Odour Management Plan

Home Farm Grange

March 2026

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Signature Page

March 2026

Odour Management Plan

Home Farm Grange



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1. INTRODUCTION

This document has been prepared by Sol Environment Ltd on the behalf of Engie Renewable Gases Ltd ("Engie" hereafter) in support of its Environmental Permit Application relating to their proposed site at Home Farm Grange at Land East of A162, Low Farm, South Milford, Sherburn in Elmet, LS25 6FW. The National Grid Reference for the site is SE 50420 32210.

The document provides a structured framework and approach in effectively managing potential odour releases associated with the operations at the site.

This Odour Management Plan document (referred hereafter as the 'OMP') has been produced in accordance with the following documents:

- Environment Agency Technical Guidance '*Odour Management: comply with your environmental permit'* published online 3rd December 2025;
- Environment Agency's Technical Horizontal Guidance Note '*H4: Odour Management: How to comply with your permit' (now withdrawn)*; and
- General monitoring procedures detailed in Environment Agency guidance document Internal Guidance for the *Regulation of Odour at Waste Management Facilities*.

The purpose of this document is to outline the management control measures that have been established to prevent and control odour emissions and associated impacts from the site.

1.1 Structure of Odour Management Plan

The OMP has been structured in accordance with the EA *H4 Odour Management Plan Guidance (since withdrawn),* and the latest version of the Odour Management guidance, published on 3rd December 2025.

This OMP has been developed to clearly define measures which will be implemented on site to what control and/or prevent odour. The potential measures considered are in-line with the available guidance and include the following:

- Receipt and Management of Odorous Materials;
- Transfer of Chemicals to Air;
- Containment of Contaminated Air;
- End of Pipe Treatment;
- Engaging your Neighbours;
- Response to Complaints;
- Ceasing or Reducing Operations; and
- Accident Management Plan.

The OMP considers the following aspects of the facility:

- Activities that have the potential to produce odour and sources of release;
- Actions to mitigate the effect of odour release (during normal and abnormal operations);
- Details of the sites monitoring regime;

- Details of responsible persons at the installation; and
- Potential outcomes of each failure scenario in respect to odour impact.

1.2 Responsibility for Implementing, Maintaining, and Reviewing the Odour Management Plan

Primary responsibility for the implementation, maintenance and review of this Odour Management Plan falls to the competent Site Operations Manager. The Site Operations Manager is responsible for ensuring all staff are trained in the contents of this management plan and that operational procedures align with the objectives of this management plan. Training is undertaken in the style of "toolbox talks" – a common practice in industry for delivering training. New staff members are trained by the Site Operations Manager (or other competent senior staff member prior to beginning their role. Refresher training is delivered to all staff annually, or when significant changes/updates have been made.

This plan is stored electronically on site, within the company's document library, and a physical copy is stored in the site office for easy access by site staff. This plan is reviewed on an annual basis as part of the site's annual environmental review of all protection measures and methodologies.

1.3 Status of Odour Management Plan

The OMP is a "live" document and will form part of the key environmental management documents for the facility. All monitoring procedures, responsibilities and compliance actions will be updated as and when required.

Any revisions in the OMP or associated Annexes will be updated and inserted accordingly.

2. SITE DETAILS

2.1 Site Location

The proposed site is located at Land East of A162, Low Farm, South Milford, Sherburn in Elmet, LS25 6FW.

The National Grid Reference for the centre of the proposed site is SE 50420 32210.

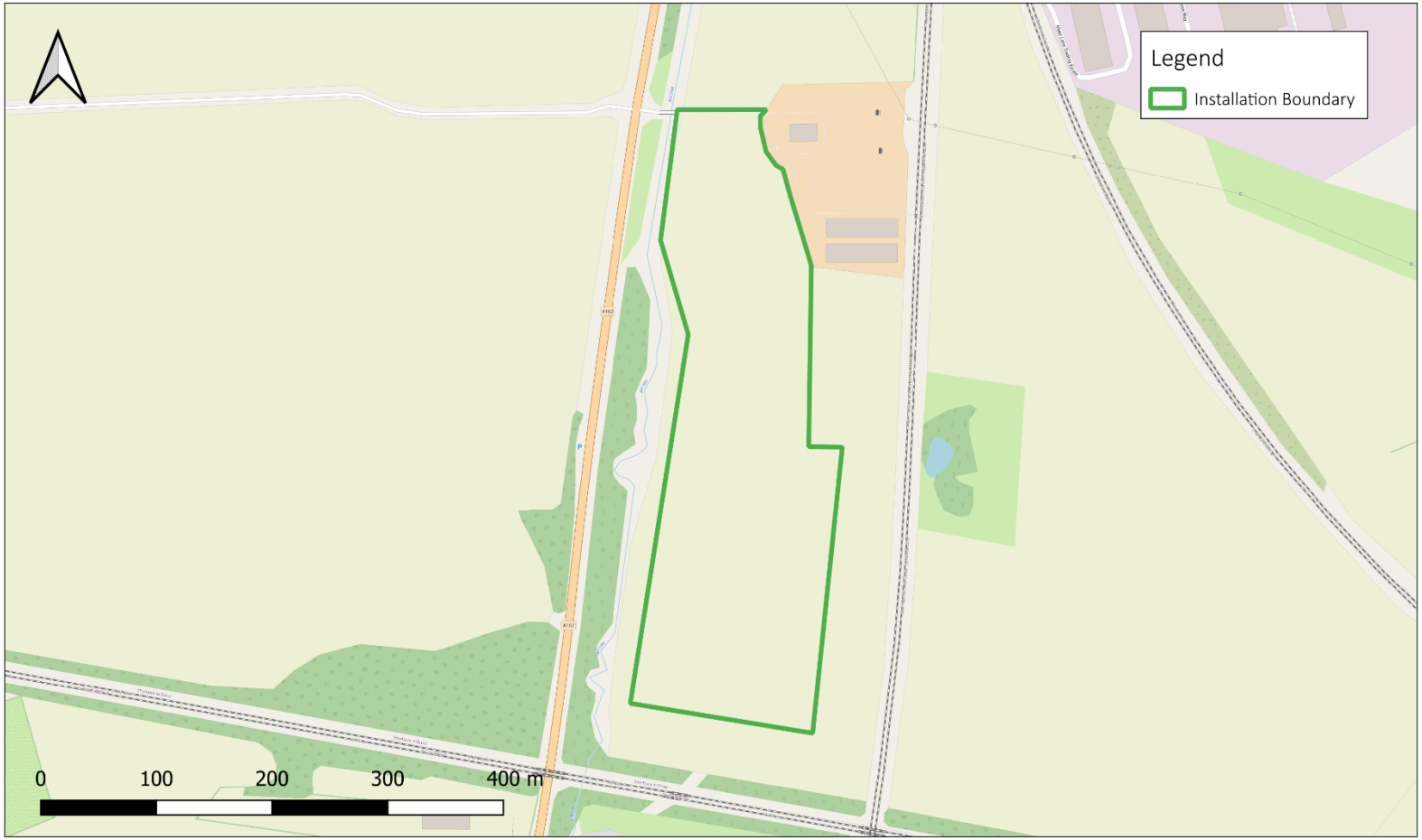
2.2 Site Description

Engie's proposed AD plant will accept up to 100,000 tonnes per annum of feedstock including manures and slurries, maize, silage, whole crop rye, vegetable waste and potato rejects from Home Farm and other local farms. Biogas produced by the AD plant will be upgraded and exported to the grid, and the digestate, which will meet PAS 110 accreditation, will be used for agricultural land improvement.

The site will comprise of the following key infrastructure, as well as a collection of ancillary infrastructure:

- Silage Clamps;
- Feedstock Reception Building;
- Feeders;
- Liquid Feed Tanks;
- 1 x Digestion Tank;
- 2 x Post Digesters;
- Biogas Upgrading Plant;
- 2 x Natural Gas Gensets;
- Digestate Lagoon;
- Grid Connection infrastructure;
- CO2 Building;
- Separator Building;
- Bund (4m in height surrounding tank area).

.



Project Number: SOL_25_P007_ENG Doc Ref: Annex B - Site Plans Map Title: Installation Boundary Date: 26/03/2025 Drawn by: RM Checked by: EH	Site Address: Land East of A162, Halstow Energy AD Facility Low Farm South Milford Sherburn in Elmet LS25 6FW	1. Do not scale off this drawing 2. All dimensions to be confirmed on site 3. This drawing is copyright of Sol Environment Ltd 4. This drawing is to be read in conjunction with relevant consultant drawings and specifications 5. QMS Reference: QMS_7.5.39_TEM - Template - GIS Drawing - Horizontal v1

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Figure 2.1 - Site Location



Figure 2.2 - Installation Layout Plan

2.3 Site Context

The following sections outline the site context, including the proposed boundary and layout, surrounding site setting and any nearby sensitive receptors.

2.3.1 Site Setting

The site is located in a mixed-use landscape, comprising of a blend of industrial, commercial (including agriculture), residential and recreational assets, as well as prominent ecological features. Table 2-1 outlines the surrounding site setting in greater detail, including features in the immediate vicinity, within 500m and beyond 500m of the proposed site.

