)
Biogas upgrade unit (BUU)	Capacity: 2,200 Nm^3/hr
Chiller(s) on BUU	
Biogas booster skid	
Compressors	
3 No. CO_2 recovery unit and CO_2 tanks	CO_2 tanks: 50 m^3
4 No. Biomethane (CNG) trailer bays /CO_2 off-take bays	
Secondary containment bund	
Parking area	
Access road	
Pump containers	
Site boundary fence	
2 No. Weighbridges	
Site office, Welfare, Workshop and Lab	
Additional clean water tank (Break tanks) and booster pumps	10 m^3
Wastewater package treatment plant (Klargester)	

1.3. Maintenance and review of the OMP

It will be the responsibility of the Site Manager to be fully aware of the contents of the OMP, to update the OMP and to provide relevant training to staff. It is expected that the Site Manager will also fulfil the role of the Technically Competent Manager (TCM).

A copy of the OMP will be maintained electronically and a paper copy held in the Site Office such that all employees have access to the latest version. The OMP will be reviewed on an annual basis (as a minimum) or immediately following any incident, complaints or a change in the operation or infrastructure to ensure that it continues to remain relevant to the Site activities and in line with current guidance. In the event of a revision to the OMP the Environment Agency (EA) will be notified, and a copy will be submitted for approval by the EA.

The Site Manager will ensure all persons performing tasks for the organisation or on its behalf, whose work may have a significant impact on the environment, are competent based on appropriate education, training and/or experience, and will retain associated records. The Site Manager will establish and implement procedures to identify the training needs associated with the OMP, the operation of the Site and the retention of staff competencies.

The training requirements for new staff will be determined following the Training Procedure **(ABL-QUAL-TRAINING-PRO-P1)**. All staff are to be fully aware of the OMP to ensure that

procedures and controls are upheld. All new staff will receive appropriate training on the OMP using the Environmental Management System (EMS) (**HRCL-ETL-EMS-MAN-P1**) and procedures to understand and reduce impact of the odour. Thereafter, any changes made to the OMP will be communicated to all operational staff via a Toolbox Talk. All formal training and Toolbox Talks received will be logged in the Skills and Competency Matrix **(ABL-QUAL-SKILLS & COMPETENCY MATRIX-MAT-P1).**

1.4. Relevant sector guidance on which this OMP is based

This OMP follows the suggested EA OMP format and has been produced in accordance with the following guidance:

EA H4 Odour Management guidance (2011)[1]

The EA H4 guidance is intended for permit holders and applicants, to advise them on how to comply with odour conditions set by the permit. It includes measures to assess, reduce, take control measures, and monitor pollution. It contains advice on odour thresholds or benchmarks for assessment.

Waste Treatment BREF (2018)[2]

The Waste Treatment BREF is a reference document on indicative Best Available Techniques (BAT) for the waste treatment sector. This includes BAT for the anaerobic treatment of waste, the associated emission levels (and other environmental performance levels) and the associated monitoring.

Biological feedstock treatment: appropriate measures for permitted facilities (2022)[3]

Appropriate measures guidance applies to aerobic and anaerobic processes including AD and the combustion or upgrading of the resulting biogas and treating the digestate (AD can include wet, dry and dry-batch digestion). There is overlap between BAT and necessary measures for waste operations. The EA uses the term 'Appropriate Measures' to cover both sets of requirements.

[1] Environment Agency (2011) H4 Odour Management – How to Comply with your Permit. Horizontal Guidance Note IPPC H4.
[2] Best Available Techniques (BAT) Reference Document for Waste Treatment, European IPPC Bureau, 2018
[3] Environment Agency (21 September 2022) Biological waste treatment: appropriate measures for permitted facilities. (https://www.gov.uk/guidance/biological-waste-treatment-appropriate-measures-for-permitted-facilities/1-when-appropriate-measures-apply).

2 Receptors

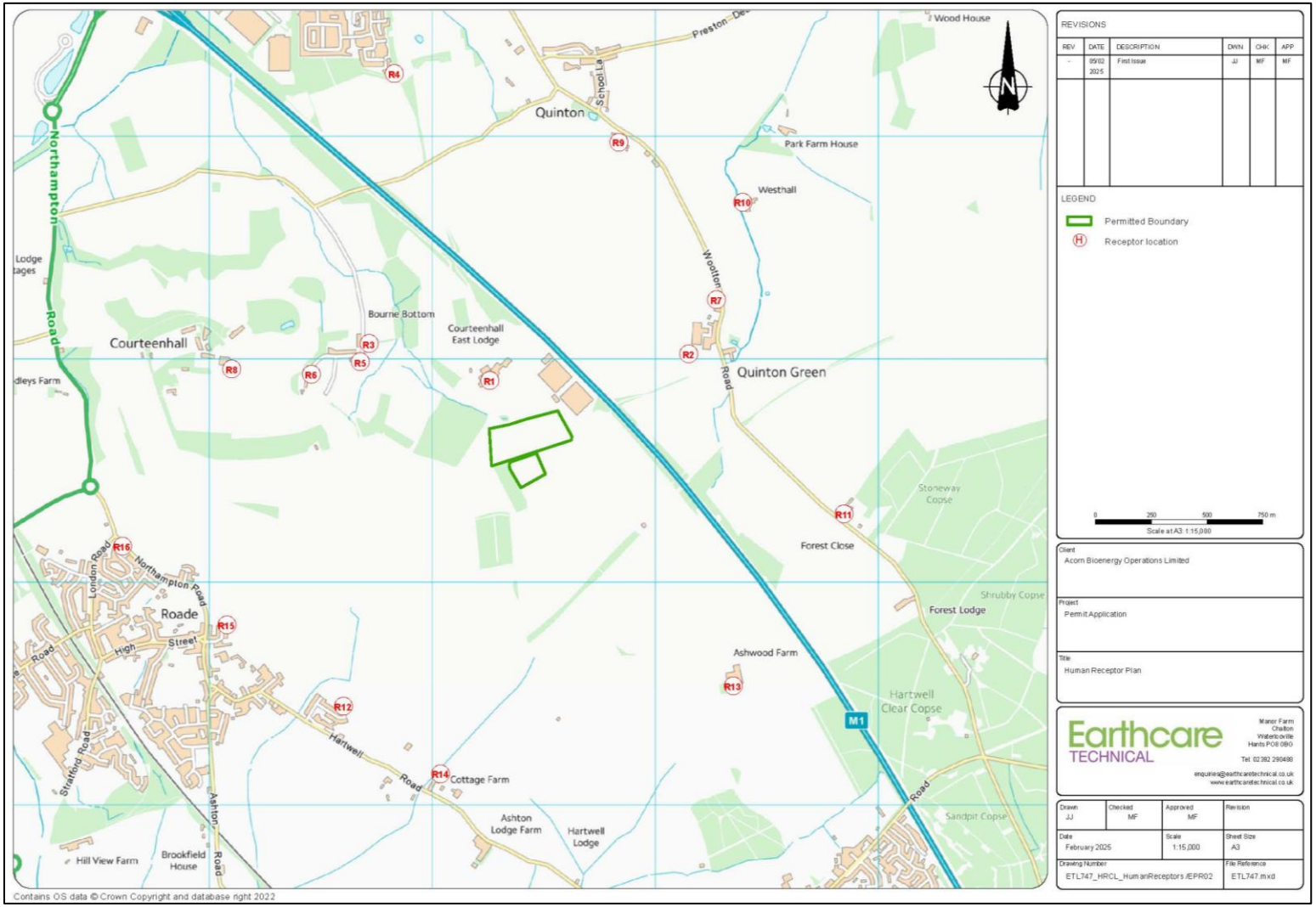
Receptors which may be sensitive to odour within approximately 2km of the site have been identified in Table 2 and Figure 1.

2.1. Receptor List

Table 2 Receptor list

ID		Land use	Direction from Site	Approx. distance to Site boundary	Sensitivity to odour
R1	East Lodge, Courteenhall	Residential, commercial	N	211	High
R2	Quinton Green	Residential, commercial	W	634	High
R3	Courteenhall, West Northamptonshire	Residential	NW	645	High
R4	Bluebell Rise, Grange Park	Residential	NW	1,643	High
R5	Village Spinney	Residential	W	660	High
R6	St Peter and St Pauls Church	Place of worship	NW	836	Medium
R7	Quinton, West Northamptonshire	Residential	SW	865	High
R8	Courteenhall Farm	Residential, commercial	S	1,190	High
R9	Quinton	Residential	SW	1,239	High
R10	Quinton	Residential	NE	1,248	High
R11	Quinton	Residential	W	1,258	High
R12	14, Fox Covert Drive, Roade	Residential	SE	1,268	High
R13	M1, Quinton	Residential	SE	1,280	High
R14	Ashton, Roade	Commercial	SE	1,336	Medium
R15	Manor Close, Roade	Residential	SE	1,451	High
R16	Northampton Road, Roade	Residential	SE	1,702	High

Figure 1 Map of Site location and receptors

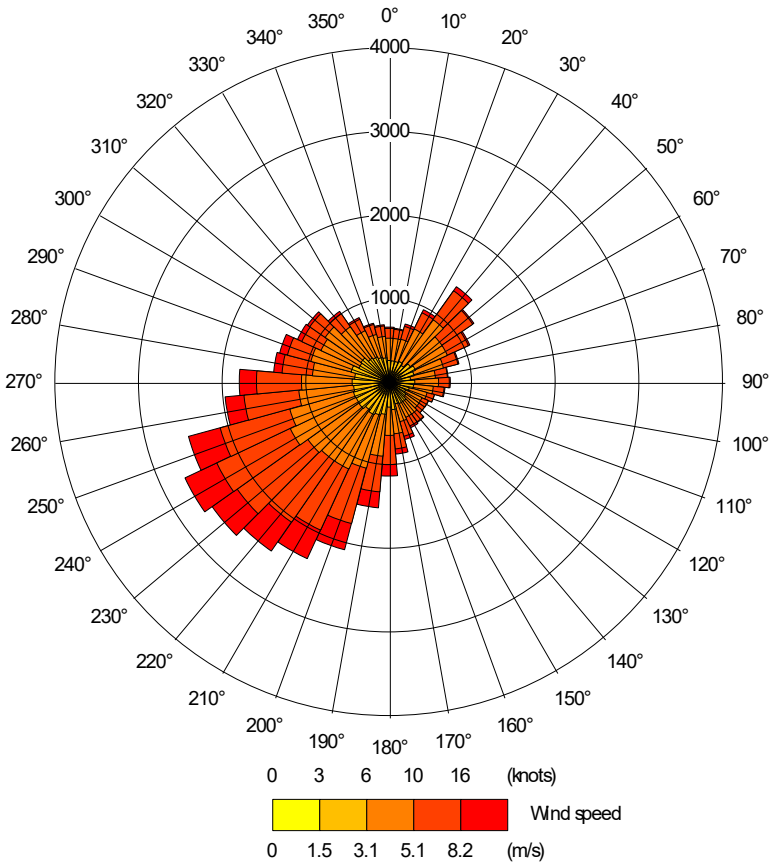


2.2. Wind rose and source of weather data

A wind rose of the Global Forecast System (GFS) meteorological data of the Site for a 5-year period shows the prevailing wind direction is from the south-west (Figure 2). The prevalence of winds from these directions means that those receptors that lie to the northeast of the site will be those most frequently 'downwind' of the site and therefore most likely to be impacted by odour emissions from the operation.

Site operatives will record daily weather conditions in an electronic Site Diary (**HRCL-QUAL-SITE DIARY-AQD 29-P1**) using information from the on-site weather station as part of the routine monitoring on-site. There will also be an on-site windsock, and meteorological data will be considered during routine odour surveys and prior to and during operations that have the potential to give rise to off-site odour impacts.

Figure 2 GFS meteorological data (52.166°, -0.868°), wind roses 2019 - 2023



Data source: AS Modelling & Data Ltd

3 Sources of odour and Site processes

3.1. Odorous materials entering and leaving site

All feedstock material will be transported to and from the proposed AD plant by road.

3.1.1 Solid Feedstock delivery

Cereal straw is provided by local farms and temporarily stored and processed on site within the dedicated Straw Processing Building. Following receipt, energy crops are stored within the silage clamps and covered with an impermeable cover. The dry matter content of energy crops is tested to confirm if they are suitable for ensiling prior to receipt. Neither feedstock will be odorous on receipt.

All vehicles delivering solid manures (waste) will be covered/ sealed. Manure will be delivered within the Manure Reception Building for use within the plant. As a worst-case, there will be a maximum of 400 tonnes stored within the Manure Reception Building at any time, following the periodic clearance of livestock housing for example, associated with a maximum of approximately 20 solid manure feedstock deliveries per day (assuming 70% is delivered via 27 tonne HGV, 30% by tractor and trailer). All energy crop (non-waste) and waste feedstock deliveries are weighed over the weighbridge and recorded within weighbridge system.

A Feedstock Management & Loading Procedure (**HRCL-QUAL-FEEDSTOCK MANAGEMENT-WI13-P1**) will be in place to ensure that the fast-acting roller shutter doors are only opened to allow vehicles in and out of the Manure Reception Building. All manure feedstock vehicle wheels will be washed down prior to exiting the reception building, so that manures are not tracked onto roads.

All waste accepted on site will be subject to pre-acceptance checks in accordance with the Waste Pre-Acceptance Procedure (**ABL-ENV-WASTE PRE-ACCEPTANCE-PRO-P1**). This procedure includes routine waste sample pre-analysis and verification analysis to check for potentially toxic elements (PTEs) and physical contaminants. The Feedstock & Digestate Manager is responsible for these checks and for booking feedstock into site, in consultation with the Site Manager. Only waste that has passed pre-acceptance checks and is booked in will be accepted on site.

When feedstock is delivered to site further checks will be carried out in accordance with the Feedstock Acceptance and Rejection Procedure (**ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1**). This includes paperwork checks by the Weighbridge Operator, visual checks by Site Operatives and verification feedstock sampling and analysis when necessary.

If an abnormally odorous load is received at the site i.e., a load with a ‘very strong’ odour (i.e., odour intensity 5 and above), it will either be rejected and removed or immediately used and the delivery vehicle will be washed down prior to leaving the enclosed reception building.

The Feedstock Acceptance and Rejection Procedure (**ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1**) is in place to ensure rejection of highly odorous feedstocks and that a first in first out (FIFO) procedure for feedstock is followed. Solid manure feedstock will be stored within the Manure Reception Building for up to a maximum storage time of up to 21 days. Odours from feedstock delivery will be treated in the building's air extraction and emissions abatement system prior to release via a single stack (emission point **A6** on Figure 4).

3.1.2 Liquid Feedstock delivery

The proposed feedstocks include a number of non-hazardous liquid wastes which may be used to supplement process water. These waste streams are not part of the current mass balance.

Liquid feedstock will be delivered in sealed tankers. Tankers containing slurry or non-hazardous liquid waste reverse up to the liquid feedstock reception point, couple up and discharge the load via sealed pipework into the Liquid Feedstock Tank. There will be up to approximately 10 deliveries per week, assuming 70% is delivered via 27 m^3 tanker, and 30% by 13 m^3 tractor and tanker.

When liquid feedstock is delivered to the Site, checks that include verification of feedstock European Waste Catalogue (EWC), waste description, and that sampling and analysis has been undertaken will be carried out, in accordance with the Feedstock Acceptance and Rejection Procedure (**ABL-ENV-FEEDSTOCK ACCEPTANCE & REJECTION-PRO-P1**).

Reception of liquid feedstocks is carried out in accordance with the Liquid Waste Reception Procedure (**ABL-ENV-LIQUID WASTE RECEPTION-PRO-P1**). Tankers reverse up to the liquid loading point, couple up and discharge the load via sealed pipework into the Liquid Feedstock Tank (402 m^3 capacity). All tanks are labelled, and unloading is supervised by site operatives.

Emissions from the tank are expected to occur as displaced air during filling of the tank. The headspace of the Liquid Feedstock Tank will be linked to an impregnated carbon filter outlet (emission point **A20**) to ensure any displaced air from the tank is contained and treated (minimum 80% emissions reduction). Should the Site accept slurry to replace manure and process water volume to balance dry matter, the tank will be used to store a maximum quantity of 100 m^3 slurry (limited to maintain available capacity for process water storage). The maximum residence time of liquids within the storage tank will be 14 days.

3.1.3 Solid digestate storage and removal

Digestate separation and the storage of separated solid fibre will be contained within a Digestate Separation Bunker. The building has a roof which forms a sealed join with the bunker base and a roller shutter door opening. The separated fibre will fall into the concrete storage bay below the separators and will then be removed to destination field heaps on farms using a tractor and large trailer and/or tipper lorry. Approximately 26,182 TPA of solid fibre digestate will be produced. Solid fibre digestate will be removed from site up to 7 times per working shift,

based on 50% of the digestate removed via 27 tonne HGVs, and 50% via 13 tonne farm tractor and trailer.

3.1.4 Liquid Digestate storage and removal

Separated liquor digestate will be pumped from the separators enclosed within the Digestate Separation Bunker to:

- the Digestate Buffer Tank (402 m^3) for recirculation; or
- the covered Digestate Storage Lagoon with working capacity of 12,350 m^3

Digestate liquor will be removed from the Digestate Storage Lagoon 2No. tanker loading points, each fitted with an impregnated carbon filter emissions abatement system. It is expected that 75% of all vehicle offtake movements will take place at the main site's loading point (**emission point A24**), while the remaining 25% will occur at the loading point adjacent to the digestate lagoon (**emission point A21**).

Approximately 67,454 TPA of digestate liquor will be produced that will be transferred for spreading and/or to dedicated offsite storage on destination farms. It is expected that liquid digestate will be removed from site on average 11 times per day based on 60% of the liquor removed daily via an HGV vehicle (capacity 27 m^3) and 40% via tractor and trailer/ slurry tanker (capacity 13 m^3), subject to availability.

Table 3 - Odorous Materials, below lists all materials delivered to site and those with the potential to become odorous as a result of processes on-site.