Table 2.1 - Site Setting

Direction	Description
North	Immediate Vicinity: Agricultural Land, Low Farm Energy AD Plant Within 500m: Agricultural Land, Bypass Park Estate, Commercial Units including YDL Distribution, David Wattson Transport, and Bishop's Move York Beyond 500m: Agricultural Land, Residential housing and local amenities in Sherburn in Elmet, A162 Road, Surface Water Lagoon, commercial units including The Great Bear, Esterform Packaging, and Sherburn Motor Spares
East	Immediate Vicinity: Agricultural Land, small woodland block Within 500m: Agricultural Land, Railway Line Beyond 500m: Agricultural Land, Sherburn in Elmet Airfield Airport (EGCJ), Breeze Aviation Services Ltd, Gascoigne Wood Power Plant
South	Immediate Vicinity: Agricultural Land, Railway Line Within 500m: Agricultural Land, Maltings Tea Rooms, Floosie Brow Artist, Woodhaven Boarding Kennels and Cattery Beyond 500m: Amur AD Plant, The Maltings Organic Treatment, Residential Housing and local amenities in South Milford, Agricultural Land, Railway Line
West	Immediate Vicinity: Mill Dike Within 500m: A162 road, Agricultural Land, small woodland Beyond 500m: Residential housing on Milford Road, Tadcaster Timber Products, Agriclutral Land, South Milford railway station, YWT Sherburn Willows Nature Reserve,

2.3.2 Nearby Sensitive Receptors

The nearest residential areas to the site are on Mill Lane, located approximately 150m south of the site boundary. Table 2.2 details the identified human receptors relevant to the site:

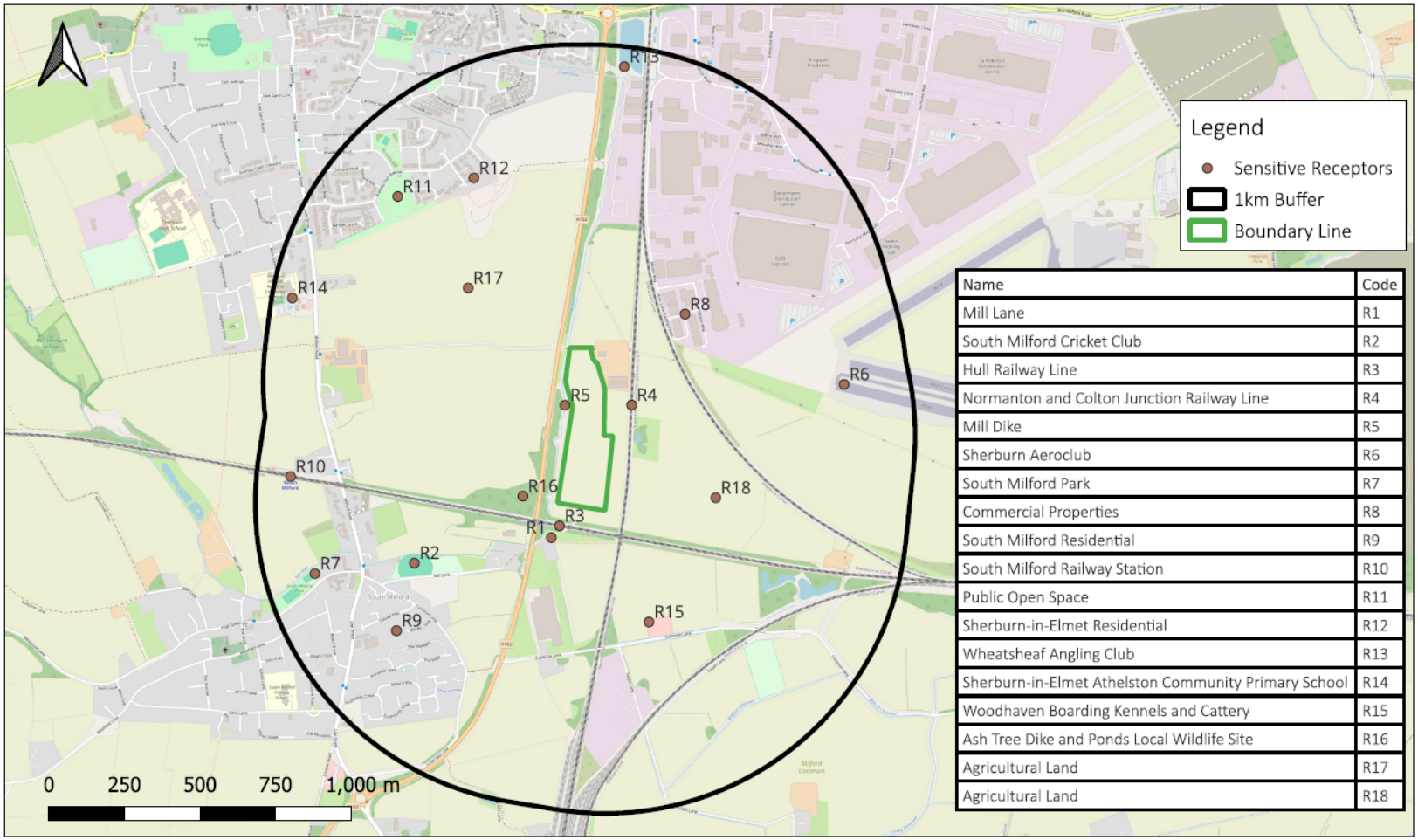
Table 2.2 - Human Receptors

Receptor Name	Distance from Site
Mill Lane	150m S
Maltings Tea Room	330m S
Milford Plants	330m S
Residential properties (Common Lane)	530m S
South Milford (residential housing)	550m SW
South Milford Cricket Club	410m SW
South Milford Football Club	430m SW
South Milford Home Farm	650m W
Residential housing – Milford Road	870m NW

Public open space	770m NW
Bypass Park Estate	430m N
Wheatsheaf Angling Club	940m N
Commercial and Industrial Estate	300m-1.72km NE
Sherburn Aeroclub	890m E
Woodhaven Boarding Kennels and Cattery	500m SE

Figure 2.3 shows the sensitive receptors identified as relevant to the site.

Due to the proximity of the site to human and ecological receptors, the site could be considered to be moderately sensitive in relation to potential emissions, such as odour. However, numerous operational measures for the control and mitigation of emissions have been applied to site to ensure that all potential releases are prevented, therefore reducing this risk.



Name	Code
Mill Lane	R1
South Milford Cricket Club	R2
Hull Railway Line	R3
Normanton and Colton Junction Railway Line	R4
Mill Dike	R5
Sherburn Aeroclub	R6
South Milford Park	R7
Commercial Properties	R8
South Milford Residential	R9
South Milford Railway Station	R10
Public Open Space	R11
Sherburn-in-Elmet Residential	R12
Wheatsheaf Angling Club	R13
Sherburn-in-Elmet Athelston Community Primary School	R14
Woodhaven Boarding Kennels and Cattery	R15
Ash Tree Dike and Ponds Local Wildlife Site	R16
Agricultural Land	R17
Agricultural Land	R18

Project Number: SOL_25_P007_ENG Doc Ref: Annex A - Site Plans Map Title: Sensitive Receptors (Home Farm Grange) Date: 03/04/2025 Drawn by: RM Checked by: EH	Site Address: Land East of A162, Halstow Energy AD Facility Low Farm South Milford Sherburn in Elmet LS25 6FW	1. Do not scale off this drawing 2. All dimensions to be confirmed on site 3. This drawing is copyright of Sol Environment Ltd 4. This drawing is to be read in conjunction with relevant consultant drawings and specifications 5. QMS Reference: QMS_7.5.39_TEM - Template - GIS Drawing - Horizontal v1

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Figure 2.3 - Sensitive Receptors

2.3.3 Wind Direction

The estimated wind direction for the proposed site comes from a predominantly westerly direction, based on historic wind direction recordings taken from the former RAF Church Fenton located approximately 5.40 km northeast of the site.

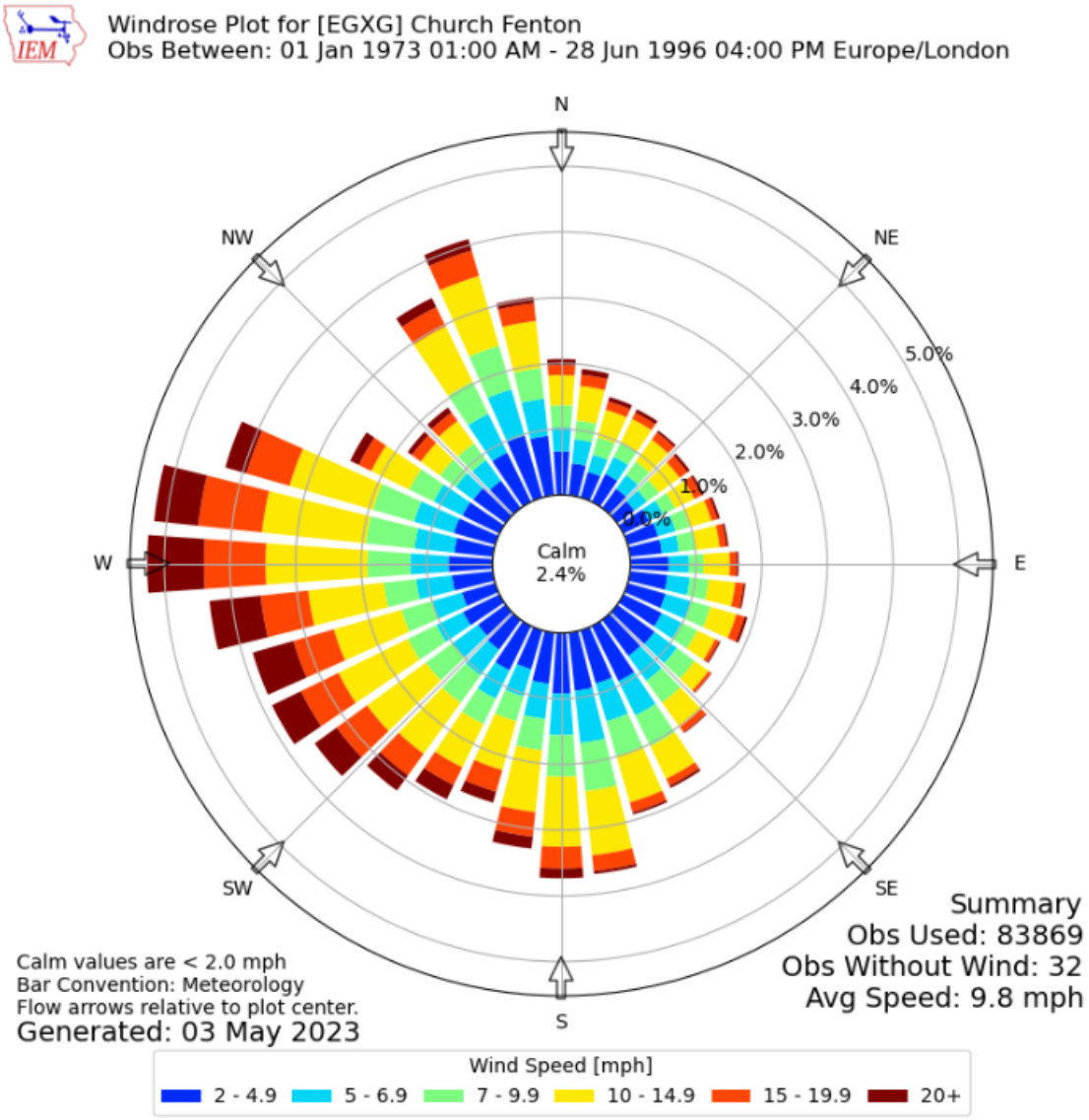


Figure 2.4 - Wind Rose for former RAF Church Fenton

3. PROCESS DESCRIPTION

The proposed AD plant will process up to 100,000 tonnes per annum of feedstock (including manures and slurries, maize, silage, whole crop rye, vegetable waste and potato rejects) from Home Farm and other local farms.

The proposed process includes these key stages:

- *Feedstock Reception and Storage*: Incoming wastes such as manures will be delivered to site and stored within the feedstock reception building. Energy crops and silage will be stored externally within the silage clamps while liquid feedstocks, such as, slurries will be stored in reception tanks:
- *Digestion*: Solid feedstocks are fed to a sealed unit via hoppers, where they are mixed with the liquid feedstocks and recirculated liquids to create a substrate which is pumped into the processing vessels (digesters). Within the digesters, the substrate is mixed and heated to allow the bacteria to break down the organic matter in the absence of oxygen. During digestion, biogas is continuously produced in the vessels, typically around 55% methane and 45% carbon dioxide:
- *Digestate Separation:* Following digestion, the residual digestate material containing indigestible fibre and nutrients is pumped to a separation system, where the solid fraction is separated from the liquid fraction. Solid digestate is then stored in a dedicated segregated Digestate Storage area within the enclosed Separator Building and liquid digestate is stored in the engineered covered digestate lagoon prior to being spread to land as fertiliser at the appropriate time;
- *Biogas Upgrading:* The majority of the biogas produced during the process is upgraded to remove CO2 and convert to pure biomethane. Biomethane is a clean renewable gas that is compliant with the gas grid specifications and regulations. The biomethane is continuously monitored and metered prior to injection into the gas grid;
- *Carbon Dioxide Recovery*: During biogas upgrading, a side stream of clen compressed CO2 is produced. This will be recovered and liquified before being sent offsite to an end user, likely the food and drinks industry;
- *Electricity Production:* Two natural gas generator sets will be utilised to provide electrical power for onsite use; and
- *Biogas Combustion*: A small portion of the gas produced will be combusted in the biogas boiler (560kWth) which will provide heat to the plant during start up and in extremely cold weather situations.

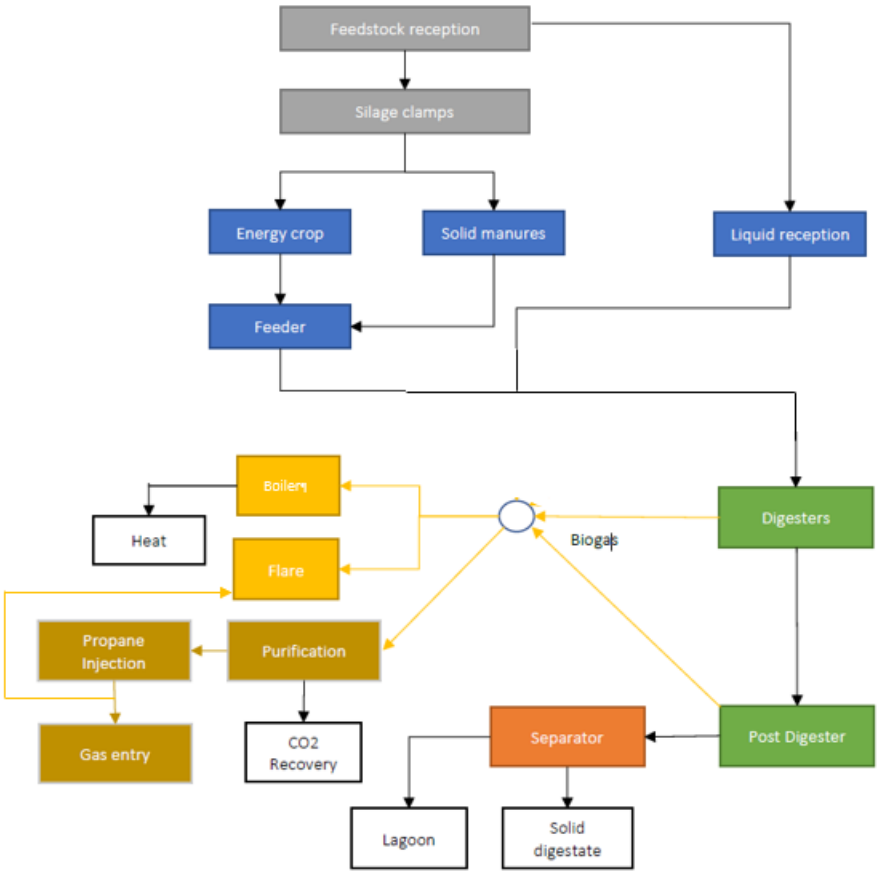


Figure 3.1 - Process Flow Diagram

3.1 Competent Operator

All site activities will be performed by competent and trained individuals who are both suitably qualified and experienced.

All personnel employed on site will be suitably trained and experienced at operating all plant and equipment associated with their particular role; especially with regard to the acceptance and handling (and associated rejection) procedures for odorous materials received on site.

On occasions where these competent and experienced personnel are off work or unable to perform their role, the most suitable replacement will be sourced from the available workforce and any relevant training will be administered before they perform the task.

3.2 Operating Hours

The AD plant will operate on a continuous 24/7 basis, with the hours of operation limited for deliveries and mobile plant usage to between 07:00 and 19:00.

For up to 30 days per calendar year, hours of operations for deliveries and mobile plant usage will be extended to between 07:00 and 21:00. This is to accommodate for crop harvests.

4. ODOUR SOURCES

The following sections detail the identified odour sources arising from both on-site sources and off-site sources.

4.1 Onsite Odour Sources

4.1.1 Source Materials

The site has been designed to accept and treat a maximum of 100,000 tonnes per annum of feedstocks including non-hazardous agricultural and green wastes.

It is acknowledged that these wastes have the potential to be odorous, and storage times onsite are largely dictated by the process. The site operates with a hierarchy of odour control and abatement measures to ensure that the potential for odour impacts is minimised.

Delivery of material to the site will be via agricultural tractor and trailer loads, HGVs and road tankers, in the case of liquid wastes. All vehicles will be covered via sheeting/roll on-roll off covers or contained to prevent odour emission during transport to site. The frequency of deliveries will vary throughout the year, with a peak during harvest of approximately 8 – 9 deliveries per hour (including non-waste feedstocks).

Waste materials will be unloaded directly into the Feedstock Reception Building which is fitted with an extraction system to keep the building under negative pressure, and an odour abatement unit, or within designated tanks.

An Odour Impact Assessment has been undertaken, concluding that potential odour impacts from the site on nearby receptors will not be significant. The table below details potentially odorous materials accepted on site:

Table 4.1 - Source Materials

Waste Type	EWC Code	Odour Potential	Quantities and Storage Time[1]
Agricultural and Forestry Wastes	02 01 01 02 01 03 02 01 06 02 01 07 02 01 99	Moderate to High Agricultural and Forestry wastes have variable odour potential, with some (02 01 06) likely having a high odour potential through release of ammonia and hydrogen sulphide.	Up to 638 tonnes in the waste reception building – maximum residence time of 1 month Liquid feedstock tanks up to 60m^3 per tank (2 tanks total) – maximum residence time of 1 week
Food Preparation and Processing Wastes	02 03 01 02 03 04 02 03 05 02 04 01 02 04 03 02 05 01 02 05 02 02 06 01 02 06 03 16 10 02	Moderate to High Food preparation and processing wastes have variable odour potential, with some (02 05 02, 02 06 01) likely having a high odour potential from dairy and bakery effluent treatment. The majority of wastes have a moderate potential for odour with worsening effects if not managed correctly.	Up to 638 tonnes in the waste reception building – maximum residence time of 1 month Liquid feedstock tanks up to 60m^3 per tank (2 tanks total) – maximum residence time of 1 week

	20 01 25 20 03 02		
Drink Production (alcoholic and non-alcoholic) Wastes	02 07 01 02 07 02 02 07 04 02 07 05	Moderate Wastes from the drinks production industry are considered to have a moderate potential, with the exception of 02 07 05 which may have a high odour potential through its fermented and microbial nature.	Up to 638 tonnes in the waste reception building – maximum residence time of 1 month Liquid feedstock tanks up to 60m^3 per tank (2 tanks total) – maximum residence time of 1 week
Waste Treatment Wastes, including produced digestate	19 02 10 19 06 03 19 06 04 19 06 05 19 06 06 19 08 09 19 08 12	Moderate to High Waste from waste treatment have a moderate to high odour potential from the organic and fermentative process used to in treatment. The waste of the highest potential are 19 06 05 and 19 08 09	Up to 638 tonnes in the waste reception building – maximum residence time of 1 month Liquid feedstock tanks up to 60m^3 per tank (2 tanks total) – maximum residence time of 1 week Sillage Clamps – 25,600 tonnes (spread over 2 clamps)
Green Waste	20 02 01	Moderate The storage of green waste is not likely to arise in significant odour potential, however during the anaerobic digestion process, green waste has the potential to strong, ammonia-like, and musty odours.	Up to 638 tonnes in the waste reception building – maximum residence time of 1 month

[1]Storage times will be kept to a minimum, however these are dictated by the anaerobic digestion process. As a result, storage times will be variable and subject to change to meet process demands

4.1.2 Releases

A number of potential odour releases have been identified. These are outlined below:

- Air exhaust from the waste reception & separator buildings via the odour treatment plant and stack;
- Exposed crops within silage clamps;
- FYM stored within the reception building;
- Liquid slurry stored within tanks via a vent;
- Exposed crops and FYM during transfer to the feeder;
- Exposed and agitated material within the feeder hopper;
- Emissions from liquid digestate storage lagoon vents; and
- Emission from road tankers at liquid digestate filling points.

Emissions from storage of solid digestate are considered as part of the air exhaust from the buildings via the odour treatment plant and stack. As the AD process is sealed, this does not form part of the list of odour releases. If releases from this plant are detected, this would indicate a fault and result in immediate remedial measures to address the issue.

4.2 Offsite Odour Sources

There are other potential sources of off-site odour identified that may be relevant to the proposed site. These are identified in the table below:

Table 4.2 - Offsite Odour Sources

Offsite Odour Source	Distance from site	Source Type
Low Farm	Approximately 20m NE	Farm
Low Farm Energy AD Plant	Approximately 20m NE	AD Plant
South Milford Home Farm	Approximately 660m W	Farm
Amur AD Plant	Approximately 520m S	AD Plant
The Maltings Organic Treatment Plant	Approximately 720m S	AD and Composting Facility
Unnamed Farm	Approximately 750m E	Farm

5. CONTROL MEASURES

The site has several measures in place to control odour; all of these are considered in relation with the operations that are undertaken on site on a daily basis.