3.2. Odorous materials (without mitigation)

Table 3 Odorous Materials

Odorous and potentially odorous material (any solid, liquid or gas)	Odour potential (High Risk / Medium Risk / Low Risk)	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	Location of odorous materials on site	Additional comments
Maize silage	Medium Risk	Approx. 24,000 tonnes [(a)]	12 months	• Clamp 1 – 19,900 m^3 • Clamp 2 – 17,000 m^3 • Clamp 3 – 11,760 m^3 Total: 48,660 m^3	Grown under farm contracts
Wholecrop silage	Medium Risk	Approx. 23,600 tonnes [(a)]	12 months		Grown under farm contracts
Straw	Negligible	4,000 tonnes	10 weeks	• Straw Processing Building, containing storage bay for crushed wet straw; 2 No. straw extruders with 1 No. feed hopper • 1 No. external set down bunker • Clamps	Grown under farm contracts. Straw will be treated on a daily basis and temporarily stored in the set-down area or on the clamps. Straw will be used in the process at a rate of 55 tonnes per day.
Farmyard manure	High Risk	Approx. 400 tonnes total solid manure in building	21 days	• Manure Reception Building	Local farms, contracts in place with suppliers. Manure will be used in the process at a rate of 46 tonnes per day.
Chicken manure	High Risk				
Cattle slurry/ pig slurry	High Risk	Approx. 402 m^3 (Liquid Feedstock Tank capacity)	14 days	• Liquid Feedstock Tank	Local farms, contracts in place with suppliers. Displaced air from the Liquid Feedstock Tank headspace during filling will be abated via a carbon filter (minimum 80% emissions reduction)
Silage effluent	Low / Medium Risk	54 m^3 Total leachate storage capacity = 54 m^3 + 804 m^3 =858 m	14 days	• 1 No. Silage Effluent Tank (54 m^3) • Dirty Water Tanks (each 402 m^3)	Sealed storage for effluent arising from the clamps from which the leachate is pumped to the 2No. above ground Dirty Water Tanks (each 402 m^3).

Odorous and potentially odorous material (any solid, liquid or gas)	Odour potential (High Risk / Medium Risk / Low Risk)	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	Location of odorous materials on site	Additional comments
Dirty water	Low Risk	Total: 1,770 m^3	14 days (a)	• 1No. Liquid feedstock Tank (402 m^3) • 2No. Dirty Water Tanks (402 m^3 each) • Underground Silage leachate tank (54 m^3) • Storage in Dirty Water Lagoon (510 m^3)	Includes surface run-off / dirty water from drainage systems which is fed back into the process. Contained within sealed system/ tanks. Should capacity be reached within the holding tanks, the Dirty Water Lagoon will allow 510 m^3 of water to be stored.
Non-hazardous liquid wastes	02 03 liquid wastes 02 03 01 02 03 04 02 03 05 02 04 liquid wastes 02 04 03 02 06 liquid wastes 02 06 01 02 06 02 02 07 liquid wastes 02 07 01 02 07 02 02 07 04 02 07 05	Unknown may replace process water volume as a contingency	21 days	• Liquid Feedstock Tank (402 m^3)	Composition expected to be less odorous than slurry.
Digester contents undergoing treatment	High Risk	Total 34,468 m^3	Three stage digestion process. Retention times: Primary – 34 days	• Primary Digester-I (9,000 m^3) • Secondary Digester-I (4,512 m^3)	Sealed tanks: biogas released only during digester tank pressure and vacuum relief valve (PVRV)

Odorous and potentially odorous material (any solid, liquid or gas)	Odour potential (High Risk / Medium Risk / Low Risk)	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	Location of odorous materials on site	Additional comments
			Secondary – 20 days Tertiary – 17 days Total: 71-day hydraulic retention time	• Primary Digester-II (9,000 m^3) • Secondary Digester-II (4,512 m^3) • Tertiary digester (7,444 m^3)	operation in over-pressure scenarios only.
Biogas	High Risk	PowerRing digester void space + Tertiary Digester Total = 6,129 m^3 Available storage in excess of 2.65 hours of production	Biogas production 2,315Nm^3/h	• PowerRing digester void spaces and Tertiary Digester (including gas dome) • Abnormal operation of 5 No. digester PVRVs	Sealed tanks. Each digester will have PVRVs. Biogas released from PVRVs in over-pressure scenarios only.
Liquid digestate	Medium Risk	12,350m^3	66 days (2 months' worth)	• 1No. covered Digestate Storage Lagoon (12,350m^3)	Residual emissions, following abatement, from covered Digestate Storage Lagoon (90% reduction), in addition to carbon filter outlet (minimum 80% reduction).
Solid fibre digestate	Medium Risk	215 tonnes	72 hours	• Digestate Separation Bunker	Stored within the Separation bunker following separation. Approx. 72 tonnes produced per day.
'Cleaned' biogas	Negligible / Low Risk	1,301 Nm^3/hr biomethane (maximum production capacity)	N/A	• Biogas Upgrade Unit (BUU) PRV • CO_2 recovery stack and PRV	Off-gas directed to carbon capture equipment. CO_2 emission from stack if carbon capture equipment not operational.
Combusted biogas	Negligible / Low Risk	2,315 Nm^3/h (maximum AD plant production capacity)	N/A	• 2 No. CHPs (1200 kWel each) • Emergency flare (50 -2,600 Nm^3/hr of biogas) • Emergency biogas boiler	Low residual odour from unburnt Non-methane Volatile Organic Carbon (NMVOCs).

Odorous and potentially odorous material (any solid, liquid or gas)	Odour potential (High Risk / Medium Risk / Low Risk)	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	Location of odorous materials on site	Additional comments
Emissions from air treatment Emissions abatement plant system (for Manure Reception Building)	Low - Medium Risk	Continuous (18,500 m^3/hr)	Sufficient extraction rate to maintain negative pressure within the building.	• 15.5m stack on Manure Reception Building	Emissions abatement system designed to reduce/ eliminate odorous compounds prior to discharge (95% reduction).
Emissions from air treatment (Liquid Digestate Off-take)	Low - Medium Risk	27 m^3 tanker	/	• Liquid Digestate off-take bay	Carbon filtration abatement system to reduce/ eliminate odorous compounds
Notes: (a) Additional off-site silage storage is available (b) Storage times will be highly dependent on rainfall.					

3.3. Overview of odorous processes and emissions

3.3.1 Process Description

This section provides a summary of the process which should be read in conjunction with the Process Flow Diagram **(HRCL-ABL-PROCESS FLOW-PFD-P1)** provided in Appendix A.

The operation will give rise to the channelled emissions to air listed in Table 4, some of which will release odour. In addition, there will be fugitive odour releases from a limited number of on-site sources, as shown in Figure 4, under normal operating conditions.

Table 4 Emission points to air

Emission Point Reference	Source
A1	Combined Heat and Power Engine stack 1
A2	Combined Heat and Power Engine stack 2
A3	Emergency Flare
A4	Emergency Boiler stack
A5	Emergency Diesel Generator
A6	Emissions abatement plant stack (Manure Reception Building)
A7	Biogas upgrade unit Pressure Relief Valve (PRV)
A8	Biogas upgrade unit carbon dioxide vent
A9	Carbon dioxide recovery plant PRV1
A10	Carbon dioxide recovery plant PRV2
A11	Compressor PRV 1
A12	Compressor PRV 2
A13	Underground Leachate Tank vent
A14	Pressure and Vacuum Relief Valve (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 (12,350m^3 capacity) 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 carbon dioxide vent
A24	Liquid digestate off-take point carbon filter outlet

3.3.1.1 Processing energy crops

The Silage Clamp cover is removed just enough to cut away the required quantity of feedstock and to keep disturbance of the ensiled material to a minimum. Silage cutting, transfer and loading will take approximately one hour on each occasion twice per day during which time there will be a release of odour from the agitated material. The two No. 120 m^3 capacity crop Feed Hoppers feed a hammermill pre-treatment process. The feedstock is then loaded through a Screw Loader into the PowerRing Digesters.

Dry straw is fed into a Straw Mill with water injection. The crushed moist straw may be stored in a bay within the building prior to being fed into the feed hopper serving the 2 No. Straw Extruders. Moist extruded straw lands in an external bunker, the Straw Set Down Bay. The processing and temporary storage of straw will not cause emissions of odour.

3.3.1.2 Processing waste feedstocks

The only waste feedstocks accepted are manure and, potentially, slurry or non-hazardous liquid wastes if these are to be used to supplement liquid process water. Solid wastes (poultry and farmyard manure) are stored within a dedicated bays in the Manure Reception Building. A front loader will be used to load manure into the conveyor hopper inside the building for treatment therefore, there will be no unnecessary removal of waste from the building. The building will benefit from an extraction and emissions abatement system, as detailed further in Section 3.3.2.

The Liquid Feeding System uses digestate from the Digester Tanks to pre-mix the solid feedstock to homogenize the incoming biomass prior to transfer to each of the PowerRing Digesters. This is carried out in an enclosed system with no emission to air, and in accordance with the daily feed plan and controlled via the SCADA control panel.

Liquid waste feedstocks are discharged from the delivery tanker and macerated within the tanker dispatch pump during transfer into the Liquid Feedstock Tank where they are stored pending feeding into the PowerRing Digesters that incorporate a primary and secondary digester in a unique Biogest design. The vent on the Liquid Feedstock Tank will be connected to an impregnated carbon filter for emissions abatement (emission point **A20**).

3.3.1.3 Processing dirty water

Both clean and dirty water will be captured on Site and reused within the AD process. The recirculation of clean and dirty water is shown in Appendix A, Figure 10, Drainage Process Flow Diagram (**HRCL-ABL-PROCESS FLOW-PFD-P1**).

Silage effluent from the silage clamps is directed to an underground leachate storage tank, from where it is pumped to the above ground Dirty Water Tanks (each 402m^3). The Silage

Effluent Tank will be fitted with one vent (emissions point **A13**), from which there may be an emission of odour.

There is the potential for silage effluent to reside in drainage channels and cause odour in hot periods. Therefore, daily checks and, if required, clearing/ flushing the clamp drainage channels will be included within the clamp maintenance procedures.

Dirty water draining from areas within the containment bund (e.g. around the Feed Hoppers, the clamp covers) and from within the Manure Reception Building and the Digestate Separator Building is collected through a series of drainage channels, pipes and chambers and stored within the process water tanks; the Liquid Feedstock Tank (402 m^3) and the 2 No. Dirty Water Tanks (402 m^3) for use in the AD process.

During periods of high rainfall additional dirty water storage is provided by the Dirty Water Lagoon which will allow 510 m^3 of water to be stored (i.e., up to 5 days' worth of process water storage). Surface waters held within the lagoon would be dilute at these times and would not be expected to be a source of odour.

Surface water from 'clean' hardstanding areas is discharged into a Klargester Full Retention Separator to ensure oil, chemicals and solids are removed. The outflow from the separator along with clean water from building roofs is stored within the Clean Water Lagoon (511 m^3). This clean water is either used within the process via the 2 No. Dirty water Tanks or outfalls to an existing watercourse. Surface waters held within the Clean Water Lagoon would not be a source of odour.

3.3.1.4 Digestate

Whole digestate from the Tertiary Digester will be pasteurised within the Pasteurisation Unit. The unit contains two cavity pumps and a macerator and 3 No. Pasteurisation Tanks, each of 25m^3 capacity, (at any one time one tank is filling, one is holding at pasteurisation temperature and one is emptying). Pasteurised digestate is pumped to the Hygienized Digestate Tank (80 m^3). Any displaced air during the pasteurisation process will be directed either to the gas line or to the Manure Reception Building emissions abatement plant.

Whole digestate is then routed to the 2 No. RC75 Börger type mechanical separators, each capable of separating 75 m^3/hr of whole digestate. The separators and separated digestate are contained within the Digestate Separation Bunker. The building has a roof which forms a sealed join with the bunker base and a roller shutter door opening. Separated fibre collects in the storage bay below the separator and is then periodically removed to destination field heaps on farms for use as a soil improver.

Separated liquor is pumped from the separator to either: the sealed 402m^3 Digestate Buffer Tank for recirculation into the process or the 12,350m^3 covered Digestate Storage Lagoon.

Any displaced air during this transfer will be directed either to the gas line or to the Manure Reception Building emissions abatement plant.

The covered Digestate Storage Lagoon will have an LDPE floating cover that will be installed and seam welded within the anchor trench around the lagoon such that the storage lagoon is sealed (airtight). The use of a three-stage digestion process with a 71-day hydraulic retention time reduces the residual biogas potential. Further process monitoring and management of the AD process ensures that this is achieved. This is the primary control to ensure that a stable digestate is stored within the lagoon.

There will be a gas collection duct system around the upper perimeter of the Digestate Storage Lagoon to collect and direct displaced air/ emissions to a fan-assisted abatement system that will comprise an impregnated carbon filter, that will achieve a minimum emissions reduction of 80%. During filling of the lagoon, when the Site is supervised during operational hours, a fan will be used to assist with ventilating displaced air through a carbon filter outlet (emission point **A19**). The fan will not operate at other times and the connection to the carbon filter sealed. There will be a PRV connected to the Liquid Digestate Lagoon as a safety feature to manage over pressure within the lagoon storage system should this occur (emission point **A22**). This will not operate under normal conditions.

Tankers will be filled with liquid digestate at one of two tanker Off-take points (emission points **A21** and **A24**) each fitted with an impregnated carbon filter emissions abatement system, that will achieve an 80% emissions reduction.

3.3.1.5 Biogas and biomethane

The gas storage afforded by the void space within the PowerRing Digesters and Tertiary Digester, as well as the gas dome, is approximately 6,129m³ which, given maximum gas production levels of 2,315 Nm³/hr is in excess of 2.65 hours of production. This storage capacity allows for planned routine gas upgrade unit maintenance events. Storage levels will be maximised prior to any planned shutdown.

Hydrogen sulphide (H_2S) levels within the digesters will be tested and monitored on SCADA. There are 2 No. Desulphurisation plant with oxygen injection on the PowerRing Digesters. Around 17 Nm^3/h of gaseous oxygen is injected into the digesters to increase the oxidising capacity of the system, thus inhibiting sulphate-reducing bacteria activity and promoting sulphide oxidation. Ferric hydroxide powder will be used to further control H_2S levels if needed. The SCADA system manages the biogas treatment, gas distribution system and emergency flare if required.

Each digester will have a PVRV (emission points **A14** to **A18**) to emit biogas or take in air if there is an over-pressure or under-pressure event respectively. PVRVs will not operate during normal operation, over-pressure is managed by operation of the Emergency Flare (emission point **A3**) before the PVRVs are operated. There will be a brief, intermittent release of odour associated with the abnormal operation of the digester PVRVs, in over-pressure scenarios only.

Biogas (~60% CH_4 by volume) will enter the Biogas upgrade unit (BUU) where it will be treated to create biomethane (~97% CH_4 by volume) which leaves the BUU. Biogas from the gas holders will be pass through a series of gas treatment steps including cooling, filtration (2 No. carbon filters to remove H_2S and 1 No. filter for Volatile Organic Compounds (VOCs), compression prior to three-stage membrane filtration which separates the biogas into methane (CH_4) and carbon dioxide (CO_2). Biomethane is transported offsite for injection to the National Gas Grid via virtual pipeline.

The BUU will be fitted with carbon capture equipment so the remaining output stream, CO_2 with traces of CH_4, H_2S and TVOC, will not be vented to air but captured prior to liquefaction of the CO_2. CO_2 captured in the gas upgrading process will be cleaned, liquefied using equipment to upgrade the CO_2 to 99.9% purity. CO_2 is stored pending removal off site via a filling station.

Under normal operating conditions there will be no emissions from the BUU. There is a PRV on the BUU (**A7**) which will only operate under abnormal operating conditions. If the CO_2 recovery plant is not operating, then CO_2 is released from the CO_2 stack on the BUU (**A8**) as is normal practice when CO_2 capture equipment is not installed.

When both the BUU and CO_2 recovery plant are operational, cleaned gas will be released from the CO_2 recovery process PRVs in over-pressure scenarios only (emission points **A9** and **A10**). CO_2 may also be released via a vent on the CO_2 capture equipment (emission point **A23**), when carbon capture equipment is not being undertaken.

3.3.1.6 Combustion emissions

Two CHPs burn either biogas or natural gas and may emit pollutants (SO_2, TVOC, NOx and CO) from 8.7m stacks (emission points **A1** and **A2**). The CHPs will be used to provide heat and power to the proposed AD plant. The emergency dual fuel biogas boiler (emission point **A4**) will be used to generate heat for the proposed AD plant when the CHPs are unavailable. The boiler will release emissions to air of SO_2, NOx and CO from the 7m stack. Emissions from the combustion of biogas and natural gas are not expected to be a source of odour.

Waste gas may arise in the form of biogas during, for example, periods of extended breakdown and maintenance or malfunction of the BUU. Feeding rates will be reduced in these circumstances to avoid production of waste gas; any surplus biogas will be burnt in the flare (emission point **A3**). The emergency flare ignites automatically and is sized appropriately; it can burn up to 2,600 Nm^3/hr of biogas. The flare should operate for a limited number of hours per year as it is only used under abnormal operating conditions.

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 out of specification, and this pure biogas stream will be returned to the gas storage dome above the Tertiary Digester. In the unlikely event that this causes any over-pressure, biogas would be flared. Emissions from the combustion of biogas/ biomethane are not expected to be a source of odour.

An emergency diesel generator (770kVA) (emission point **A5**) will provide power when the CHPs are not operational and if power is not available from the grid. It is anticipated to operate for a few hours per year under emergency conditions and is not expected to be a source of odour.