The site has aligned its environmental management system and operational procedures in accordance with the site environmental permit.

Environmental Management System procedures ensure that good operational practices are employed. Effective management and control of the process minimises odour generation.

The following sections detail management techniques, procedures, and odour control measures to minimise the potential for odour generation from the process.

5.1 Receipt and Management of Potentially Odorous Materials

Due to the nature of the site's activities, there is potential for odour emissions and impacts to arise from the site if waste is not managed effectively.

Upon receipt of odorous material, the site will adhere to its waste acceptance procedures (including pre-acceptance and rejection procedures). All incoming waste will be inspected to ensure they are permitted on site and are conforming loads with the necessary standards.

Delivery of material to the site will be via agricultural tractor and trailer loads, HGVs and road tankers, in the case of liquid wastes. All vehicles will be covered via sheeting / roll on – roll off covers or contained to prevent odour emission during transport to site. The frequency of deliveries will vary throughout the year, with a peak during harvest of approximately 8 – 9 deliveries per hour (including non-waste feedstocks).

Feedstock delivery of crops will only be undertaken for short periods, with the waste quickly compacted, covered and sealed following deposition in the storage clamps. Odour emissions from these sources are therefore likely to be short in duration and controlled effectively once the relevant materials are contained.

Delivery of FYM will be directly to the feedstock reception building. Operational controls will ensure that delivery of FYM is typically only when required. Roller shutter doors will be closed when not in use and the building is kept under slight negative pressure to prevent odour release whilst doors are open. Any particularly potentially putrescible wastes are stored within the Feedstock Reception Building.

Meteorological conditions are routinely monitored with transfer and handling of odorous materials limited when potential impact at the nearest sensitive receptors could occur.

Removal of liquid digestate created by the process will be via road tankers. There is potential for short term odour emissions to arise from the displacement of air within the tanker during the filling process. This will be mitigated through use of carbon filters. Solid digestate created by the process will be stored within the reception building before removal from the site via covered bulkers.

A primary odour control measure on site will be the strict adherence to site's EMS and accepting only waste that is outlined in the permit. Following these measures will help to eliminate odorous materials entering site that could cause potential issues, especially if left in storage for any lengthy period of time.

The below waste reception and storage regime will result in a significant reduction in the likely odour potential of waste received at the facility:

- All waste will be subject to pre-acceptance and acceptance procedures;
- Waste will be subject to random spot checks by site staff to ensure odorous materials are covered or contained appropriately;
- Materials with higher odour potential are stored within an enclosed building with extraction and abatement;
- Good housekeeping measures to ensure yard areas and drainage gullies are clear of detritus;
- AD process is fully enclosed within covered vessels;
- Storage of solid digestate internally within enclosed building;
- Storage of liquid wastes in tanks;
- Tank vents connected to abatement within the feedstock building;
- Storage of liquid digestate in covered lagoon;
- Lagoon vents are fitted with carbon filters for odour abatement;
- Covering of external feedstocks;
- Minimisation of handling times during feedstock transfer.

The maximum storage times on site for each type of waste are outlined in Table 4.1 above. The sites storage regime as outlined above will ensure that the maximum storage time for each waste type is not exceeded through careful management. Each waste type is stored within different bays within the feedstock building, and waste tracking will be undertaken to ensure that if any waste is nearing maximum storage time it is utilised as soon as possible within the process, or removed from site prior to maximum storage time being reached. Should waste be required to be removed from site this would either be sent back to the supplier, or moved to one of Engie Renewable Gases UK sister sites in the UK (dependent on their capacity).

Standard first in – first out principal procedures are not appropriate for the anaerobic digestion process which requires careful management of feed inputs. Nevertheless, where possible this principal is implemented. Storage of all wastes is internally within the feedstock building with odour abatement, as such, potential odour impacts are minimised.

5.2 Transfer of Odour to Air

Limited transfer of odour to air could take place during several of the normal operating activities undertaken on site. This will include

- Odour release from the transfer of feedstocks from clamps into the feeder unit;
- Odour release from vents surrounding the digestate lagoon;
- Displacement of air during filling of tanks.

Filling of tankers undertaken at the dedicated point east of the lagoon. It is expected that between 3 loads per day during winter and 23 loads per day over spring/late summer may occur. Displacement of potentially odorous air during tanker filling will be abated through use of a carbon filter.

Although odour release from vents on the liquid slurry tanks has been considered, these will be mitigated by connection to the abatement within the feedstock building.

All of the above odour emission sources have been included within the site Odour Impact Assessment. The OIA concludes that there will be no significant impact at the nearest sensitive receptors from operation of the AD facility.

Mobilisation of odorous chemicals to the air will be minimised through the following control measures:

- Covering of externally stored materials to reduce the rate of evaporation, prevent rain ingress, prevent escape of odorous air and prevent heating through exposure to sunlight.
- Ensuring particularly odorous materials are stored internally within the Feedstock Reception Building;
- Minimisation of handling of externally stored materials, with handling times at the face during delivery and transfer kept to a minimum before resealing with the cover;
- Covering of the liquid digestate lagoon and process tanks/vessels;
- Vents from the liquid feed tanks are connected to the feedstock building abatement unit;
- Vents from the lagoon are to be abated via carbon filter.

5.3 Containment of Contaminated Air

Storage of wastes will be within the feedstock reception building. Solid digestate will be stored within the Separator Building. Both buildings will be kept under negative pressure to ensure no fugitive emissions when the doors are open. All extracted air within the buildings will be passed through the odour control unit and emitted via the 14 m high odour stack. Please see Section 5.4 for details on the proposed Odour Control Unit.

Feedstocks stored externally are covered, with handling times kept to a minimum.

The digestate lagoon is covered, with vents fitted with appropriate abatement.

All tanks and vessels associated with the process are sealed, preventing emissions from the process itself.

Vents from liquid feed tanks / blending tank are connected to the abatement system of the feedstock building.

5.4 End of Pipe Treatment

The Feedstock Reception Building is fitted with an extraction and odour abatement system. This will effectively treat any odorous emissions from within the building prior to release to atmosphere via a 14m high stack. Emissions from the Separator Building, liquid feedstock tanks and liquid digestate tank are also routed to the odour control unit. Reductions in ammonia will be at a minimum of 97% efficiency and reductions of odour will be at a minimum of 90% efficiency.

Odour Control Unit

The proposed Odour Control Unit has been designed and manufactured by *Centriair*, using their ColdOx™ system. In summary the system utilises a hybrid approach, with an acid scrubbing system combined with a UV and activated carbon system, thereby reducing the requirements for sulphuric acid storage (H_2SO_4 96%) onsite.

It is designed to intake 50,406m^3 per hour. Prior to treatment, it is expected that there will be in excess of 150,000 OU/m^3. Following treatment, it is expected to reduce to less than 1,000 OU/m^3, marking a significant reduction in odorous compounds per unit of air.

The proposed unit is approximately 16m long and 5m wide.

In the Odour Control Unit, the first stage of treatment is within the UV reactor, built together with an active carbon filter. The UV unit has a lamp life of 16000 hours and is primarily used to treat air from the buildings. Active carbon filters with a medium residence time are required due to the initial treatment and the combined effects from oxidation and carbon. Dual carbon beds, along with industrial centrifugal fans, are present to prevent pressure drops within the system. SulphaRed filters with a medium residence time work to remove up to 100% of hydrogen sulphide by converting it to sulphur salt by chemical adsorption.

The NH_3 removal counter current scrubber is operated under acidic conditions to remove ammonia and other alkaline components from the intake gas. This is achieved by adding H_2SO_4 to the washing water. This system is designed to operate 24 hours per day without shutdown, other than for maintenance. The acid scrubbing system will primarily treat air from the reception and digestate storage tanks.

Additionally, biogas produced by the process is subject to upgrading and treatment prior to utilisation within the sites biogas boiler or injection to the grid. The raw gas treatment unit removes emissions such as Carbon Dioxide (CO_2), Hydrogen Sylphide (H_2S) and Particulates. The raw gas treatment unit effectively captures CO_2 from the raw gas and scrubs H_2S and particulate emissions via adsorption methods, activated carbon and particulate filters. H_2S is the only emission in the raw gas profile believed to be potentially odorous.

As such, the onsite biogas boiler will not release any odorous emissions.

5.5 Transport and Dispersion

Transport of potential odour sources around site, i.e. feedstocks and digestate, will be kept to a minimum, with double handling avoided and transfer times kept as low as reasonably practicable. The site will monitor meteorological conditions, including wind speed and direction to enable appropriate planning of transfer activities.

Potential odour emissions from the Feedstock Building will be treated via the odour abatement unit prior to discharge via a 14-meter-high stack. This stack has an exit diameter of 1 meter, and releases at a rate of 23.2m/s. This stack has been designed for optimal dispersion and to minimise odour impact for nearby receptors. Emissions from the Separator Building, liquid feedstock tanks and liquid digestate tank are also routed to the odour control unit. Full details can be found in the Odour Impact Assessment found in Annex A.

5.6 Contingency Measures

As detailed above, a key component of minimising potential odour onsite is waste management and storage. All wastes will be stored within the feedstock reception building with extraction and abatement.

To ensure that the site does not reach capacity, process triggers are in place which include proactive management of stock volumes rather than reactive measures. Visual inspections of the storage areas re conducted daily, taking note of bay volumes. Each bay contains a different waste type. Prior to acceptance of the waste type onsite, the bay capacities are reviewed to ensure that there is sufficient capacity to accept additional waste of that type. Reception buildings will be 'calibrated' when empty so that Feedstock

Managers (FM) are constantly aware of stock volumes and how much has been fed. The planner will be updated and reviewed weekly. Site Managers upon review, will inform FMs whether they are near/at capacity so that deliveries can cease before sufficient storage capacity becomes available again.

Should it be determined that the site is reaching capacity, then no further deliveries of waste shall be accepted until existing waste feedstocks are processed and there is further requirement for feedstock.

Should wastes arrive at site that are not acceptable (e.g. overly odorous) or that are not required for the process in the short term (within waste storage maximum times) then these are rejected and sent back to the supplier.

Additionally, should waste require removal from site, Engie Renewable Gases UK, have sister AD plants within the UK that can be utilised for storage if required (and dependent upon that sites storage capacity).

5.7 Engaging your Neighbour

If an action is being considered that has the potential to cause temporary odour impacts outside of the normal operational procedures, then the local Environment Agency area team will be informed in advance. Neighbours who may be affected as identified in Section 2.3.2 will be contacted to advise them of the operation being undertaken, and that any increase in odour will be of a temporary nature.

In addition, the site will engage with the local community as often as possible in order to alleviate against negative site perception. The site management shall operate a publicly accessible website, whereby contact information is published such that the public remain informed and are provided with a means of contacting the site if necessary.

In the event of a complaint received from a nearby receptor or stakeholder, Engie will operate in accordance with the complaint's procedure (see Section 5.7 below).

5.8 Response to Complaints

Receipt of an odour complaint during normal operations is treated as an exceedance of control levels. The primary response will be as detailed in accordance with the site's complaints procedure.

A Complaint Report Form will be completed as soon as the complaint is received, as described in Annex B.

An investigation shall be initiated into the cause of the complaint, this will involve as necessary.

- An olfactory survey following the procedure detailed in Section 6.2. The results of the survey will be recorded electronically, a list of information that is recorded electronically is provided within Annex C at the end of this document;
- An examination of the site activities at the time of the complaint;
- An examination of the meteorological conditions at the time of the complaint; and
- A review of the effectiveness of operational and odour control procedures.

If the complaint is validated, it will be treated as an exceedance of the control level. The outcome of the investigation will determine the corrective actions to be implemented (see Section 7).

5.9 Ceasing or Reducing Operations

Following investigations carried out as a result of an odour complaint, consideration will be given to waste acceptance until appropriate measures can be put in place to mitigate any odour impacts.

5.10 Accident Management Plan

The site will maintain a fully functional accident management plan as required by the Environmental Permitting Regulations.

The accident management plan sets out the actions to be taken and measures required to prevent incidents and where an incident occurs the appropriate mitigation action to be taken.

The plan considers the following scenarios:

- Any spillage or leaks;
- Any vandalism;
- Flooding;
- Fire;
- Receiving incompatible waste on site;
- Failure of main services; and
- Failure of major plant and equipment.

Please refer to Section 8 which provides more information on how the site will address any events which could cause odour emissions from site.

6. MONITORING

The company will employ the following monitoring techniques to ensure that the Control Measures (**Section 5**) are maintained, and effective, operational procedures are followed and that good practices are being implemented:

- Site inspections by the Site Manager or delegated personnel;
- Site audits and inspections by the Environmental Agency;
- Site Inspections by the Planning Authority; and
- Third party audits.

6.1 Responsible Persons

Responsible persons are detailed within Annex D. All site personnel are responsible for immediately reporting odour problems to the Site Manager or Managing Director.

6.2 Meteorological Conditions

Meteorological forecasts and conditions shall be monitored to ensure that any potential odour complaints can be fully investigated, and that effective monitoring can be carried out. Meteorological data will be recorded as per Table 6-1 below.

Table 6.1 - Meteorological Monitoring

Monitoring Requirements	Frequency
Observed and recorded description of condition	Recorded Daily
Precipitation	
Wind speed and direction	Recorded continuously
Temperature	

6.3 Olfactory Monitoring

Given the low risk of odour impact, as determined by the Odour Impact Assessment, odour shall be monitored at a frequency of once per day, as directed by the Site Operations. Observations shall be noted electronically and a list of information that is recorded electronically is provided within Annex C at the end of this document. A minimum of 1 survey will be conducted per day, with additional surveys conducted as required and directed by the Site Operations Manager.

Surveys shall be carried out in accordance with the monitoring protocol contained within the Environment Agency's *Technical Guidance Note H4*.

Four locations will be selected to carry out the "sniff test" and these locations will be downwind of the site sources but within the site boundary. Tests carried out at these locations are to confirm that malodour is not detectable at the site boundary.

If odour is detectable at the site boundary, an offsite investigation will be required in the direction of the prevailing wind and closest sensitive receptor. This will also be recorded electronically, a list of information that is recorded electronically is provided within **Annex C** at the end of this document.

The odour assessor must not be subject to significant odour in the 30 minutes prior to the assessment. This survey will be carried out in accordance with the guidance laid out in the *H4 Odour Management Guidance*. This is to ensure that monitors are not suffering from odour fatigue and will be sensitive to site odours.

If any detectable odour is identified at the site boundary and is judged to be moderate (Odour Intensity Rank 3) then the Site Operations Manager will be notified immediately and the olfactory survey will continue to attempt to determine the scope and extent of the odour plume, as follows:

- A suitable location downwind of the site and potentially sensitive receptor at which the odour plume is unlikely to extend will be selected for assessment;
- Survey will continue toward the facility until a site-related odour is perceived; and
- Assessment points perpendicular to the plume axis and equidistant from the site will then be monitored, subject to access requirements.

Monitoring frequencies shall be as detailed in **Table 6.2**

Table 6.2 - Monitoring Frequencies

Parameter	Monitoring Technique	Frequency
Meteorology	See **Table 6.1** for details	
Odour	Olfactory Monitoring	Minimum of once per day, with additional surveys conducted as required. Increased frequency in response to complaints
	External Olfactometry Monitoring	Biannual site odour monitoring by competent third party
	Complaints Monitoring	Continuous
Complaints	Corrective Action Monitoring	Post-implementation of a corrective action

The following scales will be used:

Table 6.3 - Odour Intensity Scale

Score	Intensity
0	No Odour
1	Very Faint Odour
2	Faint Odour
3	Distinct Odour

4	Strong Odour
5	Very Strong Odour
6	Extremely Strong Odour

Table 6.4 - Hedonic Tone Scale

Score	Intensity
+4	Very Pleasant
+3	Pleasant
+2	Moderately Pleasant
+1	Mildly Pleasant
0	Neutral Odour/No Odour
-1	Mildly Unpleasant
-2	Moderately Unpleasant
-3	Unpleasant
-4	Very Unpleasant

6.4 Internal Odour Monitoring

Odour monitoring is conducted at frequencies detailed in **Table 6.2** by a competent person.

The main aim of monitoring will be to test if any odours emitted from the site will be causing the nearest receptors nuisance. In scenarios where nuisance is being caused then operations can be suspended until the conditions improve, also the site operations manager may deem it necessary to find the precise source of the odour and attempt to eliminate it or neutralise it immediately.

6.5 Records

Appropriate records shall be maintained and include the following details:

- Results of inspections and olfactory monitoring carried out by site personnel;
- Meteorological conditions including wind speed and wind direction;
- Operational problems including date, time, duration, prevailing weather conditions and cause of problem;
- Notification to the EA of abnormal/odorous activities on site
- Complaints received including address of complainant (if available);
- Details of corrective action taken, and any subsequent changes to operational procedures; and
- An evaluation of the effectiveness of control and abatement techniques used.

If any samples have to be analysed by laboratory-based olfactometry then the following records must be made:

- Date, time and details of emissions point sampled, and why you chose them;
- How you preserved the samples (holding time and conditions);
- Method of sampling (e.g grab sample);
- The laboratory where the results were analysed, and any certification status;
- Any laboratory observations that might affect how you interpret results;
- Process parameters; and
- Weather conditions.

6.6 Channelled Emissions Monitoring

Monitoring of channelled emissions to air will be undertaken bi-annually in line with BAT 8 & BAT 34 of the Waste Treatment BREF and will be subject to the BAT-AELs outlined in the table below.

Table 6.5 BAT-AELs for odour channelled emissions

Parameter	Limit	Monitoring Standard
Ammonia	20 mg/Nm^3	EN ISO 21877
Odour	1000 OE/Nm^3	BS EN 13725

This relates to emissions from the Odour Abatement Unit (which will also capture emissions from the tank vents) and the Lagoon Abatement Carbon Unit.

7. ODOUR MANAGEMENT RISK ASSESSMENT

The following risk assessment, below in **Table 7.1** has been prepared in line with the latest Odour Management guidance, published on 3rd December 2025. It considers the risks relevant for the site, and the sources of the described risks, relevant receptors, pathways from source to receptor, control measures, as well as overall risk ratings.

Table 7.1 - Odour Impacts Risk Assessment

Odour Source	Pathway	Receptor	Risk Rating (before mitigation)	Mitigation Measures	Risk Rating (after mitigation)
Receipt and Storage of Solid Wastes	Airborne	Local Residents businesses and recreational users of the area	Medium	▪ A primary odour control measure on site will be the strict adherence to site's EMS, including waste acceptance and rejection procedures and accepting only waste that is outlined in the permit. Following these measures will help to eliminate odorous materials entering site that could cause potential issues. ▪ All incoming waste will be inspected to ensure they are permitted on site and are conforming loads with the necessary standards. ▪ Delivery of material to the site will be via agricultural tractor and trailer loads and HGVs which will be covered or sealed to prevent odour releases. ▪ Delivery of FYM will be immediately to the feedstock reception building. Roller shutter doors will be closed when not in use and the building is kept under slight negative pressure to prevent odour release whilst doors are open. ▪ Any particularly potentially putrescible wastes are stored within the Feedstock Reception Building. ▪ Solid waste materials with higher odour potential are stored within an enclosed building with extraction and abatement; ▪ Meteorological conditions are routinely monitored with transfer and handling of odorous materials limited when potential impact at the nearest sensitive receptors could occur. ▪ Waste will be subject to random spot checks by site staff to ensure odorous materials are covered or contained appropriately; ▪ AD process is fully enclosed within covered vessels; ▪ Good housekeeping measures to ensure yard areas and drainage gullies are clear of detritus; ▪ Storage of solid digestate internally within enclosed building; ▪ Minimisation of handling times during feedstock delivery and transfer.	Low