3.3.2 Odour control of emission in the Manure Reception Building

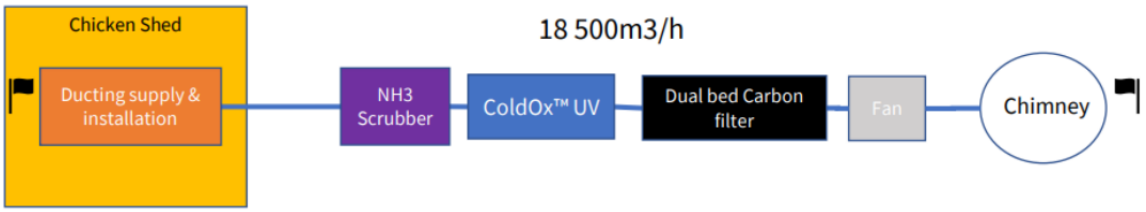
In the Manure Reception Building waste manure feedstock will be received, stored, and transferred into the hopper. Odour emissions from the Manure Reception Building are controlled using an air handling and emissions abatement system and fast-acting roller shutters on the vehicle access doors of the building. The air handling system will maintain a negative pressure in the building to ensure effective treatment within the emissions abatement system.

The design of the emissions abatement system for the Manure Reception Building has been informed by characterisation of emissions from the surface of chicken manure, (the principal solid manure feedstock material), and is designed to abate the odorous compounds anticipated. The air handling and emissions abatement system, provided by Centri-Air AB, utilises a multi-stage treatment process including chemical treatment to reduce odorous compounds.

The stages are shown in Figure 3 and include:

- Ammonia scrubbing system consisting of a chemical resistant packed column with an acid/ alkali dosing system, and including an effluent/wastewater removal system to remove the spent/consumed sulphuric acid/water solution
- High intensity ultraviolet (UV) light which performs cold oxidation of VOCs a treatment termed ‘ColdOx UV’. This provides two wavelengths of UV light to both breakdown complex compounds and to produce ozone, which is used to reduce odour, VOCs, H_2S, mercaptans, and dimethyl sulphide (DMS).
- Double layer (dual bed) carbon filter system allowing for the use of two types of carbon media within the same system 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 integral fan will achieve the specified air flow of 18,500Nm3 per hour and ensure negative pressure within the building in normal operational conditions
- The treated air is released via a 15.5 m high stack (emission point A6) to meet the odour BAT-AEL of 1,000 ou/m^3 and 0.3 – 20 mg/m^3 for NH_3.
- The treatment process will be managed by a control system that will incorporate H_2S sensor(s) to ensure system performance

Figure 3 Flow diagram of proposed Centri-Air AB abatement system



The scrubber stage for NH_3 removal consists of a reaction vessel with packing and distributor. The packed column includes a demister; water conditioned with sulphuric acid reacts with the NH_3 to form ammonium sulphate. The process water is drained when the ammonium sulphate concentration reaches approximately 25%. The process water would then be recirculated for reuse within the AD plant. The combination of fast-acting roller shutter doors, constant negative pressure and an emissions abatement system will minimise fugitive odour emissions from door opening; fugitive emissions from the Manure Reception Building are, therefore, assumed to be negligible. Technical information for the proposed emissions abatement system is provided in Appendix B.

3.3.3 System safeguards

To ensure odour treatment system performance and compliance over time there are operating safeguards:

- The system has been designed by Centri-Air AB based on previous measurements and reference values for expected concentrations at the inlet to the system. Centri-Air AB state there is a degree of tolerance factored into the design; if the inlet values are higher than expected there is spare capacity in the UV power, and retention time in the carbon filter to increase the capacity if necessary.

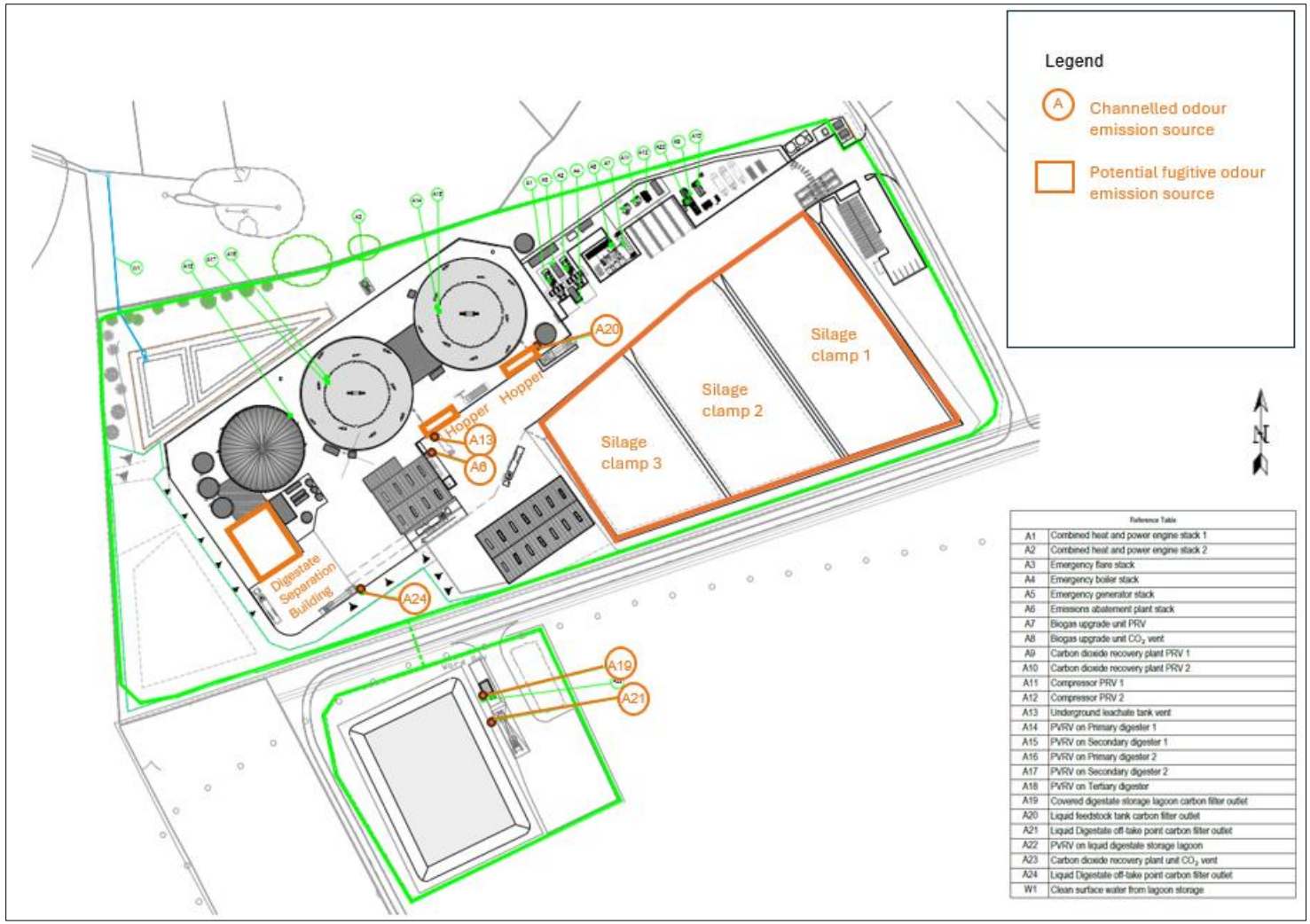
- Regular inspection of the emissions abatement system for the Manure Reception Building in accordance with the Maintenance Planner (**HRCL-QUAL-MAINTENANCE PLANNER-AQD 27-P1).**

- System sensors will log parameters that indicate if an error has occurred, or if there is a need for carbon exchange or replacement of lamps. For example, there will be UV power monitoring, to determine when the UV lamps fail.

- A planned preventative maintenance programme will be in place for the Centri-Air AB system with the manufacturer's inspection and maintenance recommendations and as per the monitoring and maintenance schedules of the EMS (**HRCL-QUAL-MAINTENANCE PLANNER-AQD 27-P1**). This will include prescribed actions to maintain the system's performance. Critical parts will be held on site.

An example of a service and maintenance schedule is provided in Appendix B.

Figure 4 Permit boundary and odour emissions point plan



Note: Base plan produced by Acorn Reference: HRCL-LAY-ABE-010RevC Site Emissions Plan. Reproduced by Earthcare Technical Ltd June 2025.

4 Control measures and process monitoring

4.1. Appropriate Measures / BAT

Table 5 lists the odorous and potentially odorous materials held or odorous processes undertaken on-site and the relevant controls and actions that the operator will take to prevent or minimise odour from these sources that include containment, abatement, Appropriate Measures, and BAT.

Table 5 also sets out: how often these control measures on site are monitored; the process parameters that are monitored (including the optimum performance levels for each parameter); associated trigger levels (that will help identify that the process is under control and there is potentially a higher risk of odour); and actions to be taken if the monitoring shows results outside of the optimum performance levels.

In each case, the following trigger limits will also apply that indicate that an aspect of the site is operating outside of optimum performance levels, that will initiate an investigation as to the odour source and implementation of appropriate remedial action(s):

1. Receipt of an odour complaint (Section 5.1)
2. Boundary and/or off-site odour (odour intensity 3 or above) as detected during routine (daily) odour monitoring ('sniff test' method) (Section 5.3)
3. Strong odour (odour intensity 4 or above) reported by staff/ visitors on arrival at the site (Section 5.3)

The details of all monitoring carried out in response to the above will be recorded accordingly.

Table 5 Monitoring procedures for Appropriate Measures/ BAT

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
Vehicle Movements (imports/ exports)	**Containment** • Liquid feedstock transferred in sealed tankers • Solid manure feedstock, other than that sourced from the adjacent poultry unit, will be transported in sealed/ covered vehicles to enclosed reception building • Fibre digestate transferred via covered vehicle/ trailer • Liquid digestate is transferred in tankers. **Management** • Adherence to Waste Pre-Acceptance Procedure (**ABL-ENV-WASTE PRE-ACCEPTANCE-PRO-P1**) • Adherence to Feedstock Acceptance and Rejection Procedure **(ABL-ENV-FEEDSTOCK ACCEPTANCE REJECTION-PRO-P1**) • Adherence to Liquid Waste Reception Procedure **(ABL-ENV-LIQUID WASTE RECEPTION-PRO-P1)** • Any spilled material will be immediately cleared (**HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1**) • Routine cleaning schedule for operational areas in accordance with Housekeeping Procedure **(HRCL-QUAL-HOUSEKEEPING-WI03-P1)** • Pressure wash wheels inside the reception building before they leave site when required.	**Constant** • Dynamic visual and odour observations by staff • SCADA (feed quantity) **Daily** • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Housekeeping Procedure (**HRCL-QUAL-HOUSEKEEPING-WI03-P1**)	Visual inspection (of vehicles). Daily visual checks to ensure operational areas kept clear of debris/ clean. Feedstock & Digestate Manager: feedstock and feedstock records through the Feedstock Acceptance and Rejection Procedure and Feedstock Management & Loading Procedure to ensure site treatment and storage capacity not exceeded. Odour 'sniff tests' (Section 5.3).	Very strong odour from vehicle prior to unloading manure (intensity 5 or above) and/or the Manure Reception Building ambient H_2S or NH_3 readings are above the safe working limits (8hr). Odour complaints attributed to this source.	Rejection of highly odorous feedstock in accordance with Feedstock Acceptance and Rejection Procedure (**ABL-ENV-FEEDSTOCK ACCEPTANCE REJECTION-PRO-P1**). The supplier will be contacted to advise of non-compliance and to understand why the abnormally odorous load occurred. In the event of re-occurrence, the contract arrangements with the supplier will be reviewed/ terminated as necessary. Review cleaning frequency of transfer vehicles.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
Solid feedstock receipt	**Containment** • Manure delivered within an enclosed Manure Reception Building under negative pressure controlled by an air handling and emissions abatement system and with fast-action roller shutter doors shut prior to load discharge. • Energy crops are delivered to silage clamps and covered within an impermeable cover for silage preservation, and odour prevention. **Management** • Adherence to Waste Pre-acceptance Procedure (**ABL-ENV-WASTE PRE-ACCEPTANCE-PRO-P1**) • Highly odorous feedstocks will not be accepted in accordance with the Feedstock Acceptance & Rejection Procedure (**ABL-ENV-FEEDSTOCK ACCEPTANCE REJECTION-PRO-P1**). • Feedstock tonnages will be monitored and controlled through the Feedstock Tracking Spreadsheet and verified through Daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • The Manure Reception Building will be cleaned in accordance with the Housekeeping Procedure **(HRCL-QUAL-HOUSEKEEPING-WI03-P1).** **Abatement**	**Constant** • Dynamic odour observations by staff • Supervised unloading • Visual checks by the Feedstock & Digestate Manager to ensure the site does not become over-supplied **Daily** • Tracking of feedstock receipt • AD Plant Daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Feedstock sampling in accordance with Sampling & Analysis Procedure **(ABL-ENV-SAMPLING & ANALYSIS-PRO-P1)**	Visual inspection (of feedstock) Feedstock Tracking Spreadsheet Representative samples of feedstocks will be taken in accordance with Sampling & Analysis Procedure that includes the frequency and method of sampling for each feedstock types. Odour 'sniff tests' (Section 5.3).	Door(s) stuck open. Feedstock booked in for next 24 hours exceeds storage capacity in Manure Reception Building. Feedstocks with high odour concentrations (intensity 5 and above). Decreased efficiency of emissions abatement system. Odour complaints attributed to this source.	Call door engineer if Operator unable to resolve. If manure reception storage is reaching capacity, feedstock deliveries will be ceased until process back under control. Extremely odorous feedstocks (intensity >5) will be rejected. The supplier will be contacted to advise of non-compliance. In the event of re-occurrence, the contract arrangements with the supplier will be reviewed/ terminated as necessary.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The air extraction and emissions abatement system will reduce odour emission concentrations and maintain negative pressure within the building • Emissions abatement system stack will be 15.5m high to ensure effective dispersal. • Efficiency of abatement system will be monitored and maintained.				
Opening of access doors to the Manure Reception Building	**Management** • Fast acting roller shutter doors will be installed on vehicle access / egress points on the Manure Reception Building. • Odour awareness and contingency measures included within staff inductions and training. • Maintenance and service contract in place with supplier. **Containment** • Manure Reception Building will benefit from an air handling system which will keep the building air under negative pressure.	**Constant** • Dynamic visual observations by staff during shift **Daily** • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**)	Roller shutter door speed (TBC) The appropriate 'hang time' for each access door will be set once operational. Odour 'sniff tests' (Section 5.3)	Door shutter speed (TBC) The appropriate hang time for each access door will be set once operational. Door(s) stuck open. Odour complaints attributed to this source.	Hang time for doors can be adjusted as required. Call engineer if Operator unable to resolve. Cease taking manure feedstock in the event of plant/ door failure to prevent build-up of material.
Solid feedstock treatment/ storage	**Containment** • Manure stored and transferred into dedicated feed hopper inside the building with air extraction and emissions abatement system • The silage clamps remain covered with just the working face open when material is not being loaded. **Abatement**	**Constant** • Visual checks by Feedstock & Digestate Manager • Dynamic odour observations by staff **Daily**	Visual/ odour inspection of feedstock for signs of degradation. Feedstock Tracking Spreadsheet.	Feedstock booked in for next 24 hours exceeds storage capacity in Manure Reception Building.	If Manure Reception Building storage is reaching capacity, feedstock deliveries will be ceased until process back under control. Increase the frequency of cleaning.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The air extraction and emissions abatement system will reduce odour emission concentrations and maintain negative pressure within the Manure Reception Building • Emissions abatement system stack will be 15.5m high to ensure effective dispersal. **Management** • Manure types are stored in separate piles. • FIFO procedure will be adopted in accordance with the Feedstock Loading & Management Procedure (**HRCL-QUAL-FEEDSTOCK MANAGEMENT-WI13-P1)** however, odorous materials that are deemed acceptable will be processed first. • The manure is conveyed via a hopper and front-end loader inside the building for treatment in the process. • Quarantined feedstock can be stored separately. • Feedstock tonnages will be monitored and controlled through the Feedstock Tracking Spreadsheet and verified through Daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Implementation of housekeeping regime **(HRCL-QUAL-HOUSEKEEPING-WI03-P1)** inside and outside the building • Odour awareness and contingency measures included within staff inductions and training.	• Tracking of feedstock receipt • Abatement plant: inspection of fan, filters, process parameters (see below for: Abatement Plant) • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**)	Odour 'sniff tests' (Section 5.3).	Feedstocks with high odour concentrations (intensity 5 and above). Odour complaints attributed to this source.	In the event of abatement plant failure, feedstocks would not be delivered to site to prevent build-up of feedstock.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
Liquid Feedstock receipt, pre-treatment/ storage	**Containment** • Liquid feedstock transported in sealed tankers and discharged into the sealed pre-treatment system prior to being stored in the Liquid Feedstock Tank. • The headspace of the Liquid Feedstock Tank is connected to a carbon filter to ensure any fugitive emissions are contained and abated (80% reduction). • Liquid feedstocks are transferred in sealed pipework into the digesters. **Management** • Receipt of liquid feedstock managed in accordance with Liquid Waste Reception Procedure (**ABL-ENV-LIQUID WASTE RECEPTION-PRO-P1**) • Compliance with spill control procedure (**HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1**) in the event of a spill	**Constant** • Dynamic odour observations by staff • Supervised unloading **Daily** • Tracking of feedstock receipt • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Liquid feedstock sampling (**ABL-ENV-SAMPLING & ANALYSIS-PRO-P1**)	Feedstock Tracking Spreadsheet. Representative samples of liquid feedstocks will be undertaken in accordance with Sampling & Analysis Procedure which includes the planned frequency and method of sampling for each feedstock types. Odour 'sniff tests' (Section 5.3).	Liquid feedstock spillage. Odour complaints attributed to this source.	Initiate Spill Control Procedure (**HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1**)
Feedstock loading (external)	**Management** • External loading of silage and straw feedstocks only	**Constant** • Dynamic odour observations by staff • Supervised cutting/ transfer/ loading **Daily** • Tracking of feedstock	Daily visual checks to ensure operational areas kept clear of debris/ clean.	Feedstocks with high odour concentrations (intensity 4 and above)	Ensiled crop should not have a high odour intensity; investigate process failure.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The silage will be rolled into the clamps carefully to ensure the silage is well compacted and that oxygen is excluded at the harvest stage to aid the ensiling process. • The clamps will incorporate a polythene sheeting covering system to ensure that rainwater and oxygen are kept out and any odours generated are kept in. • The clamps will be inspected daily to ensure the sheeting is intact and provides effective coverage of the silage. • The silage clamps will be covered with an impermeable clamp cover which will be weighted down and will help to **reduce rates of evaporation** by: - containing humidity, reducing the release of dissolved odorous chemicals; and - eliminating airflow over the surface of odour-releasing materials to reduce the rate of evaporation. • The exposed surface area of the clamp for removal of silage will be limited: by removing a section of the clamp cover to reveal a working face from which silage can be cut, a light sheer grab will be used to cut a tight face, without disturbing silage left behind.	• AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Housekeeping Procedure (**HRCL-QUAL-HOUSEKEEPING-WI03-P1**)	Feedstock Management & Loading Procedure (**HRCL-QUAL-FEEDSTOCK MANAGEMENT-WI13-P1**) Odour 'sniff tests' (Section 5.3).	Odour complaint received in relation to this activity.	If an odour complaint is received an investigation will be undertaken as to the cause. If the odour complaint is confirmed to have been caused by feedstock handling, checks should incorporate the clamp cover, adherence to feedstock handling procedures and meteorological conditions at the time of the complaint/ transfer activity. Contingency measures will be confirmed as effective through an additional documented odour survey at the on-site odour source, at the downwind site boundary and at the affected off-site receptor location(s).

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The time the silage is agitated for will be limited: the silage will be removed from the clamp on a twice daily basis and transferred over short haulage distance using a large front loader bucket from the clamp to the feed hopper such that the period of time material is exposed to air is kept to a minimum before loading. • There are weigh cells in each feed hopper to ensure that the correct tonnages of silage from the clamps and treated straw are added. The tonnages are recorded on SCADA. • Straw feedstock is not expected to emit odour. Extruded (wet) straw will be placed within the hoppers. • Operational areas shall be checked and maintained in a clean condition and regularly scraped/ swept/ washed using hoses/ grey water. •				
Emissions abatement plant/ stack	**Management** • A planned preventative maintenance programme will be in place with the manufacturer's inspection and maintenance recommendations and as per the monitoring and maintenance schedules of the EMS **(HRCL-MP-01, HRCL-QUAL-DAILY CHECKS-AQD 24-P1)**. • Critical parts held on site.	**Constant**: • Dynamic visual and odour observations by staff during shift • H_2S sensor (on carbon filter) **Daily** • Inspection of fan, filters, process parameters	**Process gas flow** 18,500m^3 **UV specification** UV Lamp life: approx. 16,000 hours. UV max. operating temp: 45°C **Packed acid scrubber** Pressure drop: Approx. 500 Pa Filter media volume: TBC	Optimum process parameters are out of range MCERTS emission monitoring results exceed limit: TBC Odour complaints attributed to this source.	On detection of notable odour from the emissions abatement plant stack/ off-site odour impact check emissions abatement system inspection record to diagnose the cause e.g., fault in system/ filter media expiry.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	Process Control Monitoring • There will be a sampling point on the discharge stack to audit the performance of the system based upon the emission levels to atmosphere. • Emission parameters set by the technology provider will be at or below BAT-associated emission levels (BAT-AELs) for channeled emissions of odour (200 - 1,000 ou_E/Nm^3) and NH_3 (0.3 – 20 mg/m^3).	• AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **6-monthly** • Inspection of filters, system fans • MCERTS monitoring of NH_3 or odour concentration **Quarterly** • Site measurement of gases relevant to odour to evaluate performance.	**Active Carbon Specification** Filter renewal period: interval of approx.18-24 months (3500 kg) Residence time: TBC MCERTS monitoring (emission parameters specified by technology provider): TBC Odour 'sniff tests' (Section 5.3)		If problem cannot be rectified by site staff, the technology provider will be contracted to investigate the integrity of emissions abatement system and remedial actions taken immediately where necessary. In the event that odour complaints are attributed to this source, the Operator will, through discussion with the technology provider and the EA, prepare a programme of improvements for agreement with the EA.
Fibre digestate storage and transfer	**Containment** • The digestate is separated via mechanical separators enclosed in a bunker with roller doors that will be opened for digestate dispatch only. • Separated fibre will be stored in a dedicated bay below the separators.	**Constant** • Dynamic odour observations by staff **Daily** • Visual inspection • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**)	Visual inspection of separator bunker to ensure operational areas kept clear of debris/ clean. Odour 'sniff tests' (Section 5.3).	Digestate spillage Very strong odour from fibre digestate (intensity 4 or above). Odour complaints attributed to this source.	Halt the operation. Remove the malodorous load from site and investigate why the fibre is particularly odorous.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	Management • Loading of the fibre will be carried out in accordance with Digestate Handling Procedure (**HRCL-QUAL-DIGESTATE HANDLING (SOLID AND LIQUID)-WI25-P1**). • Fibre digestate will be produced to PAS110 standard. Process Monitoring Procedure (**HRCL-QUAL-PROCESS MONITORING-WI16-P1**) and management to ensure stable digestate produced with low residual biogas potential. • The digestate separation area will be regularly cleaned and maintained in accordance with observations made during the daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**). • Minimum (weekly) cleaning of operational areas next to Separation Bunker.	• Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Samples of fibre digestate prior to seasonal use in accordance with Sampling & Analysis Procedure (**ABL-ENV-SAMPLING & ANALYSIS-PRO-P1)** • Housekeeping Procedure (**HRCL-QUAL-HOUSEKEEPING-WI03-P1**).			
Liquid digestate storage	**Containment** • Digestate is separated within mechanical separators enclosed within a covered bunker • Following separation liquid digestate is fully contained and the liquor pumped from the separator to either: - the covered Digestate Storage Lagoon (residual emissions from the digestate storage lagoon are released via carbon filter outlet – 80% emissions reduction)	**Constant** • Dynamic visual observations • Dynamic odour observations by staff **Daily** • AD Plant daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**)	Process monitoring of fill levels linked to SCADA. The Covered digestate storage lagoon sits within a lined bund with leak detection.	Very strong odour (intensity 4 or above). Odour complaints attributed to this source.	Check pipework/ cover for damage. Initiate Spill Control Procedure **(HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1)**

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	- the Digestate Buffer Tank (402 m^3) which feeds the premix system (residual gas within the tank will be passed via pipework to the gas system or to the Manure Reception Building abatement plant). **Management** • Process Monitoring Procedure (**HRCL-QUAL-PROCESS MONITORING-WI16-P1**) and management to ensure stable digestate produced with low residual biogas potential. • There is a digital level indicator inside the bag which indicates the volume of digestate liquor stored and which is linked to SCADA. • The volume within the covered Digestate Storage Lagoon is restricted to 12,350m^3 to maintain a 750mm freeboard at all times.	• Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Quarterly** • Sampling of digestate liquor	The site is designed such that the liquid digestate produced could be compliant with BSI PAS110: 2014 Specification; sampled and analysed to determine appropriate spreading rates in accordance with the Digestate Management Plan (**HRCL-ETL-DMP-RPT-P1**). Odour 'sniff tests' (Section 5.3)		
Liquid digestate transfer	**Containment** • Liquid digestate tanker off-take point: liquid digestate is transferred off-site via sealed tankers. • Loading of the liquor will be carried out via pipe coupling and in accordance with Digestate Handling Procedure (**HRCL-QUAL-DIGESTATE HANDLING (SOLID AND LIQUID)-WI25-P1**). • The risk of major liquid release is checked, and isolator valves activated.	**Constant** • Dynamic visual observations • Dynamic odour observations by staff **Daily** • Routine odour monitoring **Weekly** • Monitor NH_3 at carbon filter outlet (during filling) using hand-held gas meter or NH_3 Draeger tubes	Visual inspection during tanker filling (signs of damaged hoses/ connections, leaks during filling etc.) The site is designed such that the liquid digestate produced could be compliant with BSI PAS110: 2014 Specification.	Very strong odour from tanker vent(s) (intensity 5 or above). Odour complaints attributed to this source.	Check pipework/ seals/ connections for damage. Initiate Spill Control Procedure. Advise the EA of the circumstances.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The drainage design is such that any spillage resulting from collection of digestate liquor would be contained within the dirty water drainage system and be used in the AD process. • Any spillages arising during digestate off-take will be contained within a sump at the offtake point and managed promptly in accordance with the Spill Control Procedure (**HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1**). **Abatement** • Emissions to air from the empty tanker during filling will be exhausted via connection to the on-site carbon filter emissions abatement systems (emission points **A21** and **A24**) (80% emissions reduction). **Management** • To prevent "tanker drive-off", site operatives will be trained and provide training and oversee the first delivery or dispatch for a new driver. • Site operatives will check and replace hose couplings as required. • Minimum (weekly) cleaning of operational areas next to off-take points.		Sampled and analysed to determine appropriate spreading rates in accordance with the Digestate Management Plan (**HRCL-ETL-DMP-RPT-P1**). Odour 'sniff tests' (Section 5.3)		
Drainage system	**Containment** • Dirty water is contained within sealed site drainage system and recirculated back into process **Monitoring**	**Daily** • Ensure drains are clear of debris and blockages, including clamps.	Visual inspection (of dirty water level, debris in channels)	Odour from drainage system (intensity 4 or above)	Investigate reason.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• Drainage system water levels **Management** • Facility to turn pumps off e.g., if spillage • Emptying and cleaning of the drainage system is undertaken as required	• Routine odour monitoring • Annual drainage integrity and inspection report in line with GGP recommendations	Odour 'sniff tests' (Section 5.3)		The drainage system will be cleared out using vacuum tankers if required. Clamp drainage channels to be cleared/ flushed.
'Raw' biogas (gas storage above digester tanks, digestate storage tanks)	**Containment** • Odour abatement is a key feature of the design as capture and recovery of the biogas is central to the plant's efficiency. The likelihood of gas leaks is therefore very low. • All digester tanks are bonded to the biogas stores to ensure digestion process takes place in sealed, airtight vessels and that there are no fugitive emissions. **Abatement** • There will be oxygen injection on the PowerRing digesters. To reduce H_2S in the biogas, a small amount of oxygen is injected to increase the oxidising capacity of the system, thus inhibiting sulphate-reducing bacteria activity and promoting sulphide oxidation. • Oxygen is generated from air via pressure swing absorption unit and injected into the tank headspace. Ferric hydroxide powder will be used to further control H_2S levels if needed. **Process Control** • The AD process is fully regulated using a SCADA process control monitoring system.	**Constant** • Dynamic odour observations by staff • Personal gas alarms worn by site operatives • Monitoring via SCADA **Daily** • AD Plant Daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Periodic** • Annual Leak Detection & Repair (LDAR) surveys will be carried out in accordance with permit requirements.	Continuous systems monitoring (SCADA) including excess gas use in the CHPs, flare systems or operation of PVRVs. Monitoring gas flow/ quality to the engines: - CH_4 - O_2 - H_2S - CO_2 Gas concentrations may be checked using a hand-held gas monitor. Odour 'sniff tests' (Section 5.3) Site 'Sign-in App' for visitors/ contractors.	Personal gas alarm alert. DSEAR limits observed for explosive atmospheres. 'Raw' biogas odour detectable on-site (intensity 3 or above). Odour complaints attributed to this source.	Follow Biogas Leak Response Procedure (**HRCL-QUAL-BIOGAS LEAK RESPONSE-WI09-P1**) Notify Site Manager immediately. Check operation of PVRVs on all tanks. Portable monitors will be used to check gas type and concentration. If required, the plant engineers will be contacted to resolve the issue immediately.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	Monitoring • The gas in the void spaces of the PowerRing digesters and the Tertiary digester will be monitored (SCADA). • Releases from the PVRVs will be recorded on SCADA. • After commissioning the Operator will establish an LDAR programme to measure diffuse emissions of ammonia, VOCs including CH_4 and odour from all sources identified in the LDAR. This may include but not be limited to gas storage membrane and PVRVs. **Management** • Routine inspection and maintenance schedule for the AD tanks and integrity of associated infrastructure. • Training and authority to work is required. Risk assessment undertaken when work is required. Contractor technician will oversee work. • In the event of planned plant outages for maintenance or repair, the production of biogas is slowed down in advance by reducing the quantity of feedstock into the digesters and by halting the stirrer activity. • Any excess gas will be flared in preference to releases of raw biogas to ensure that there will be no fugitive emissions of odorous gas.				
Biogas upgrade unit (BUU) vent	**Abatement** • The BUU will be fitted with carbon capture equipment.	**Constant** • SCADA	Continuous systems monitoring (SCADA).	Personal gas alarm alert.	Notify Site Manager immediately.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• In the event that carbon capture is not operational, there will be emissions of residual CO_2 only. **Monitoring** • There will be continuous process control monitoring to ensure the plant is operating at optimum efficiency. **Process Control** • The regulation of gas flow to the gas upgrading plant will ensure that its capacity is not exceeded, and that gas is not released directly to atmosphere. • The upgrading plant will incorporate a PRV for over-pressure situations. When operated, there would be an intermittent release of odorous biogas.	• Dynamic odour observations by staff • Personal gas alarms worn by site operatives **Daily** • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) • AD Plant Daily checks (**HRCL-QUAL-DAILY CHECKS-AQD 24-P1**) **Weekly** • BUU (draining of the condensate vent pipe) **Bi-annual** • Annual leak detection checks or as otherwise stipulated by the environmental permit	Gas analyser used to measure and allow control on the quality of incoming gas: - CH_4 - H_2S - CO_2 - O_2 Odour 'sniff tests' (Section 5.3)	DSEAR limits for explosive atmospheres. 'Raw' biogas odour detectable on-site (intensity 3 or above). Odour complaints attributed to this source.	Check operation of PRVs on BUU. Portable monitors will be used to check gas type and concentration. If required, the plant engineers will be contacted to resolve the issue immediately.
CHP stack emissions	**Process Controls** • The combustion of biogas by the CHP engines will destroy any potential odorous compounds. • AD plant automated systems (process control) monitoring (SCADA)	**Constant** • SCADA - gas quality analysis • Dynamic odour observations by staff	Continuous systems monitoring (SCADA) (process control monitoring / periodic gas quality analyses).	SCADA alert 'Raw' biogas odour detectable on-site (intensity 3 or above).	Combusted biogas emissions from the CHP engine will not give rise to an off-site odour impact.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
	• The emergency flare will be used to combust excess biogas under abnormal operating conditions. **Abatement** • Desulphurisation of biogas via oxygen injection into the PowerRing digesters and, if required, ferric hydroxide powder to reduce H_2S in the process. **Dispersion** • CHP emissions released from 8.7m stacks to ensure effective residual odour dispersal. **Monitoring** • The gas flow will be regularly inspected to ensure that combustion capacity is not exceeded. • MCERTS monitoring of stack emissions conforms to emission limit values (ELVs) specified by the manufacturer and are within the site's permit. **Management** • CHPs subject to routine services and maintenance schedule (**HRCL-QUAL-MAINTENANCE PLANNERAQD** • **27-P1**), that includes leak detection and MCERTS emissions testing undertaken by specialist contractors. • Excess gas will be re-directed to the gas upgrade plant. If this is not possible, the gas will be flared to ensure that there will be no fugitive emissions of odorous gas.	• Personal gas alarms worn by site operatives. **Daily** • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Annual** • MCERTS emissions monitoring • Leak detection checks	Odour 'sniff tests' (Section 5.3) MCERTS monitoring of emissions to air to check compliance with limits: NOx – 500 mg/m^3 (biogas), 250 mg/m^3 (natural gas) CO – 1,400 mg/m^3 TVOCs – 1,000 mg/m^3 SO_2 – 107 mg/m^3 (biogas) Third-party leak detection survey.	Odour complaints attributed to this source.	If 'raw' biogas is detected, rather than combusted biogas, refer to the above procedure for 'raw biogas'. If the nature of the combusted emissions gives cause for concern i.e., become odorous, Site Manager to call CHP service contractors to further investigate and undertake remedial action if required. Upgrade or flare all biogas until issue resolved.

Odorous and potentially odorous process / material	Control measures (Appropriate Measure / BAT)	Monitoring frequency	Monitoring procedure and optimum process parameters	Trigger level	Action taken if outside optimum process parameters
Emergency Flare stack emissions	**Process Controls** • The combustion of excess biogas by the flare will destroy any potential odorous compounds. • The flare will start up automatically at a set pressure / gas storage volume. **Monitoring** • There will be continuous process control monitoring. Hours of operation of the flare will be recorded on SCADA. • The gas flow to the flare will be regularly inspected by the service engineer. • In the event that the flare is operated >10% of the year (876 hours) MCERTS monitoring of stack emissions will be undertaken to check compliance with permit limits. **Management** • Combustion emissions released at height that will ensure effective odour dispersal.	**Constant** • SCADA - gas quality analysis • Dynamic odour observations by staff • Personal gas alarms worn by site operatives. **Daily** • Routine odour monitoring (**HRCL-ETL-ODOUR MONITORING -WI19-P1**) **Annual** • MCERTS emissions monitoring (if flare operated >876 hrs).	Continuous systems monitoring (SCADA) (process control monitoring / periodic gas quality analyses). Odour 'sniff tests' (Section 5.3) MCERTS monitoring of emissions to air to check compliance with limits: NOx – 150 mg/m^3 CO – 50 mg/m^3 TVOCs – 10 mg/m^3	SCADA alert 'Raw' biogas odour detectable on-site (intensity 3 or above). Odour complaints attributed to this source.	If the nature of the combusted emissions gives cause for concern i.e., become odorous, Site Manager will call the relevant contractor for an emergency call-out to further investigate and undertake remedial action.

5 Odour reporting

5.1. Complaints reporting

Complaints data is recognised by the EA as the most direct and reliable form of monitoring which odours are causing a problem outside of the site boundary. The Operator will address both internal and external complaints in a prompt and comprehensive manner to resolve any issue as quickly as possible.

All complaints will be collected, registered, and validated following the Complaints Procedure (**ABL-QUAL-COMPLAINTS-PRO-P1**). If an odour complaint is received, the Site Manager or deputy will complete an Odour Complaint Form (**ABL-QUAL-Complaint form AQD04-R1**).