Receipt and Storage of Liquid Wastes	Airborne via release from vents and displaced air in tanks	Local Residents businesses and recreational users of the area	Medium	▪ A primary odour control measure on site will be the strict adherence to site's EMS, including waste acceptance and rejection procedures and accepting only waste that is outlined in the permit. Following these measures will help to eliminate odorous materials entering site that could cause potential issues. ▪ All incoming waste will be inspected to ensure they are permitted on site and are conforming loads with the necessary standards. ▪ Delivery of material to the site will be via road tankers which will be covered or sealed to prevent odour releases. ▪ All liquid waste will be stored in tanks, and tank vents will be connected to abatement within the feedstock building.	Low
Air exhaust from the waste reception & separator buildings via the odour treatment plant and stack	Airborne via release into atmosphere	Local Residents businesses and recreational users of the area	Medium	▪ The Feedstock Reception Building is fitted with an extraction and odour abatement system. ▪ Any odorous emissions from within the building will be effectively treated prior to release to atmosphere via a 14m high stack. ▪ Emissions from the Separator Building, liquid feedstock tanks and liquid digestate tank are also routed to the odour control unit. Reductions in ammonia will be at a minimum of 97% efficiency and reductions of odour will be at a minimum of 90% efficiency. ▪ Odour value at the stack will be 1000 OU/m^3. ▪ The odour extraction and abatement systems will be well-maintained in-line with the manufacturer's instructions to prevent breakdown or failure. ▪ Only suitable trained operatives will be permitted to operate the extraction and abatement system to prevent accidental damage occurring from improper operation	Low
Exposed crops within silage clamps	Airborne via wind-whipping	Local Residents businesses and recreational users of the area	Medium	▪ Feedstock delivery of crops will only be undertaken for short periods, with the waste quickly compacted, covered and sealed following deposition in the storage clamps. Odour emissions from these sources are therefore likely to be short in duration and controlled effectively once the relevant materials are contained. ▪ All external feedstocks will be covered whilst stored in silage clamps	Low
Exposed crops and FYM during transfer to the feeder, and within the feeder hopper	Airborne via agitation	Local Residents businesses and recreational	Medium	▪ All feedstocks will be minimally handled to prevent odour release via excessive agitation ▪ During transfer to the feeder odour release may happen though will be minimal and for a short duration	Low

		users of the area		▪ Handling of transfer of feedstock to the feeder will be done in accordance with onsite waste and feedstock handling procedures ▪ Only trained site staff will carry out transfer activities to the feeder.	
Emissions from liquid digestate storage lagoon vents	Airborne via release from vents	Local Residents businesses and recreational users of the area	Medium - Low	▪ All liquid digestate will be stored within the onsite covered lagoon. ▪ There are 11 vents from the lagoon. ▪ Each vent is fitted with a carbon filter as appropriate abatement to further odour emissions arising from the venting of gases.	Low
Emission from road tankers at liquid digestate filling points	Airborne via displacement of air	Local Residents businesses and recreational users of the area	Medium-Low	▪ Removal of liquid digestate created by the process will be via road tankers. There is potential for short term odour emissions to arise from the displacement of air within the tanker during the filling process. ▪ During tanker filling, displaced air will be vented via a carbon filter as appropriate abatement to prevent odour	Low
Spills and Material Handling Failures	Airborne via agitation from spill/leak	Site Staff, Local Residents businesses and recreational users of the area	Low	▪ All infrastructure will be constructed in line with the relevant standards to prevent accidental spills or leakages of odorous material. ▪ All storage areas are located upon impermeable hardstanding with sealed drainage systems. ▪ Any and all spills or leakages will be cleaned up immediately upon detection to prevent any undue odour release to air ▪ Appropriate guidance for storage, such as CIRIA 736, is followed on site to minimise the risk of leakages or loss of containment ▪ All operational staff will be trained in the safe handling of odorous materials in relation to their specific role to prevent spillages arising from operational error ▪ Tanks will be inspected visually on a daily basis by the site staff to ensure the continued integrity of the tanks and identify the requirement for any remedial action. The site manager will be ultimately responsible for ensuring monitoring, inspections and where applicable, maintenance, is carried out. ▪ The site EMS includes a Spill Response Procedure and spill kits are located and maintained at strategic locations around site.	Low

Plant or Equipment Failure	Airborne via failure of containment within process or associated abatement	Local Residents businesses and recreational users of the area	Medium	▪ Plant or equipment failures (e.g. odour abatement plant, transfer vehicles) have the potential for significant release of odour, although the likelihood of the plant/equipment failing remains low ▪ All plant and equipment are subject to the Inspection, Maintenance and Repair programme implemented on site designed to minimise the risk of plant/equipment failing ▪ All plant and equipment is maintained in accordance with the manufacturer's instructions ▪ Only site staff are permitted to operate plant and equipment to the level they have been trained at. No unauthorised operation of plant or equipment will be undertaken on site ▪ All plant and equipment will be constructed to the relevant standards to prevent breakdown or failure, and therefore the release of odour. ▪ Should plant or equipment fail, and the risk of significant odour releases arise, secondary control measures appropriate to the failure will be implemented. This may include ceasing operations or the acceptance of new material until repairs are made.	Low
Vandalism	Airborne via agitation, fire, or plant damage/destruction	Local Residents businesses and recreational users of the area	Low	▪ The site will have a CCTV monitoring system ▪ The site will be secured by a 2.4m high steel paladin-type perimeter fence. ▪ Motion detecting security lighting will be in operation across the site ▪ Fencing will be maintained and repaired to ensure its continued integrity. If damage is sustained, repair will be made within the same working day. If this is not possible, suitable measures will be taken to prevent unauthorised access to the site and permanent repairs will be affected as soon as is practicable. ▪ All visitors to the site are required to register in the visitor's book and sign out again on exit, thereby minimising the risk of unauthorised visitors on the site.	Low

8. COMPLIANCE ACTION PLANS

8.1 Control and Trigger Levels

Control and Trigger levels are presented below in

Table 8.1 - Control and Trigger Levels

Parameter	Monitoring Technique	Control Levels
Odour	Routine Olfactory Monitoring	Odour Intensity ⩾3 recorded at any monitoring location (persistent / transient nature noted and considered)
	Complaints Monitoring	Receipt of complaint

8.2 Compliance Actions

A recording of Odour Intensity ≥3 during routine olfactory monitoring or the receipt of a complaint will necessitate further investigation into the causes and indicate whether further monitoring is required. Actions to be taken in the event of an exceedance will be dictated by the nature and extent of the exceedance(s) (e.g., by considering the magnitude of exceedance and whether it was event driven or on-going).

8.3 Detection of Moderate Odour During Olfactory Surveys

Detection of a moderate odour, (i.e., 'odour easily detected while walking and breathing normally, possibly malodorous), will initiate a more extensive olfactory survey to determine the extent of the odour plume (as described in Section 6.3). An investigation will be initiated into the cause of the odour. This shall involve as necessary:

- A review of the site activities at the time of the olfactory survey;
- A review of the meteorological conditions at the time of the olfactory survey; and
- A review of the effectiveness of process operations and odour control procedures.

8.4 Corrective Actions

The outcome of an investigation will determine the corrective actions to be implemented. The following corrective actions will considered, but not be limited to:

- Alteration to waste reception procedures and odour control measures employed;
- Review of all processes on site; and
- Update of OMP if new procedures are created.

Extent of the corrective actions undertaken will be decided by the competent site operations manager, as per their responsibility of implementing this odour management plan.

8.5 Reporting

Exceedance of a control level will be investigated (as described above) and recorded. This includes recording the following:

- Nature of the incident;
- Date of occurrence(s);
- Results of the investigation;
- Details of responses / action plans implemented;
- The event will be marked within the site's incident log; and
- The report of any exceedance will be made available to the Environment Agency on a quarterly basis.

9. INCIDENTS AND EMERGENCIES

Consideration has been given to the types of failure or abnormal events that have the potential to result in an odour impact. Abnormal events include the following:

- Power outage or electrical supply fault
- Breakdown of plant resulting in potential backlog of waste;
- Breakdown of plant resulting in failure of air extraction system; and
- Fire and Explosion.
- Road Closures

Failure and abnormal event scenarios are summarised below.

Power Outage or electrical supply outage

Power to the site is provided by two onsite natural gas generator sets. In the event of a power outage, an emergency diesel generator is available to provide power to critical systems until genset power is restored.

In the unlikely event this were to occur, short-term odour impacts may be experienced through loss of the odour control unit in the reception building.

Breakdown of plant resulting in potential backlog of waste

A supply of critical spares will be maintained onsite. The site will employ skilled fitters / contractors to promptly repair any faults.

All plant and equipment will be maintained and regularly serviced in accordance with the manufacturer's recommendations and planned maintenance procedures to minimise breakdowns.

In the event that repairs cannot be promptly carried out relevant activities will be suspended where there is an increased risk of odour emissions or offsite impact.

If necessary, the facility will remain closed to further deliveries of waste until the plant is restored and any backlog cleared.

Breakdown of plant resulting in failure of extraction and abatement system

Receipt of potentially odorous or putrescible feedstock material will cease.

All stored feedstock from the feedstock reception building will be processed as quickly as possible and no additional waste will be stored in the feedstock reception building.

All plant and equipment will be maintained and regularly serviced in accordance with the manufacturer's recommendations and planned maintenance procedures to minimise breakdowns.

If necessary, the facility will remain closed to further deliveries of waste feedstock until the plant is restored and the backlog is cleared.

Fire and Explosion

Fire and explosion risk procedures will be adopted onsite. If required following a fire or explosion, operations will cease in the affected area until all plant and infrastructure are restored.

The site will operate a full evacuation plan in the event of a fire or explosion, and the relevant authorities and will be informed at the earliest opportunity.

Following a fire, all plant would be inspected, replaced and repairs implemented as necessary. Further waste receipt would be suspended until normal operation is restored.

Road Closures

In the event that the A162 is closed, the site will be unable to received additional feedstock. Operations will continue as normal for the site, and the road closure team will be consulted about provisions for access to and from the site during road closure times.

Given the local significance of this highway, extensive road closures are very unlikely and impacts from road closures are expected to be minimal.

9.2 Abnormal Meteorological Conditions

Although it is accepted that a number of meteorological conditions can exist that promote the generation of odour and may inhibit its effective dispersion (i.e. high temperatures and still conditions) such scenarios are not considered to have the potential to impact the facility and surrounding receptors.

The facility will monitor and record all meteorological conditions and make suitable planning arrangements to ensure that any major maintenance activities are carried out in favourable meteorological conditions to reduce the potential for impact

10. INSPECTION, MAINTENANCE AND REPAIRS.

The site, including all of its infrastructure, plant and equipment, will be subject to the site's Inspection , Maintenance and Repair programme. The programme will fulfil all of its duties when reviewing onsite infrastructure including water containment facilities, abatement systems, treatment plant and equipment as well as site surfacing.

This programme will be in place, in part, to prevent unplanned odour releases for plat failure or breakdown before it occurs by regularly inspecting, maintaining and repairing (where necessary) all plant, equipment and infrastructure showing signs of damage or degradation. These will include:

- Process equipment, including AD digestors and feeders;
- Monitoring instruments;
- Ventilation systems, including the onsite extraction and abatement system;
- Buildings, including the Feedstock Reception Building and Separator Building;
- Infrastructure such as the silage clamps; and
- Containment features, including all tanks and bunds.