In order that odour complaints can be substantiated it is imperative that the Site is immediately informed either by the complainant themselves or by the EA. Local residents will be encouraged to immediately contact the site in the event of an off-site odour to enable site personnel to verify the presence, extent, and cause of the odour. The Site Manager's telephone number will be displayed at the site entrance.

A stepwise approach to odour complaint investigation and reporting is presented in Figure 5. The complaint investigation will start with an initial screening exercise to verify the odour incident to screen out those odour complaints that are unlikely to be due to the facility. The initial screening exercise will consider the following:

- potential odour sources at the facility (Table 3.1);
- routine/ additional odour monitoring data; and
- meteorological conditions considered in relation to the location of the complainant.

If the Site Manager can attend the complaint location quickly, it may be possible to carry out effective appraisal of the complaints independently by a 'sniff test'. This is further described in Section 5.4 'Reactive Odour Monitoring'.

After recording the complaint on the Odour Complaint Form (**ABL-QUAL-Complaint form AQD04-R1**) and completing the appropriate level of investigation the Site Manager will discuss the matter with the Director.

The Odour Complaint Form (**ABL-QUAL-Complaint form AQD04-R1**) will be forwarded to the EA together with the outcome of the checks within 24-hours of investigation and validation and any corrective and preventative actions taken in response to the complaint.

The Operator will maintain a system of complaints monitoring and analysis. Complaints will be registered on a database, validated where possible and reviewed monthly.

All complaints forms/records will be kept until the surrender of the Permit. All records will be available for inspection by EA representatives.

5.1.1 Problem resolution

The complaint investigation will involve identifying the odour source and implementing measures to bring the source under control. The corresponding odour investigation report will detail the actions taken to minimise the potential for re-occurrence. To bring the process back under control the following will be considered:

- Cease the activity causing the abnormal situation and/or if necessary, arrange for the immediate removal of any odorous materials giving rise to the problems;
- Take immediate steps to eliminate the cause of the abnormal situation;
- If necessary, contact the relevant maintenance contractor;
- Record the response to the situation and the remedial actions taken; and
- Advise the EA of the complaint(s), details of the problem, and mitigation/improvement measures undertaken.

5.1.2 Temporary problem rectification

If the default procedure does not provide a satisfactory resolution, the following actions will be considered until the problem is resolved:

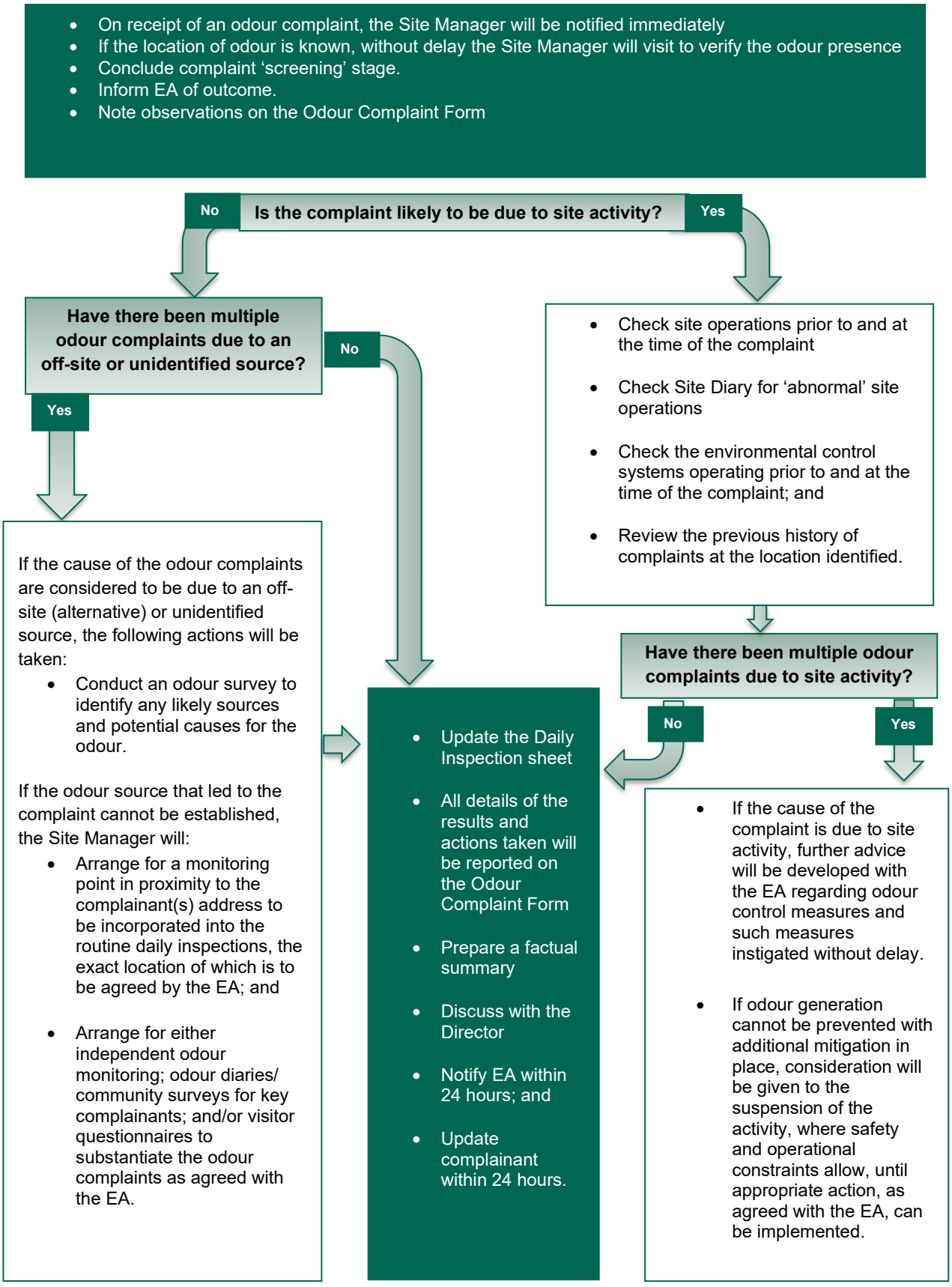
- Temporarily restrict feedstock acceptance at the site; and/or
- Temporarily reduce the feedstock throughput.

5.1.3 Review and improvement following complaints

Once the cause of the problem is identified and the improvements implemented, the following actions will be undertaken:

- A further odour survey will be completed to assess if the improvements have addressed the source of the elevated levels.
- If the cause is due to inadequately followed odour management controls, then re-training of employees will take place to ensure that all employees operate to the required standards.
- If the odour management controls are determined to be inadequate it will be raised as part of the review of control measures detailed in the OMP; and
- All parties affected will be notified of the cause, actions, and resolutions by the Site Manager.

Figure 5 Odour Complaints Procedure – Stepwise Procedure



5.2. Community engagement

The Operator will ensure that they are always approachable and open to discussion, the primary objective is to encourage feedback and also for complainants to feel comfortable to contact the Operator in the first instance so that problems can be identified and rectified at the earliest opportunity.

Liaison with local residents in closest proximity to the site operations (subset of the receptors given in Table 2.1) and the EA will be co-ordinated through the Site Manager. Both parties will be notified of activities that have the potential to generate significant odour emissions, and of any activities programmed to take place outside of normal site operating conditions or hours.

In circumstances where, over an extended period, odour complaints from the community do not match the results of the regular sniff-test monitoring the Operator will engage with members of the community, in key locations, to participate in a period of community monitoring. These designated residents would perform offsite surveys, recording the data in an 'Odour Diary' for an agreed length of time. The Operator will maintain logs of community involvement and keep all completed odour diaries for future reference.

5.3. Pro-active odour monitoring

5.3.1 Meteorological Monitoring

Meteorological conditions are key to understanding the potential odour impacts to receptors. Meteorological monitoring at the site will therefore be performed:

- During routine odour monitoring;
- To predict periods when conditions for the dispersion of odour are likely to be poor, enabling planned maintenance operations to be re-scheduled to avoid such times;
- At the time of abnormal events to predict where odour impacts could potentially occur;
- To identify times when plant conditions and/or odour abatement techniques need to be adjusted to account for adverse conditions; and
- For the investigation of odour complaints.

There will be an on-site weather station which will automatically predict and log meteorological conditions. Meteorological data will also be sourced by site operatives from on-line resources.

5.3.2 Monitoring Odorous Releases

Site staff will be trained to be continuously aware of odour during the working shift and to report any issues to the Site Manager. This section of the OMP sets out the additional monitoring procedures that will be implemented, during normal operations.

5.3.2.1 Questionnaire System

Visitors to site are required to complete a 'site odour evaluation' when signing-in. An alert is sent to the Operator Site Manager if a strong odour (intensity 4 or above) is reported by visitors.

The Site Manager will direct an investigation to establish the source and identify the requirement for remedial measures. The details of the odour will be recorded using the Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**).

5.3.2.2 Routine (Daily) Olfactometry Monitoring

The Operator will carry out routine daily odour checks in accordance with the Odour Monitoring Procedure (**HRCL-ETL-ODOUR MONITORING -WI19-P1**). Observations will be recorded on Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**).

Predetermined monitoring locations (that includes locations listed below from number 1 to number 6 inclusive) should be surveyed on every occasion.

Two flexible downwind monitoring locations (locations numbered 7 and 8 below) will be chosen if required according to conditions at the time of the survey.

An additional survey location (OMP9) will be visited once weekly at the nearest downwind off-site receptor location(s) even if odours are not detected at Site boundary. This is to acknowledge that odours may ground beyond the site boundary even where no on-site or site boundary odour is detected.

As a minimum monitoring will be undertaken at the following (with upwind locations to be surveyed first):

To be undertaken daily:

- **OMP1** - Proposed AD Plant, NE boundary
- **OMP2** - Proposed AD Plant, N boundary
- **OMP3** – Proposed AD Plant, NW boundary
- **OMP4** – Proposed AD Plant, W boundary
- **OMP5** – Proposed AD Plant, S boundary
- **OMP6** – Proposed AD Plant, E boundary
- **OMP7** – Flexible location: a location on the downwind site boundary (if this is not already included as a fixed monitoring location listed above)
- **OMP8** – Flexible location: the nearest downwind receptor if the odour intensity at the site boundary is >3)

To be undertaken weekly:

- **OMP9** - Flexible location: the nearest off-site downwind receptor location(s) (even if odours are not detected at site boundary).

An Odour Monitoring Locations Plan is included in Figure 6.

Monitoring will be undertaken at different times each day during operational hours to capture a range of conditions and at times when there is a risk of off-site odour impact, for example due to operational changes or due to weather conditions. Additional odour monitoring surveys will be undertaken during the following circumstances:

- During operational hours, where the risk of odour dispersion is towards off-site receptors. This may be due to prevailing wind direction and/or during periods of still air conditions. During these periods an odour survey will be conducted at the downwind site boundary and at the downwind off-site receptor location(s). Any off-site odours will be traced to their potential source which may include a full inspection on-site of the area of operations.

- During routine operations where there is an increased risk of odour release.

- During periods of maintenance and/or abnormal operating conditions (Table 7) where there is increased risk of odour release. During these periods an odour survey will be conducted at the downwind site boundary and at the downwind off-site receptor location(s) to establish the presence of odour off-site.

- In order to verify to success of any contingency measures implemented on-site to control odour in response to either the detection of abnormal odour release during routine odour monitoring (Section 5.3) or as a result of measures implemented in response to verified odour complaint(s). The survey will be undertaken on-site at the location of the verified odour source(s), at the downwind site boundary and at the off-site affected receptor location(s).

- In order to qualify the presence or absence of odour from other sources beyond the site boundary if there is no established pathway between the site but odour has been detected at a potential offsite sensitive receptor.

- The results will be recorded on the Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**) and Site Diary (**HRCL-QUAL-SITE DIARY-AQD 29-P1**). This data can be used to inform proactive odour management.

5.3.3 The Odour Assessor

Monitoring staff must not be desensitised to odour. A variety of trained odour monitoring personnel should be used and, where possible, selected from office-based staff who are unlikely to have been exposed to on-site odours.

The odour assessor must not be subject to significant odour in the 30-minutes prior to the assessment or consume strongly flavoured food or drink within this time period. This is to ensure that the assessor is not suffering from odour fatigue and will be sensitive to on-site odours. If odour complaints are received, and the results of routine odour testing suggest that

site personnel are unable to detect odour whilst on-site the Operator will consider using independent contractors for sniff testing until the source of the odour is established and/or issue is resolved.

It is important to note that olfactory monitoring ('sniff tests') are subjective and both the hedonic tone and intensity may be experienced differently by different people. The Hedonic Scale and Odour Intensity Scale is included in the Odour Monitoring Procedure (**HRCL-ETL-ODOUR MONITORING -WI19-P1**), Appendix C.

5.3.4 Routine Monitoring Inspection Methodology

1. Monitoring personnel will walk slowly, breathing normally, and starting at points with least expectation of odour (e.g., off-site and/or upwind). If an odour cannot be detected in this way, the inspector will periodically stand still and inhale deeply facing upwind.

2. If no odour is perceptible in this manner, then the intensity will be 0. If odour is detected but there is some doubt as to whether an odour is present, then the intensity will be recorded as 1 (very faint). If odour is detected but cannot be described using precise words or terms, then intensity will be recorded as 2 (faint). If odour is detected while walking and the odour character is recognisable, the intensity will be recorded as at least 3 (distinct). If the odour character is easily recognisable then the intensity is 4 (strong). If the odour is considered offensive the intensity is 5 (very strong) and if the odour is offensive and possibly nauseous i.e., an instinctive reaction is to reduce personal exposure to the odour, then the intensity is 6 (extremely strong). The score used to classify odour are provided on the Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**). Other supporting classification systems and information are provided in Appendix C.

3. If a recognisable or 'distinct' odour or stronger (i.e., intensity of 3 and above) is detected at the downwind site boundary and/or at off-site receptor locations, an on-site inspection of operations will be carried out to trace any observed off-site or site boundary odour to the source, or identification of the direction of an off-site odour, so that appropriate corrective action can be taken.

4. On reporting results, it is important that additional observations including time, date, weather conditions, odour type, location, intensity, extent, and sensitivity are recorded in the Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**).

5. Abnormal site operating conditions at the time of the survey e.g., maintenance to process equipment will also be recorded.

5.4. Reactive Odour Monitoring

5.3.5 Actions in the Event of Abnormal Emissions

5.3.5.1 Investigate Pollution Incident and Cause

If odour monitoring or odour complaint(s) indicates that abnormal emissions from the facility are taking place the Site Manager (or deputy) will investigate the complaint as soon as possible on receipt of the odour survey results/ complaint.

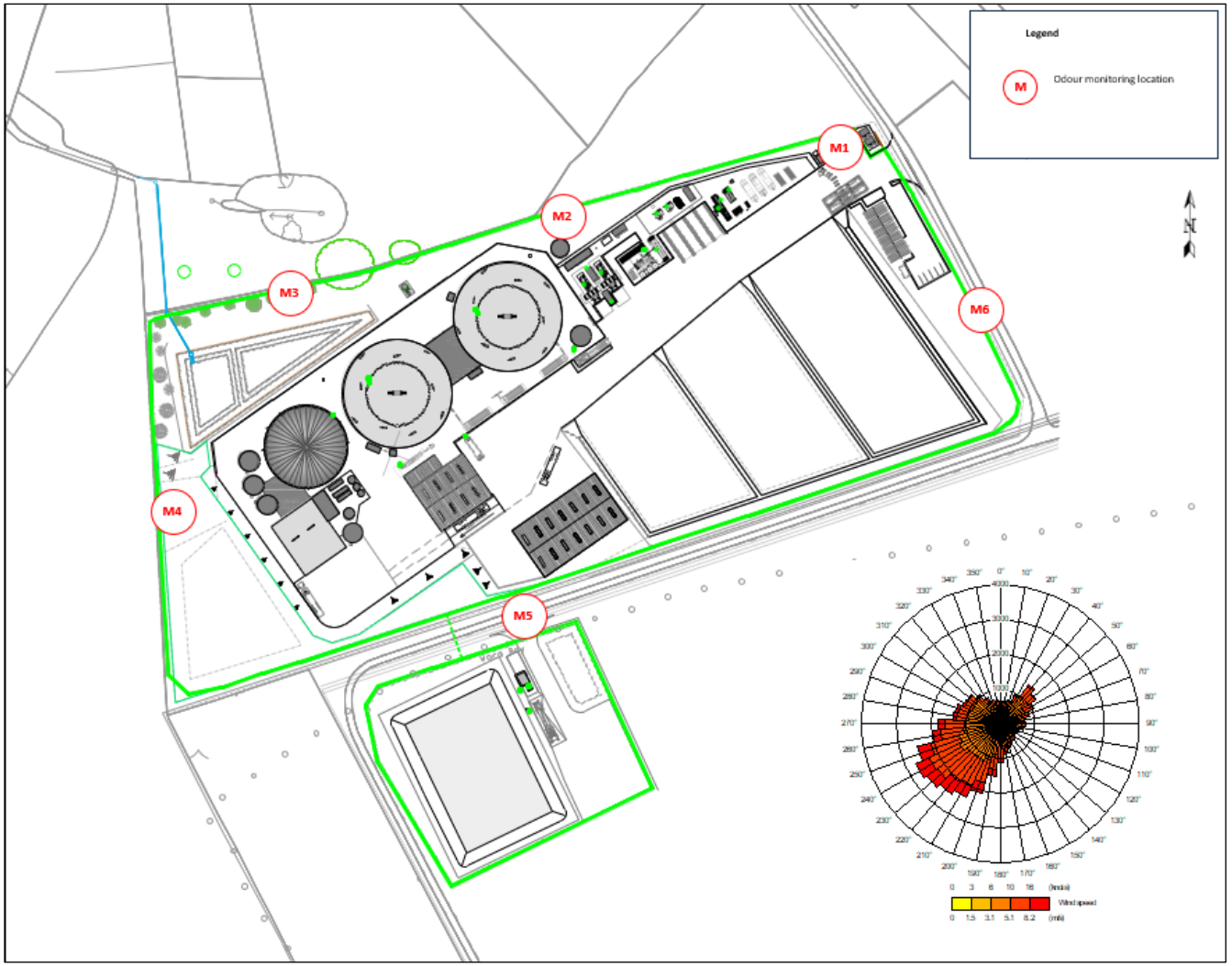
The Site Manager will check relevant items of odour abatement equipment to identify the possible cause of the abnormal emission and/or attend the complaint location to carry out a 'sniff test'.

The Operator will liaise with the EA immediately to inform of the outcome of the screening assessment (Figure 5) and whether any action is to be taken. If the Site is not confirmed to be the odour source, then the investigation will stop at that point.

If the screening process confirms the odour incident, then a more detailed investigation will be carried out. The actions outlined in Figure 5 will be followed if the site is identified as the origin/cause of the odour complained about. Figure 5 also outlines the actions that will be undertaken by the Operator in circumstances where the source of the odour cannot be confirmed. If the odour complaint is received during operational hours the complaint will be investigated immediately.

Table 6 Schedule of Odour Monitoring ('Sniff Tests'), summarises the schedule for proactive and reactive odour monitoring.

Figure 6 Site plan showing odour monitoring locations



Note: Base plan produced by Acorn Reference: HRCL-LAY-ABE-010 Site Emissions Plan. Reproduced by Earthcare Technical Ltd June 2025

Table 6 Schedule of Odour Monitoring ('Sniff Tests')

Frequency	Person Responsible	Method	Reason	Records	Actions
Proactive (daily)	Trained office-based staff or non-operational staff or, if unavailable, by operational staff at the start of a working shift	Perform sniff test at locations indicated on Figure 6	Routine monitoring to establish normal working conditions and check for odour emissions/ issues	Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**)	If a distinct odour (intensity 3 or above) is detected at site boundary/ at off-site receptor investigate and establish source during the survey and identify the requirement for remedial measures. Record the details of the odour using the Odour Monitoring Form.
Proactive (ad-hoc)	Site visitors and site personnel	Site visitors - perform sniff test on arrival at site and log during site induction/sign in. Site personnel – dynamic odour monitoring during shift.	To establish odour emissions/ issues; or during operations where there is an increased risk of odour release	Sign-in App (Site Office) Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**)	An alert is sent to the Site Manager if a strong odour (intensity 4 or above) is reported by visitors. Investigate and establish source and identify the requirement for remedial measures. Record the details of the odour using the Odour Monitoring Form.
Reactive (ad-hoc)	Site Manager (or deputy)	Perform sniff test at relevant receptor locations, boundary locations and at suspected on-site sources	In response to odour complaint	Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**) Odour Complaint Form (**ABL-QUAL-Complaint form AQD04-R1**)	Follow stepwise approach (Figure 5).
Reactive (ad-hoc)	Trained office-based staff or non-operational staff	Perform sniff test at relevant receptor locations, boundary locations and at suspected on-site sources	To establish/ confirm odour source in the event of an odour release	Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**)	If a distinct odour (intensity 3 or above) is detected at off-site receptors identify appropriate remedial measures. If odour generation cannot be prevented with additional mitigation in place, consideration will be given to the suspension of the activity, where safety and operational constraints allow, until appropriate action, as agreed with the EA, can be implemented. Record the details of the odour using the Odour Monitoring Form.

6 Abnormal events

Table 7 provides a summary of the foreseeable situations that may compromise the Operator's ability to prevent and/or minimise odorous releases from the process. The response requirements to minimise the impact to abnormal event scenarios are also summarised in Table 7.

Potential odour sources under abnormal operating conditions, may include:

- AD plant infrastructure compromised (leading to gas/ liquid release from storage tanks, pipework)
- Plant breakdown
- Absence of key staff
- Flood
- Fire/ explosion
- Unavailability of transfer vehicles

It is expected that, any emissions arising due to abnormal operations, incidents and/or due to periods of maintenance at the site would not occur frequently and would not be sustained or of prolonged duration.

When maintenance work is undertaken, there is the potential that the facility is more vulnerable, or there is a risk of a small odour release, e.g., removing a pump, replacing a pipeline, or rodding/flushing a pipe/chamber etc. Suitably qualified and competent contractors will complete maintenance works. Rules/work permits will be required for all contractors working on site. Sections of the plant which require maintenance will be sealed off from the main process to control and limit the potential release of odours during maintenance works.

The Operator will immediately inform the EA when planned or emergency maintenance of plant items must be carried out and there is a likelihood of odour being released to atmosphere to the degree that an adverse off-site impact may occur. The Operator will provide details of the event, actions being taken to resolve the issue and likely timescale to rectify.

A list of contingency contacts in the event of abnormal operations/ critical failures is provided in the Accident Management Plan (AMP) Manual (**HRCL-ETL-AMP-RPT-P1**).

In the event of a critical failure of the facility which results in restricted feedstock reception capacity, additional mitigation measures will be put in place to minimise the impact of the incident. These will include:

- Stop receipt of feedstock
- Containment of spillages or odour releases (**HRCL-QUAL-SPILL CONTROL/USE OF SPILL KITS-WI24-P1**)
- Clean-up/ wash-down procedures in accordance with Housekeeping Procedure **(HRCL-QUAL-HOUSEKEEPING-WI03-P1)**
- Containment of feedstock either into sealed containers/by covering or removal to an alternative facility within 24 hours

In the case of operational difficulties, feedstock would be prevented from travelling to and/or diverted to an alternative facility before arriving at site. In the event of serious odour issues and disaster or emergency situations, measures are also in place to divert or remove feedstocks for landfill disposal as a last resort.

An emergency diesel generator is available on-site to avoid power failure impacting the operation. The generator will be subject to routine servicing. Mains water supply will be available.

Deputies are available for any individual key staff member should they be unavailable for any reason.

Table 7 Abnormal events

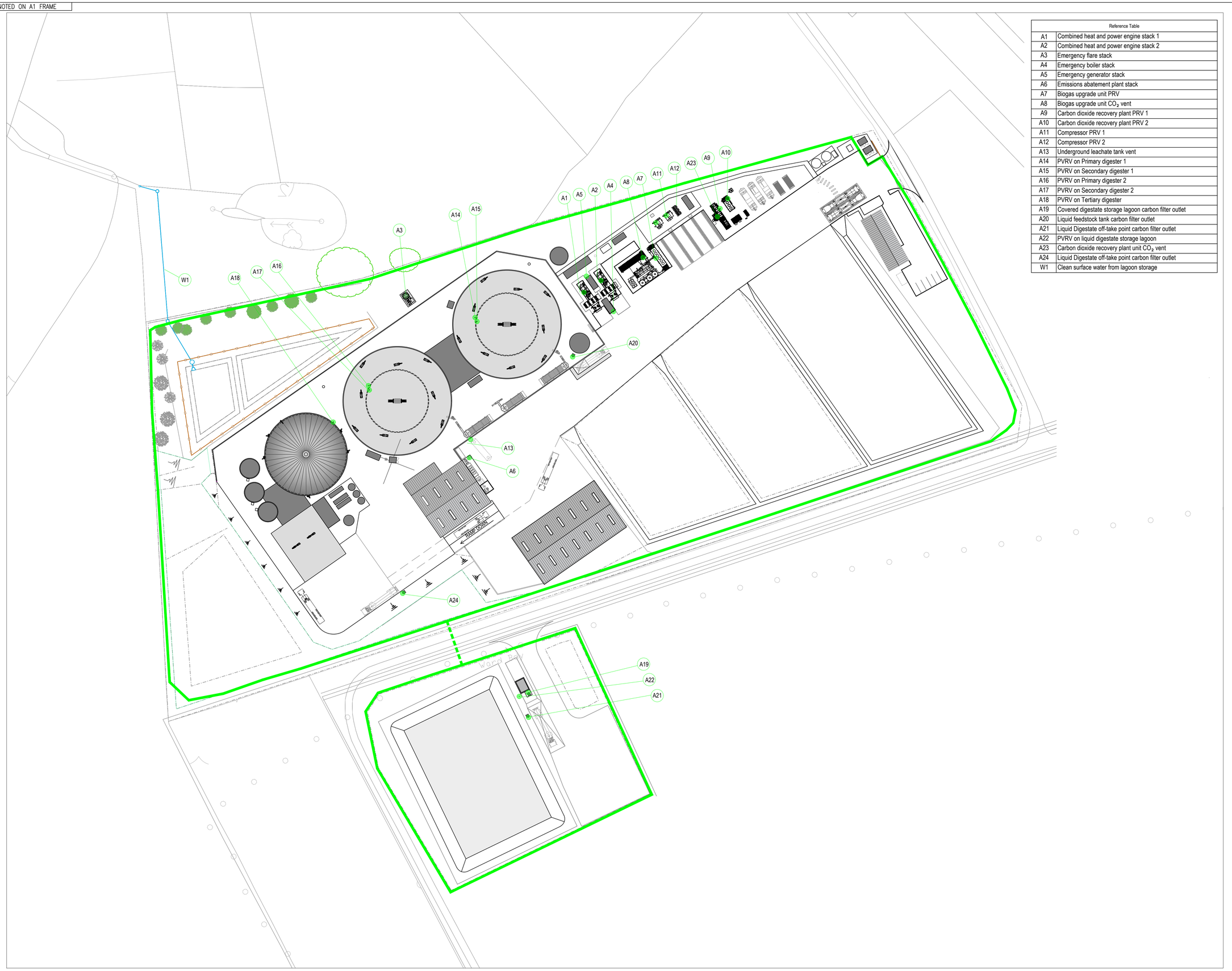
Abnormal event	Recovery steps
AD plant infrastructure compromised (gas / liquid release)	• The SCADA system, that includes level sensors on all tanks, will enable identification of the issue. Systems alerts, and overrides are integral to the automated system. The system fitted with fail-safes for blockages, high or low pressure stops and valve interlocks. • Member of Site personnel always on duty to attend (e.g., to stop pumps/ close valves etc. as necessary). Portable monitors will be used to check gas type and concentration. • Supply of critical spare parts held on-site. • Support to be provided by Acorn engineers and pre-approved third-party engineers for emergency breakdown/ repairs. • A suction puddle pump is available on-site at all times and a vacuum tanker can be called in to retrieve liquids. Clean affected area with squeegee, apply absorbents. Clean equipment surfaces. • Feedstock will be diverted to authorised disposal facility until repaired.
General plant/ equipment Breakdown/ unplanned maintenance	• Refer to Hazard and Critical Control Point Plan (**HRCL-ETL-HAZARD AND CRITICAL CONTROL POINT PLAN-E&S-P1**) • Refer to Safe shut down procedure as required (**HRCL-QUAL-SAFE SHUTDOWN-WI06-P1**) • Routine and emergency maintenance contracts in place with associated contractor for plant/ equipment (**HRCL-QUAL-MAINTENANCE PLANNER-AQD 27-P1**). • Member of Site personnel on duty at all times to attend e.g., to stop pumps/ close valves as necessary. • Supply of critical spare parts held on-site (**HRCL-QUAL-Critical Spares List-AQD 31-P1**) • Feedstock will be diverted to authorised disposal facility until repaired.
Emissions abatement plant system (for Manure Reception Building) breakdown	• Routine and emergency maintenance will be undertaken by suitably trained and competent personnel to minimise the likelihood of breakdowns. • In the event of a breakdown, actions will depend on the specific situation or significance of the breakdown/ malfunction, likely to be limited to mechanical failure of fan, accidental damage to a system component (ductwork, fan, filters), exhaustion of filter media. Actions may include: - Replacement/ repair of parts/ filter media by trained personnel (refer to Table 5 for Action Levels) - If required, repair/ replacement of components by specialist engineer(s) • In the event of a breakdown that prevents the emissions abatement system functioning as intended, there will be a temporary cessation of manure deliveries until the emissions abatement system is repaired/ fully operational. Manure already within the Manure Reception Building will be fed into the system. Door openings will be kept to a minimum during this time.
Power failure	• Invoke Main Power Outage Response Procedure (**HRCL-QUAL-MAINS POWER OUTAGE RESPONSE WI05-P1)**

	• In the case of failure, power is provided by the on-site emergency diesel generator. • Feedstock will be diverted to authorised recovery or disposal facility until repaired.
Absence of key staff	• Deputy/ technically competent personnel will be available at all times. • The Operator's primary point of contact will be the Site Manager for the site on all matters associated with site operations and its environmental performance. • Odour awareness and contingency measures included within all staff inductions and re/training, including that for drivers (Training Procedure, **ABL-QUAL-TRAINING-PRO-P1**). • System processes will be automated and monitored remotely by technology provider. • In the short-term, other staff members will be reassigned to critical operations. • In the event of prolonged absence of staff members, temporary staff will be recruited and appropriately trained to fulfil non- critical roles whilst other more experienced staff members are reassigned.
Flood (the site is situated in a location which has a low probability of flooding)	• The site is situated in a location which has a low probability of flooding. In the event of a flood, invoke Flood Response Procedure (**HRCL-QUAL-FLOOD RESPONSE**) as appropriate. • If due to a man-made incident, follow Spill Control Procedure (**HRCL-QUAL-SPILL CONTROL/ USE OF SPILL KITS-WI24-P1**). Use suction tanker to retrieve liquids from sumps and subsequently load to process as appropriate.
Fire and/or explosion	• Follow Fire & Explosion Response Procedure (**HRCL-QUAL-FIRE & EXPLOSION RESPONSE-WI08-P1**) • Contact the Fire and Rescue services. • If safe to do so, attempts should be made to extinguish the fire using fire response equipment held on-site.
Unavailability of transfer vehicles	• The Site Manager is responsible for overseeing the supplier policy and a contingency plan. • Sufficient capacity is available on site for additional short-term storage. • Additional transfer vehicles are available for use.

Appendix A – Drawings

Figure 7 Site Emissions Plan (Plan (HRCL-LAY-ABE-010 Rev C Site Emissions 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

Figure 8 Site Layout & Permit Plan (HRCL-LAY-ABE-011 Rev C Site Layout and Permit Plan)

AS NOTED ON A1 FRAME

Reference Table	
1	Site Office / Staff Welfare and Workshop
2	Weighbridges (in and out)
3	Site Parking
4	CHP No2
5	CHP No1
6	Emergency Boiler
7	Switch Room
8	Biogas Upgrade Unit
9	CO2 Recovery Unit and CO2 tanks
10	Emergency Generator
11	CNG Unit
12	CNG Trailer Bays - 4 Nos.
13	Covered lagoon - Volume 12,350m³ plus 750m freeboard
14	Gas Flare
15	Digestate Separator Building
16	3 No. Pasteurisation tanks (25m³ each)
17	Manure Reception Building
18	Abatement Plant
19	Straw Process Building
20	Tertiary Digester - Volume 7444m³
21	Secondary Digester 1 - Volume 4512m³
22	Secondary Digester 2 - Volume 4512m³
23	Primary Digester 1 - Volume 9000m³
24	Primary Digester 2 - Volume 9000m³
25	Digestate Buffer Tank - Volume 402m³
26	Water Tank 1- Volume 402m³
27	Water Tank 2 - Volume 402m³
28	Fire Water Tank - Volume 250m³
29	Liquid Feedstock Tank - Volume 402m³
30	Feed Hoppers - Volume 2No 120m³ & 1No 65m³
31	Covered Storage Clamp 1 - Volume 19900m³
32	Covered Storage Clamp 2 - Volume 17000m³
33	Covered Storage Clamp 3 - Volume 11760m³
34	Silage Leachate Tank - Volume 54m³
35	Condensate sump 1
36	Condensate sump 2
37	Wastewater treatment plant
38	Digestate offtake bay with sump (5.1m³)
39	Liquid Feedstock loading point
40	Straw set down bay
41	Site Boundary Fence
42	Dirty water lagoon 511m³
43	Attenuation lagoon (clean) 510m³
44	Hygienized tank 80m³
45	Clean water break tank 10m³
46	Oxygen Generator
47	Biogas desulpherisation
48	Heat distribution container
49	Machinery Hall
50	Pump building
51	Clean Water Tanks, each 30m³

NOTES:-

Permitted Area Boundary (5.89ha)

Underground pipe conduit with leakage detection

N

Rev	Date	Description	DR	CH
C	15/05/25	Issued For Approval	SJC	-
B	25/02/25	Issued For Approval	SJC	-
A	21/11/24	Issued For Approval	SJC	-

acorn BIOENERGY

Job Title
AD Plant.
Horse Close

Drawing Title
Site Layout & Permit Plan

Status
Approval

Scale	Date
As Shown	Nov '24

Drawn By	Checked	Approved
SJC	–	–

Drg. No.	Rev
HRCL-LAY-ABE-011	C

PERMIT PLAN
Scale: 1:750 @ A1

Figure 9 Process Flow Diagram (HRCL-ABL-PROCESS FLOW-PFD-P1)