The site will undergo daily inspections once operational to ensure signs of damage or degradation are detected as early as possible, so repairs can be made before failure occurs.

All plant and equipment will be maintained, serviced, and repaired in line with the manufacturer's instructions.

If significant repairs or maintenance is required, appropriate secondary control measures will be sought to prevent significant odour release. This may include ceasing operations or the acceptance of further waste on site. Secondary control measures will be determined on a case-by-case basis.

A full record of inspections, maintenance and repair activities will be kept on site.

APPENDIX A ODOUR IMPACT ASSESSMENT

enzygo
environmental consultants



Agricultural Anaerobic Digestion Plant - Odour Assessment

Section 73 Application to vary Planning Permission NY/2024/0200/FUL for an Agricultural Anaerobic Digestion Facility – Land East of A162, Home Farm, Bond Ings, Sherburn in Elmet, LS25 6FW

Halstow Energy Limited

SHF.0174.006.AQ.R.002.P02

'Experience and expertise working in union'

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Agricultural Anaerobic Digestion Plant - Odour Assessment

Project:	Land East of A162, Low Farm, South Milford, Sherburn in Elmet, LS25 6FW
Reference	SHF.0174.006.AQ.R.002.P02
For:	Halstow Energy Limited
Status:	Final Issue
Date:	January 2026
Author:	Conal Kearney, Director of Air Quality (BEng, MSc, MIAQM, MIEnvSc)
Reviewer:	Josh Davies, Principal Air Quality Consultant (BSc)

Disclaimer:

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Non-Technical Summary

i. Enzygo Limited was commissioned by Halstow Energy Limited to undertake an updated Odour Assessment to support of the application for the construction and operation of an Agricultural Anaerobic Digestion (AD) Plant on agricultural land to the east of A162, Low Farm, South Milford, Sherburn in Elmet, LS25 6FW.

ii. The site benefits from extant planning permission for the Development of an Agricultural Anaerobic Digestion Facility. Since the grant of planning permission, the technology provider has changed resulting in changes in layout and emissions characteristics.

iii. The odour assessment for the consented scheme concluded that all impacts on sensitive receptors would be not significant.

iv. During the operation of the revised scheme there is the potential for impacts to occur at sensitive locations due to odour emissions from a number of sources at the plant. An updated Odour Assessment was therefore undertaken to consider effects in the vicinity of the site.

v. Channelled emissions from the proposals will also be subject controls and, where applicable, emission limits as part of the operator's Environmental Permit.

vi. Potential odour emissions were defined based on the proposed plant operation and a review of literature and emissions used at similar facilities. Robust assumptions were used to consider odour emissions the manure types proposed in this facility and maximum permitted emission limits assumed from the odour stack.

vii. These were represented within a dispersion model. Impacts at sensitive receptor locations in the vicinity of the site were quantified, the results compared with the appropriate odour benchmark level.

viii. Predicted odour concentrations were below the lowest odour benchmark level at all sensitive receptors in the vicinity of the site for all modelling years.

ix. The results show an improvement on the previous assessment at the closest receptor.

x. In addition, using the IAQM guidance significance criteria, worst case impacts were negligible at all representative sensitive receptors and overall impacts are therefore considered to remain as not significant.

xi. As such, considering the results and robust assumptions made, overall potential for odour impacts generated by the AD facility is not considered to represent a constraint to planning permission with regards to odour impacts.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Limited was commissioned by Halstow Energy Limited to undertake an updated Odour Assessment in respect to a revised Agricultural Anaerobic Digestion (AD) Facility on agricultural land to the Land East of A162, Low Farm, South Milford, Sherburn in Elmet, LS25 6FW.

1.1.2 The site benefits from extant planning permission. Application NY/2024/0200/FUL was granted full planning permission, with 25 conditions, on 31 July 2025 for the:

"Development of an Agricultural Anaerobic Digestion (AD) Facility and associated plant and equipment and soft landscaping at Agricultural land to the east of the A612, Home Farm, Bond Ings, Sherburn in Elmet, LS25 6FW."

1.1.3 Since the grant of planning permission, the technology provider has changed. This has resulted in a need to amend some of the approved technological elements of the anaerobic digestion (AD) process and associated equipment and their layout. This will require amendments to the details approved under condition 2 (approved details) of the permission. The northern part of the development remains unchanged, including the landscaping and planting, site entrance and access, weighbridge, drainage basin, digestate lagoon and silage clamps(footprint remains the same although now 2 clamps rather than 3).

1.1.4 As a result of the technological amendments other elements of the plant have been reviewed to make the development more efficient in terms of use of the land and operationally more pragmatic. Primarily this relates to the layout of the car parking and the office and welfare and feedstock reception buildings but also reductions in the height of the buildings. The feedstock building has also been separated into two buildings to separate the feedstock storage from the digestate separator operations, without any increase in building footprint.

1.1.5 The following S73 odour impact assessment is being undertaken as a review the original odour quality assessment, referenced CRM.0174.002.AQ.002.R1, considering revisions to the site layout, plant/equipment revisions and updated meteorological and emissions data.

1.1.6 The original assessment concluded that emissions generated by the consented AD facility, at all sensitive receptors would be not significant.

1.1.7 The main changes relate to the digestion tanks and building sizing and layouts with some changes to the type of processing plant employed. There are now 3 digestors rather than 4 with 2 having domed rooves and 1 with a reduced height flat roof. Also the removal of nitrogen stripping and replacing the CHP engines with natural gas generators.

1.1.8 As such, an updated Odour Assessment was required to assess impacts at sensitive locations in the vicinity of the site.

1.1.9 The proposed AD plant will accept approximately 65,000 tonnes per annum (tpa) of feedstock from local farms. The proposed development would generate biogas which will upgraded to biomethane then connected via pipeline to be injected into the national grid directly from the site.

1.1.10 The AD process uses the principles of digestion to convert waste material into biogas. The biogas is upgraded to biomethane and exported to the national gas grid, providing sustainable, renewable gas for the county. Some biogas is used in a boiler for the provision heat required on site.

1.1.11 A secondary output of the AD process is digestate, which will be used on local farms in place of raw manures and artificial fertilisers.

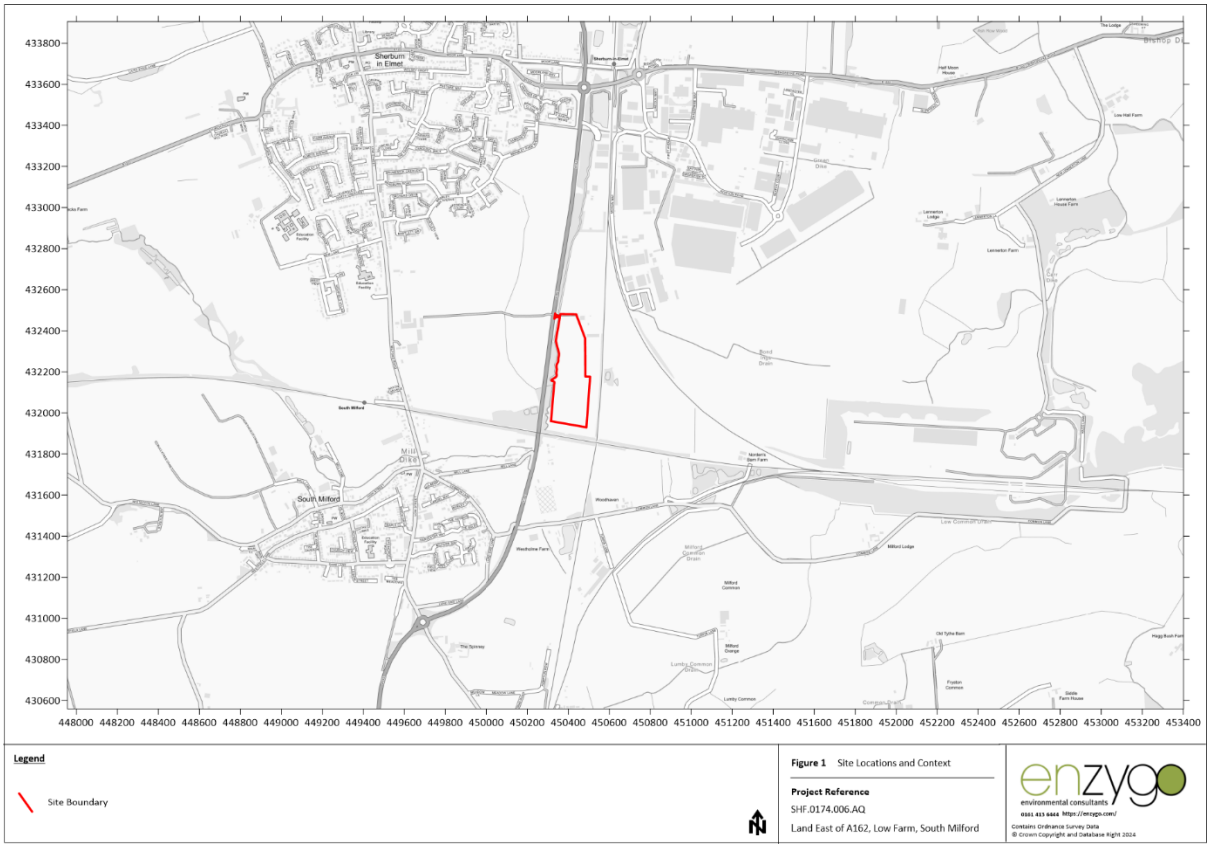
1.1.12 Proposed controls for odour emissions have been included in this assessment.

1.2 Site Location and Context

1.2.1 The facility is located on land east of A612, Low Farm, South Milford, Sherburn in Elmet, at approximate National Grid Reference (NGR): 450420, 432210.

1.2.2 The site is located in a predominantly agricultural area with a sparse mixture of working farms and residential properties in the vicinity of the site. The nearest residential property is a dwelling on Mill Lane, Millford 386 m south of the site. Figure 1 shows the location of the site and surrounding areas.

Figure 1: Site Location



1.2.3 The proposed changes will not affect the main elements of the AD facility. It will have silage clamps, reception building for solid wastes, enclosed tanks for liquid wastes, enclosed anaerobic digestion tanks, biogas collection, storage and treatment, biogas use to generate energy (heat) to the facility, biogas upgrading to biomethane and injection into the gas grid, and separation of digestate into liquid and solid fractions and storage of the liquid digestate in a storage lagoon.