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

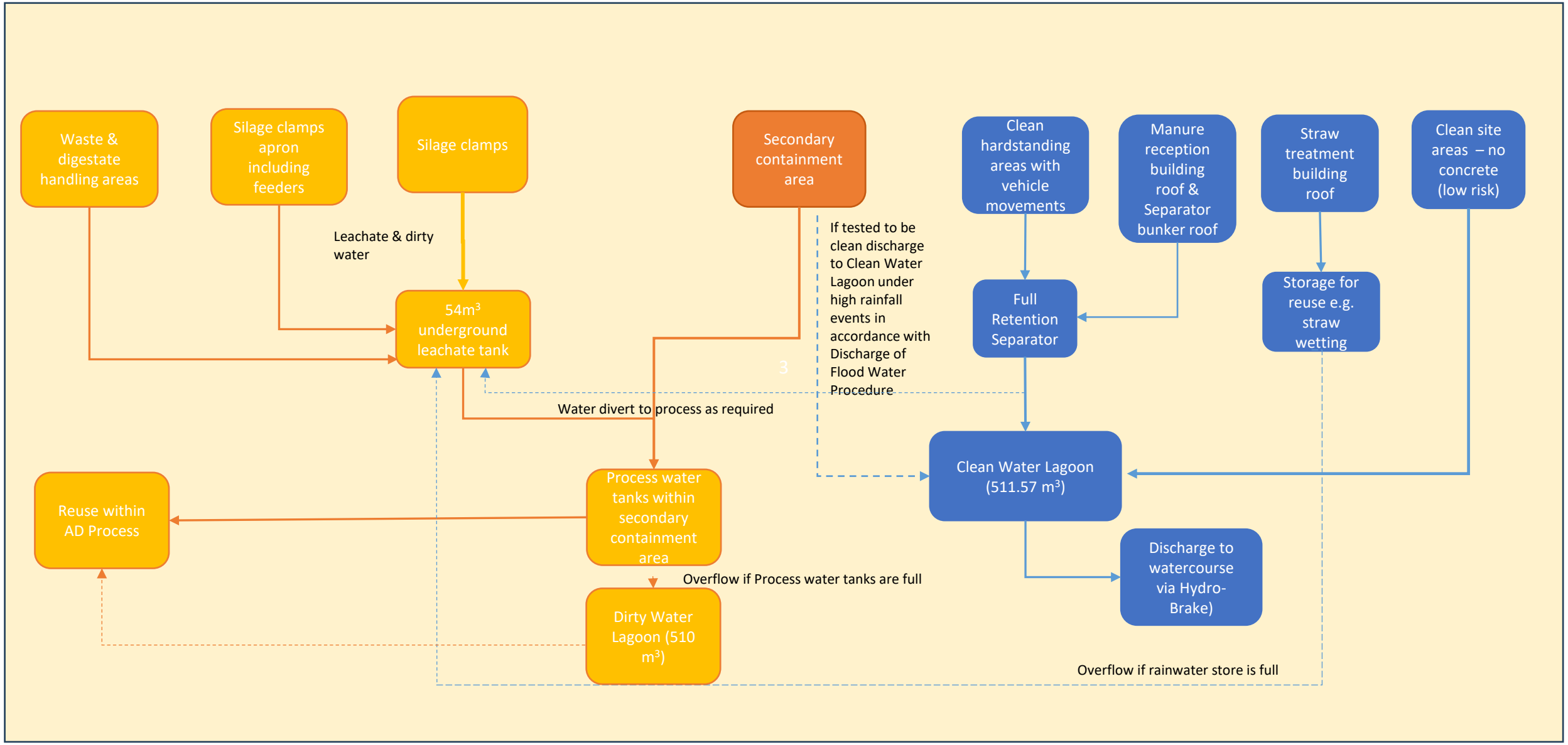
Drawn By: NDJ

Checked: – –

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

Figure 10 Drainage Process Flow Diagram (HRCL-ETL-DRAINAGE PROCESS-PFD-P1)

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



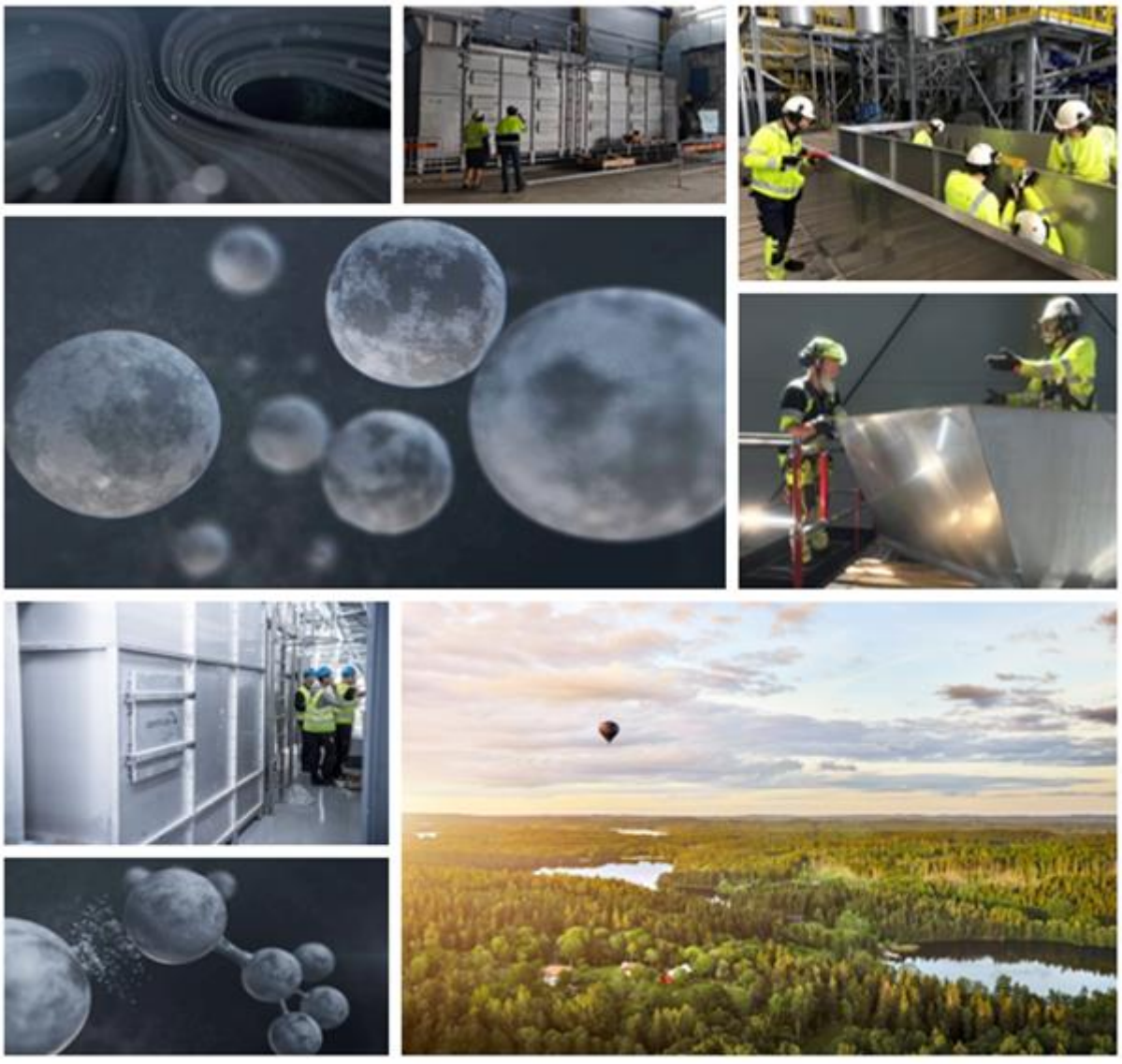
Appendix B – Emissions Abatement Plant System

- Technical Description
- Table 8 Example Annual Service and Maintenance Schedule

centriair

Quotation no.: 1 517

Acorn Bioenergy



Quotation no:	1517	Valid through:	2024-09-19	Customer:	Acorn Bioenergy
Date	2024-08-19	Your ref:	Emanuel Andersson	Our ref:	Roger Hammet

Budget Quotation for Odour removal

Centriair develops and offers technology leading solutions for abatement of industrial airborne emissions. We provide solutions with proven environmental and economic benefits. Our systems typically have higher performance and lower energy consumption than prevailing solutions. We help the industry solve a broad range of emission problems while

- increasing the productivity and
- reducing operations and maintenance costs.

These benefits are achieved through higher performance, lower energy consumption and by recovering energy from the process. We work across a broad range of industry sectors, however most of our customers are in the food processing and waste processing industries.

Biogas

Biogas plants typically have a challenge with odour, mainly due to the fact that the sources in the plant have very varying odour concentrations. Public perception is also that the biogas plants generate fairly aggressive odors, something that creates resistance to new projects and raise the focus of authorities. Centriair have focused on these particular aspects of the technical challenge in biogas odour treatment, with our range of technologies targeting different odour concentrations with adapted technologies. This has resulted in a number of very well-functioning plants that still have relatively low consumption of energy and consumables.

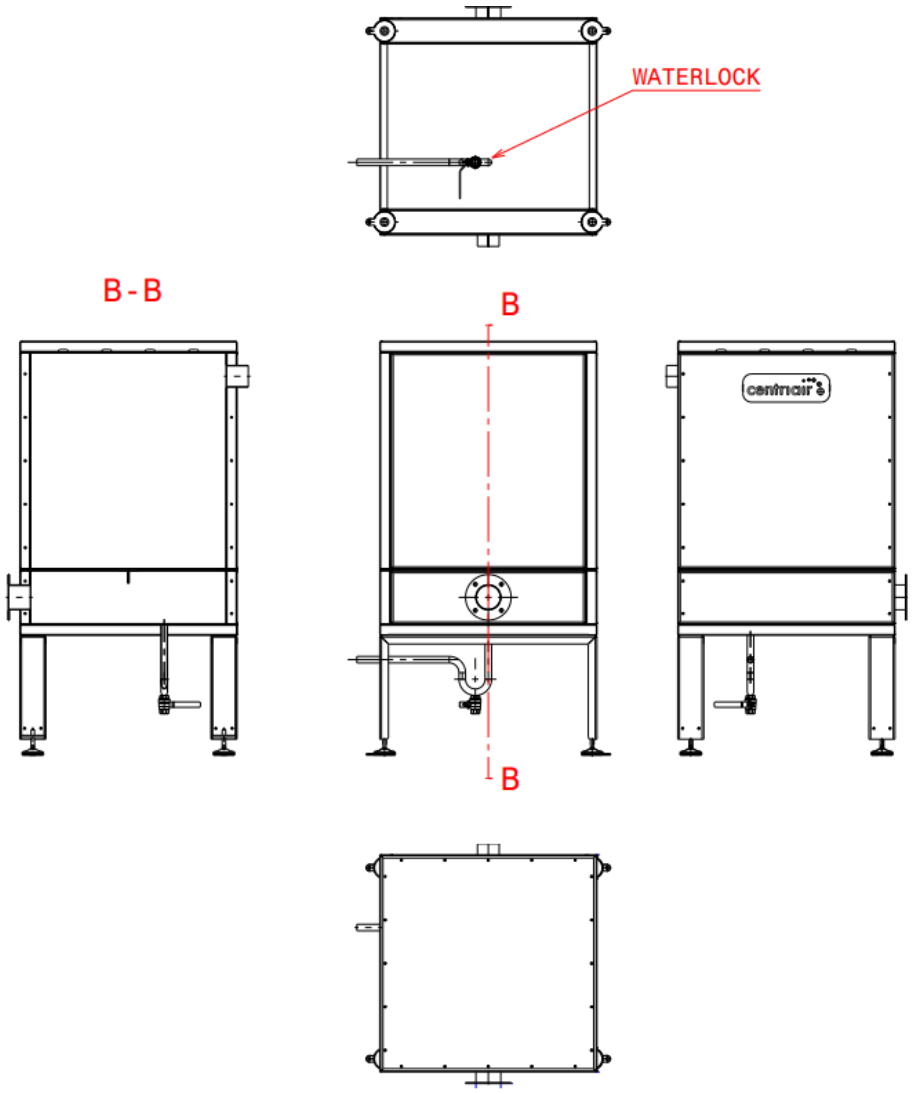
Introduction

Centriair is pleased to offer this quotation for odour removal at the client site based on the ColdOx™ system.

The following system is suggested to be designed for the application:

Position	No	Component	Power Installed/Normal operation	Material
	3	Activated carbon filter unit		Stainless steel AISI 316

Preliminary Layout



Overall system specification:

Active Carbon Specification:

Description:	Centriairs standard carbon CTC-60 is a high quality pellet media from coal. High quality raw material guarantees a physically stable product, hard with low dust levels. A large variation in pore size and high activation degree makes it a versatile product suitable for the complex gas compositions of odour treatment.
Carbon volume:	300 kg
Material:	Stainless steel AISI 316
Dimensions:	1 000 x 1 000 x 1 800 mm
Disposal of Carbon	For the disposal of spent media, we recommend following the guidelines of the European Waste Catalogue EWC and use the waste code number 19 09 04 or 15 02 03 – non hazard waste. Numerous landfills containing household trash and building materials will accept the loaded gas purification product, which is totally harmless to the environment, after submitting a declaration of analysis.

Example picture of the activated carbon filter unit

Schedule 16: Performance tests and procedures

1. Schedule Summary

This schedule describes the performance tests, per Clause 35, that are to be carried out, their duration, the raw materials to be used, what product is to be made, the conditions under which they are to be carried out, how the Plant is to be operated and so on. The parameters that are actually to be guaranteed and their associated liquidated damages are then set out below and in Schedule 17.

Performance Test shall demonstrate:

- the Plant satisfies the Performance Guarantees; and
- the Plant complies with the Specification and the requirements of this Contract.

2. Pre-requisites to Performance Tests

These include but not limited to:

- Following completion & acceptance of Schedules 9, 10, 13, 14 & 15, the performance test period will commence.
- All values and figures are based on the fact that the Plant is operated in line with the operation and maintenance manuals supplied by the **Contractor** and with the feedstock supplied by the **Purchaser** under Schedule 3
- Steady state operation as stated in Schedule 15
- The **Purchaser** shall instruct the **Contractor** as to where and how noise and emissions shall be measured. In response, the **Contractor** shall prepare a method statement outlining the process for measuring noise and emissions, such method statement to be in accordance with all requirements set out in the **Purchaser's** planning permission.

3. Performance Test Parameters

The **Contractor** will provide to the **Purchaser** a Performance Test plan which will include all procedures to achieve a successful test. it will follow to demonstrate the Plant will meet the Performance Parameters listed below

The following table details the performance parameters, expected and guaranteed values that are to be demonstrated by the **Contractor** and are linked to the Performance Damages in Schedule 17:

Design and guaranteed process values

Parameter	Unit	Expected Value	Guarantee Value	Acceptability Criterion	Comments
Total Air flow	m^3/hour	18,500	18,500*	not less than	Equates to building dimension to give a minimum of 3 changes per hour
Ammonia concentration (from exhaust stack)	Mg/Nm ^{3}	0.3-20	0.3-20	not more than	Conform to BAT guidelines

Odour units (from exhaust stack)	Ou/Nm^3	<800	<1000	not more than	Conform to BAT guidelines

* The flow rate and changes will be sufficient to ensure a negative pressure within the building based on dimensions supplied by on Acorn, in normal operation.

The following table details the performance parameters with expected values and acceptability criteria that are to be demonstrated and are linked to the achieving an Acceptance Certificate under Clause 35 and 36:

Additional Performance Parameters				
Parameter	**Unit**	**Expected Value**	**Acceptability Criterion**	**Comments**
Power usage	kW	39.25- in normal operation	No more than	Total power of complete Works in normal operation
Air changes per hour	No. per hour	3*	No less than	
Water usage	Litres per day	1000- Based on expected ammonia concentrations	No more than	

* The flow rate and changes will be sufficient to ensure a negative pressure within the building in normal operation

4. Performance tests and procedures

The **Contractor** agrees to provide performance guarantees. Guarantees of performance measured by tests will establish how well the Plant is performing against the Contract requirements. The tests and criteria are set out above and the guaranteed values are in Schedule 17. The Performance test and procedures are defined in Clause 35 and set out below;

1. The **Contractor** is to confirm in writing to the **Purchaser** that the Plant has achieved steady state, i.e., it runs as per the requirements as defined in Schedule 15 for 48 hours prior to the commencement of the Performance Test. A 2-week notification period will be given prior to the commencement of the performance test.
2. Once the Performance Test window commences the window will last for a maximum of 6 weeks

3. Proof of performance is considered to have been achieved as soon as the Performance Parameters of the Plant over a rolling period of 28 days is on average within the parameters stated and their respective acceptability criteria in the Performance test parameters. Testing frequency and methodology to be agreed.
4. If any equipment reliability issues hinder the performance test, the 6-week testing period will reset, within the 18-week window.
5. There are a maximum of 3 resets during the 6-week performance testing window.
6. As a minimum to evidence the performance the following information will be recorded and logged:
   6.1. Parasitic power consumption
   6.2. Total air flow (Nm^3 per hour)_
   6.3. Odour (units) from exhaust stack
   6.4. Ammonia (units) from exhaust stack

   6.5. Any other non-air components (units) exiting the exhaust stack
   6.6. Consistent negative pressure within the building
7. The Contractor and Purchaser shall calibrate all instruments used in the Performance test in their respective scope prior to the Performance test.
8. If the performance of the Plant will be reduced or interrupted for any reasons not caused by the Contractor, the performance test duration as well as the performance test window will be extended by the same amount of time lost due to the disruption (including the time required to get back to steady state conditions, if applicable). In this case, the Contractor must notify the Purchaser within 5 working days of the disruption. Consequently, the output recorded due to the reduction and/or interruption shall be excluded from the dataset.
9. The plant will be operated by the **Purchaser** (Acorn Operations) staff during this period under the direction of the **Contractors'** experienced staff**.**

Cause & Effect list (Interlocks for PLC program)

1108 Acorn Bioenergy - Three Maids

Document 1108-200-006_01
23.04.2024

Centriair Odour Abatement Plant

Tag	Name	Function	Location	Range	Signal	Description	START	STOP	UV Reactor (UV lamps) S01-L01-UV01	CIP solenoid valve (UV reactor) S01-L01-UV01-SV01	Scrubber S01-L01-SCB01	Main fan S01-L01-FA01
Fire Alarm Customer (if available)			Input Signal Customer	-	1/0	External fire alarm signal from customer, shuts down ColdOx system.			OFF	closed	OFF	OFF
Emergency Stop			Emergency stop button	-	1/0	Emergency stop function, immediately switches off ColdOx system and generates an alarm when e-stop button is pushed.			OFF	closed	OFF	OFF
Sensor limits and alarms												
S01-L01-UV01-PI01	Pressure sensor UV	PI	UV reactor	-100 to +100 mbar	4-20 mA	Measures and monitors the process pressure at the suction side of the UV reactor. Shuts off UV if there is no underpressure (no air flow)			OFF	closed	/	/
S01-L01-UV01-GS01	Door safety switch	GS	UV reactor	-	1/0	Immediately shuts down the UV if the door is opened during operation			OFF	closed	/	/
S01-L01-UV01-TI01	Temperature sensor UV	TI	UV reactor	-50 to +400 C	Pt100	Measures and monitors the process gas temperature at the inlet of the UV reactor. Shuts off UV and generate alarm if temperature is too high.			OFF	closed	/	/
S01-L01-UV01-TI02	*Temperature sensor cabinet*	*TI*	*balllast cabinet*			*Measures and monitors the temperature inside of the ballast cabinet. Generates an alarm if temperaure is too high.*			/	/	/	/
S01-L01-UV01-XI01	*UV lamp power*		*balllast cabinet*			*Power meter to monitor UV lamp power (total). Generates alarm if power is below limit.*			/	/	/	/
S01-L01-CF01-PI01	Pressure sensor CF	PI	carbon filter	-100 to +100 mbar	4-20 mA	Measures and monitors the process pressure at the outlet of the carbon filter. Generate an alarm and turn down main fan if pressure is too low.			/	/	/	Set Speed (reduce power)
S01-L01-FA01-VFD01	Variable frequency drive	VFD	VFD cabinet			Monitors the state of the fan (motor). Switch off UV in case of fan error/failure.			OFF	/	OFF	OFF
S01-L01-FA01-PI01	Pressure sensor inlet	PI	Inlet pipe	-100 to +100 mbar	4-20 mA	Measures and monitors the process pressure at the inlet of the Centriair system. Controls main fan to maintan suction (underpressure) at inlet. Generate an alarm if pressure is too high.			/	/	/	Set Speed
S01-L01-FA01-QI01	H2S sensor	QI	outlet pipe	0 to 100 ppm	4-20 mA	Measures and monitors the H2S level at the outlet of the Centriair system. Generate an alarm if H2S concentration is too high.			/	/	/	/
S01-L01-SC01-TI01	Temperature sensor inlet	TI	Inlet pipe	-50 to +400 C	Pt100	Measures and monitors the process gas temperature at the inlet air. Generate alarm and shut off system if temperature is too high.			OFF	closed	OFF	OFF
S01-L01-DP01	Differential pressure calculation (S01-L01-UV01-PI01 / S01-L01-CF01-PI01)	DP	virtual / calculation			Monitors differential pressure in UV and CF. Generates alarm if differential pressure is too high.			/	/	/	/
Operating conditions												
SYSTEM ON - System is running normally (start signal from external source, no alarms)									ON	CIP active	ON	ON
SHUTDOWN - End of run, shut-down (start signal switched off, no alarms)									OFF	CIP once	OFF	ON
STANDBY - Ready for operation (no start signal, no alarms)									OFF	closed	OFF	OFF

Tag	Set value (Normal value)	Alarms and Interlocks (Safety Chain): High-high	High-high action	Low-low	Interlocked to	Alarm message HMI	Warnings (Text only): High	Warning message HMI	Low	Warning message HMI	Sensor failure	Warning message HMI	Range: Min	Max	Unit	Rev
Fire Alarm Customer (if available)	NC	contact opens	Shut off ColdOx system.	-			-		-							
Emergency Stop		e-stop button pushed	Switch off ColdOx system and generate an alarm when e-stop button is pushed.	-	-	*Emergency stop engaged, system halted (critical).*	-		-							
Sensor limits and alarms																
S01-L01-UV01-PI01	-500 Pa	> -100 Pa	shut down the UV reactor lamps	-	S01-L01-UV01	*No underpressure (no suction) in UV reactor (critical).*	-300 Pa	*Check underpressure in UV reactor.*	-		Generate alarm, system stays in operation	*Pressure sensor X fault.*	-10000	+10000	Pa	
S01-L01-UV01-GS01	NC	contact opens	shut down the UV reactor lamps	-	S01-L01-UV01	*UV reactor door open (critical).*	-		-		n.a.					
S01-L01-UV01-TI01	40°C	> +70°C	shut down the UV reactor lamps	-	S01-L01-UV01	*UV temperature too high (critical).*	55 °C	*Check UV reactor temperature.*	-		Generate alarm, system stays in operation	*Temperature sensor X fault.*	-50	+400	°C	
S01-L01-UV01-TI02	*45°C*	-	*Generate alarm if cabinet temperature is too high*	-	-		*> +55°C*	*Check ballast cabinet temperature.*	-		*Generate alarm, system stays in operation*	*Temperature sensor X fault.*	*-20*	*+80*	*°C*	
S01-L01-UV01-XI01	*100%*	-	*Generate alarm if UV power drops below lower limit.*	-	-		-		*< 70%*	*Check UV lamps/ballasts.*	n.a.				*kW*	
S01-L01-CF01-PI01	-1.800 Pa	-	Generate an alarm and turn down main fan if pressure is too low.	< -2.400 Pa	S01-L01-FA01	*Pressure after carbon filter too low (critical).*	-		-2.000 Pa	*Check pressure after carbon filter.*	Generate alarm, system stays in operation	*Pressure sensor X fault.*	-10000	+10000	Pa	
S01-L01-FA01-VFD01	-	VFD fail	Switch off UV in case of fan error/failure.	-	S01-L01-FA01 S01-L01-UV01	*VFD / fan failure (critical).*	-		-		-					
S01-L01-FA01-PI01	-100 Pa	-	Generate an alarm if pressure is too high.	-	S01-L01-FA01		> 300 Pa	*Check underpressure at inlet.*	-		Generate alarm, run fan at fixed speed. (Define fixed speed during comissioning.)	*Pressure sensor X fault. Fan set to fixed speed.*	-10000	+10000	Pa	
S01-L01-FA01-QI01	0 Pa	-	Generate an alarm if H2S concentration is too high.	-	-	-	> 2 ppm	*H2S level at outlet too high.*	-		Generate alarm, system stays in operation	*H2S sensor X fault.*	0	100	ppm	
S01-L01-SC01-TI01	35°C	> +90°C	Generate alarm and shut off system if temperature is too high.	-	S01-L01-UV01 S01-L01-SC01 S01-L01-FA01	*Inlet temperature too high (critical).*	80 °C	*Check inlet temperature.*	-		Generate alarm, system stays in operation	*Temperature sensor X fault.*	-50	+400	°C	
S01-L01-DP01	300 Pa	-	Generate alarm if differential pressure is too high	-	-		> 700 Pa	*Check differential pressure in carbon filter.*	-		n.a.					

/	= no change/effect to actor
CIP active	= open CIP valve at set interval

Table 8 Example of an Annual Service and Maintenance Schedule

Item	Unit	Description	Frequency
1	**UV Reactor**		
	Inspection	Lamps and ballasts (replaced if needed)	6 months
		Gaskets, CIP nozzles and drainage	6 months
		Function check of pressure sensor and door switches	6 months
	Activities	Replacement of gaskets	6 months
		Replacement of lamps	2 years
		Replacement of ballasts	5 years
		Replacement of CIP nozzles	5 years
2	**Carbon Filter**		
	Inspection:	Gaskets around the hatches	6 months
		Hatches	6 months
		Drainage	6 months
	Activities	Replacement of gaskets	6 months
3	**Fans**		
	Inspection:	Gaskets	6 months
		Impeller	6 months
		Drainage	6 months
		Vibration	6 months
	Activities	Replacement of gaskets	2 years
		Replacement of vibration-damping connectors	3 years
		Inlet/Outlet connections	2 years
4	**Media-Activated Carbon/Iron- Oxide**		
	Inspection	Visually verify status of media	6 months
	Activities	Replacement of activated carbon/iron oxide media – cost of media not included	1-2 years

Appendix C – Odour Monitoring Procedure

Procedure: HRCL-ETL-ODOUR MONITORING -WI19-P1

HRCL-ETL-ODOUR MONITORING -WI19-P1

Odour Monitoring Procedure

Issue 1 – February 2025

Version Control

Issue	Date	Revision Details / Summary of Changes	Author	Approved by
1	Feb 2025	Odour Monitoring Procedure	Earthcare Technical Ltd	

Document owner

[Department i.e., Engineering & Delivery]

Management approval

[i.e., Director of Engineering and Delivery]

ROUTINE ODOUR MONITORING (DAILY)

1. The Odour Assessor

You must only undertake routine odour monitoring if you are not desensitised to odour i.e., you have not been subject to significant odour in the 30-minutes prior to the assessment or have not consumed strongly flavoured food or drink within this time.

2. Recording

The reporting forms used will depend on the level of odour investigation required. Observations should be recorded on:

Odour Monitoring Form (HRCL-ETL-ODOUR MONITORING-AQD 22-P1)

- Record weather conditions and time
- Record details of the routine (daily) odour survey at the 'fixed' monitoring locations (nos. 1 – 6) using the **Odour Monitoring Form**

Site Diary

- The Site Diary is filled in every day
- On completion of the odour survey at the 'fixed' monitoring locations enter either 'OK' or 'not OK' if odour issues are noted e.g., odours of moderate intensity (i.e., a score of 3 and above) are detected at receptor locations

3. Weather

Site operatives are responsible for recording the weather conditions before/ during the survey using onsite weather station data or an online resource and cross-checked against field observations during the survey. Observations should include wind direction, wind speed, and air temperature.

4. Odour 'sniff tests'

Routine (daily) monitoring should be undertaken at the 'fixed' locations shown in Figure 6 in the **Odour Management Plan**. Additional monitoring (i.e., at other locations or at another time during the working shift) may need to be undertaken:

- At the relevant downwind site boundary

- If a distinct odour (intensity of 3 and above) is detected at the downwind site boundary a sniff test should also be undertaken at the nearest downwind receptor location (if not already covered by the fixed monitoring locations)
- In the event of an odour complaint
- During any on-site operations where there is an increased risk of odour release

If a distinct odour (intensity of 3 or above) is detected at a receptor location the source of the odour should be traced and investigated.

If the source of the odour is found to be due to site activities, measures should be implemented to bring the odour release back under control and/or the activity should be stopped until the issue is resolved and/or prevailing weather conditions are more suitable.

Record data using both the Odour Monitoring Form and the Daily Check sheet.

Table 1 - Routine (Daily) Odour Monitoring Locations – see Figure 6 in OMP

Daily ('fixed') Proposed AD Plant boundary locations	
OMP1	NE boundary
OMP2	N boundary
OMP3	NW boundary
OMP4	W boundary
OMP5	S boundary
OMP6	E boundary
Daily Flexible locations	
OMP7	Flexible location: a location on the downwind site boundary (if this is not already included as a fixed monitoring location listed above)
OMP8	Flexible location: the nearest downwind receptor if the odour intensity at the site boundary is >3)
Weekly Flexible location	
OMP9	Flexible location - nearest off-site downwind receptor location(s) (even if odours are not detected at site boundary)

4.1 Sniff test method

Start at off-site locations and/or upwind locations. Walk slowly, breathing normally. If an odour cannot be detected in this way, periodically stand still and inhale deeply facing upwind.

Use the guidelines below to compete the odour sniff test and record findings on the **Odour Monitoring Form:**

Odour intensity is scored between 0 - 6 as follows:

0	**No detectable odour**
1	**Very faint odour** e.g. if odour is detected but there is some doubt as to whether an odour is present
2	**Faint odour** e.g. if an odour is detected but cannot be described using precise words or terms
3	**Moderate odour** e.g. odour is detected while walking and the odour character is recognisable
4	**Strong odour** e.g. if the odour character is easily recognisable
5	**Very strong** e.g. very strong but bearable
6	**Extremely strong** e.g. an instinctive reaction is to reduce personal exposure to the odour

Odour duration is scored between 1 – 5 as follows:

1	**No detectable odour**
2	**Transient odour** e.g. whiff (only detectable for brief intermittent spells).
3	**Sporadic discrete odour** <5 to 10 minutes or <50% of total assessment time at that location if less than 30 minutes
4	**Persistent odour** greater than 50% of the assessment time but not continuous, fairly localised
5	**Continuous** present throughout the assessment period

Receptor sensitivity is scored between 1 – 3 as follows

1	**Low** e.g. footpath, road
2	**Medium** e.g. industrial or commercial workplaces
3	**High** e.g. housing, pub/hotel, etc.

Description of odour

Provide a **description** of what the odour smells like. These include, for example:

- Raw biogas (pungent, sulphurous/ eggy, sweet)
- Silage (fruity/ sweet/ floral)

State the **hedonic tone** of the odour.

The hedonic score refers to the type of smell and how pleasant or unpleasant it is irrespective of its strength (intensity) and can help to decide how offensive an odour may be. As shown in Table 2, the hedonic scale ranges from +4 (pleasant) through zero (neutral) to -4 (unpleasant).

Table 2 – Hedonic Tone

Hedonic Tone	Verbal Description
-4	Extremely unpleasant
-3	Moderate unpleasant
-2	Unpleasant
-1	Slightly unpleasant
0	Neutral
+1	Slightly pleasant
+2	Pleasant
+3	Moderate pleasant
+4	Extremely pleasant

If known, the suspected or confirmed source of the odour should be entered into the **'Operational status'** section.

Abnormal site operating conditions at the time of the survey e.g., maintenance to process equipment should also be recorded.

5. Odour Monitoring - Flow Diagram

Step 1
Monitoring

- Record weather conditions and time
- Record details of the routine (daily) odour survey at the 'fixed' monitoring locations (nos. 1 – 6) and flexible downwind locations (nos. 7 - 9)
- If odour present at intensity 3 or above at receptor location(s) an investigation regarding the source of the odour should be undertaken
- Proceed to Step 2

Step 2
Investigation

- Use extra lines on the Odour Monitoring Form to record the additional locations surveyed as part of investigation into odour source
- If known, the suspected or confirmed source of the odour should be entered into the 'Operational status'
- Complete Odour Monitoring Form and report results to Site Manager

Step 3
Record

- On completion of the odour survey at the fixed (1 - 6) and flexible monitoring locations (7 - 9) enter either 'OK' or 'not OK' if odour issues are noted on the Site Diary report results to Site Manager

Appendix D – Forms

- Odour Complaint Form (**ABL-QUAL-Complaint form AQD04-R1**)
- Odour Monitoring Form (**HRCL-ETL-ODOUR MONITORING-AQD 22-P1**)

Horse Close AD Plant - Odour Complaint Form (ABL-QUAL-Complaint form AQD04-R1)	
Time and date of complaint:	Name and address of complainant:
Telephone number of complainant:	
Date and time of odour:	
Location of odour, if not at the above address:	
Weather conditions (*i.e.*, dry, rain, fog, snow):	
Temperature (very warm, warm, mild, cold or degrees if known):	
Wind strength (none, light, steady, strong, gusting):	
Wind direction (*e.g.* from the NE):	
Complainant's description of odour: • What does it smell like?	
• Intensity (see below)	
• Duration (time)	
• Constant or intermittent in this period:	
• Does the complainant have any other comments about the odour?	
Are there any complaints relating to the installation, or to that location? (either previously or relating to the same exposure):	
Any other relevant information:	
Do you accept that odour is likely to be from your activities?	
What was happening on site at the time that the odour occurred?	
Operating conditions at the time that the odour occurred	
Actions taken:	
Form completed by:	Date:
Signed:	

Intensity

0	No odour	3	Moderate odour	6	Extremely Strong odour
1	Very faint odour	4	Strong Odour		
2	Faint odour	5	Very strong odour		

Survey Locations					HORSE CLOSE AD PLANT					Version: 1	
					Odour Monitoring Form (HRCL-ETL-ODOUR MONITORING-AQD 22-P1)					Week Commencing:	
Date	**Time**	**Location**	**Odour Intensity (0 – 6)**	**Odour Duration (1 – 5)**	**Sensitivity (1 – 3)**	**Odour Description**	**Wind direction**	**Ave. wind Speed (mph)**	**Temp. (°C)**	**Operational Status/ Comments**	**Assessor**
Mon		**1**									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
Tue		**1**									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									

Odour Intensity Scale is from 0 – 6

0. No detectable odour
1. Very faint odour (odour detectable but doubt as to whether present)
2. Faint odour (need to inhale facing into the wind)
3. Moderate odour (easily detected)
4. Strong odour (bearable)
5. Very strong odour
6. Extremely strong odour (e.g., possibly causing nausea)

Odour Duration Scale is from 1 – 5

1. No detectable odour
2. Transient odour e.g., whiff (only detectable for brief intermittent spells).
3. Sporadic discrete odour: <50% of total assessment time at that location
4. Persistent odour greater than 50% of the assessment time but not continuous, fairly localised
5. Continuous, present throughout the assessment period

Sensitivity

1. Low (e.g., footpath, road)
2. Medium (e.g., industrial or commercial workplaces)
3. High (e.g., housing, pub/hotel, etc.)

Monitoring Locations:

1. OMP1 – NE boundary
2. OMP2 – N boundary
3. OMP3 – NW boundary
4. OMP4 – W boundary
5. OMP5 – S boundary
6. OMP6 – E boundary
7. OMP7 – A location on the downwind site boundary (if this is not already included as a fixed monitoring location as above)
8. OMP8 – The nearest downwind receptor (if the odour intensity at the site boundary is >3)
9. **OMP9 - Weekly only:** Flexible location - nearest off-site downwind receptor location(s) (even if odours are not detected at site boundary)

Date	Time	Location	Odour Intensity	Odour Duration	Sensitivity	Odour Description	Wind direction	Wind speed	Conditions/ Temp.	Operational Status/ Comments	Assessor
Wed		1									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
Thurs		1									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
Fri		1									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									
Sat		1									
		2									
		3									
		4									
		5									
		6									

		7									
		8									
		9									
Sun		**1**									
		2									
		3									
		4									
		5									
		6									
		7									
		8									
		9									

Additional Survey Locations	HORSE CLOSE AD PLANT	Version: 1
	Odour Monitoring Form (HRCL-ETL-ODOUR MONITORING-AQD 22-P1)	Week Commencing:

Date	Time	Location	Odour Intensity	Odour Duration	Sensitivity	Odour Description	Wind direction	Wind speed	Conditions/ Temp.	Operational Status/ Comments	Assessor