1.2.4 The feedstock is unaffected by the S73 proposals and will continue to be derived from agriculture, including, energy crops and manures. The biogas volume produced for export into the national gas grid is also unchanged.

1.2.5 The process can briefly be described as follows:

- Feedstock reception and storage: silage will be stored in SAFFO compliant silage clamps and will be covered except for the clamp face during removal of feedstocks. Manures will be deposited initially outside on a pad before being stored inside a

feedstock reception building which will be operated under negative pressure and have an inbuilt odour control system to control odours. Liquid feedstocks, such as, slurries will be stored in sealed reception tanks;

- The solid feedstocks will be loaded into the feed hoppers with a tele-handler or loading shovel by the site operatives, according to a pre-defined ration,

- The feeders will consist of hoppers for conveyance of bulk solids. The hoppers will have covers which can retract when filling with feedstock and close when not in use. The solids are transferred into a feeding pump, where they are mixed with liquid feedstocks, in a sealed unit, with recirculated liquid, to make an organic pumpable substrate;

- The substrate is pumped into the process. The processing vessels are high-integrity, reinforced concrete tanks, with double membrane gas dome holders as covers. The vessels are gas tight, are heated using heat generated by the biogas boilers when required, and are mechanically mixed to ensure the substrate, bacteria and heat are well distributed around the vessel. Including the pre-treatment process, the total retention time is typically 40 days including the pre-treatment process;

- During digestion, biogas is continuously produced in the vessels, typically around 55% methane and 45% carbon dioxide;

- After digestion, the gas has been recovered from the substrate and the residual material is known as digestate. This contains indigestible fibre and nutrients. It is pumped to a separation system within a dedicated enclosed building, where the fibre is squeezed from the liquid phase. The fibre is a clean, stackable, homogenous, low odour product that is a very popular soil improver for agricultural purposes. It is temporarily stored on the silage clamps prior to being spread to land at the appropriate time;

- The liquid digestate fraction, after separation, is pumped into a purpose built, engineered lagoon or stored in a 250 m^3 tank. The lagoon will be formed from site soil and will be lined with a heavy duty liner and a cover. The liquid digestate is an excellent biofertiliser with a balanced source of nutrients and organic matter and will be spread to farmland for agricultural benefit. A minimum of 6 months digestate storage will be provided to ensure that the digestate is spread at the appropriate time of year and in line with regulations and good practice;

- Vented air from the reception and separation buildings and liquid storage tanks will pass through an odour control unit (OCU) to remove up to 99% of odours and 96% of ammonia. This is then vented to the atmosphere via an odour stack, emissions from which will limited by the Environmental Permit;

- A small portion of the gas produced will be combusted in a boiler unit. This will provide during cooler months of the year (approximately 24% of the time) based on the required demand;

- The remainder, and the largest portion, of the gas will be upgraded to convert it from biogas to biomethane. This is a clean renewable gas that is compliant with the gas grid specifications and regulations. The biomethane is continuously monitored and metered prior to injection into the gas grid;

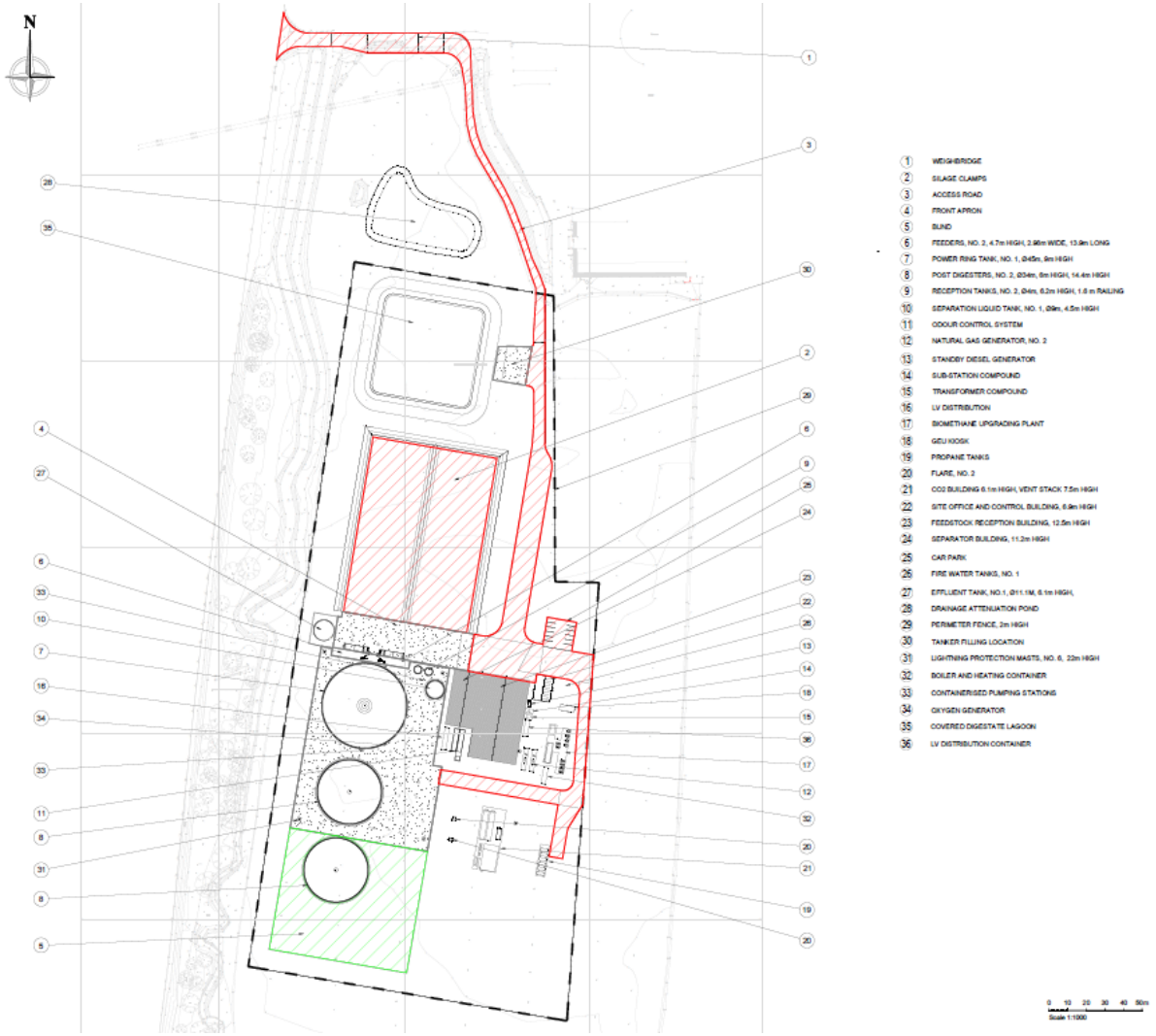
- A side stream of clean, compressed carbon dioxide is produced from the upgrading of the biogas. It is intended that the carbon dioxide will be recovered and liquified before being sent off-site to end user (to displace non-renewable carbon dioxide).

1.2.6 The activities associated with the proposed plant are controlled under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. As such, the operator will be required to obtain an Environmental Permit from the Environment Agency (EA) as the appropriate regulator prior to operation.

1.2.7 The operation of the plant may result in odour emissions from a number of activities. These have the potential to cause impacts at sensitive locations within the vicinity of the site and have therefore been assessed within this report.

1.2.8 Figure 2 shows the proposal site layout.

Figure 2: Site Layout



2.0 Legislation Guidance and Policy

2.1 Odour Impact

2.1.1 The following legislation and guidance will be considered and adhered to during the preparation of the Odour Impact Assessment:

- H4: Odour Management, EA, 2011[1];
- Odour Guidance for Local Authorities (withdrawn), Department for Environment, Food and Rural Affairs (DEFRA), 2010[2];
- Guidance on the Assessment of Odour for Planning, IAQM, 2018[3];
- Industrial Emission Directive (2010/75/EU);
- Environmental Permitting (England & Wales) Regulations 2016 (as amended) – Chapter 4 Standard rules; and
- SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, EA, Updated 5th July 2022[4].

2.1.2 The magnitude of odour impact depends on a number of factors and the potential for complaints varies due to the subjective nature of odour perception. The FIDOL acronym is a useful reminder of the factors that will determine the degree of odour pollution:

- Frequency of Detection - frequent odour incidents are more likely to result in complaints;
- Intensity as Perceived - intense odour incidents are more likely to result in complaints;
- Duration of Exposure - prolonged exposure is more likely to result in complaints;
- Offensiveness - more offensive odours have a higher risk of resulting in complaints; and
- Location - the type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

2.1.3 It is important to note that even infrequent emissions may cause loss of amenity if odours are perceived to be particularly intense or offensive.

2.1.4 The FIDOR factors can be further considered in conjunction with the following in regard to the potential for an odour emission to cause a nuisance:

- The rate of emission of the compound(s);
- The duration and frequency of emissions;

[1] H4: Odour Management, Environment Agency (EA), 2011. Now withdrawn

[2] Odour Guidance for Local Authorities, DEFRA, 2010

[3] Guidance on the Assessment of Odour for Planning, IAQM, 2018 – Version 1.1.

[4] https://www.gov.uk/government/publications/sr2021-no-6-anaerobic-digestion-facility-including-use-of-the-resultant-biogas-installations/sr2021-no-6-anaerobic-digestion-facility-including-use-of-the-resultant-biogas-installations

- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of receptors to the emission i.e. whether the odorous compound is more likely to cause nuisance, such as the sick or elderly, who may be more sensitive;
- The odour detection capacity of individuals to the various compound(s); and
- The individual perception of the odour (i.e. whether the odour is regarded as unpleasant). This is greatly subjective and may vary significantly from individual to individual. For example, some individuals may consider some odours as pleasant, such as petrol, paint and creosote.

2.2 Odour Measurement

2.2.1 The concentration at which an odour is just detectable to a "typical" human nose is referred to as the "threshold" concentration. This concept of a threshold concentration is the basis of olfactometry in which a quantitative sensory measurement is used to define the concentration of an odour. Standardised methods for measuring and reporting the detectability or concentration of an odour sample have been defined by European standard BS:EN 13725:2003. The concentration at which an odour is just detectable by a panel of selected human "sniffers" is defined as the detection threshold and has an odour concentration of 1 European odour unit per cubic metre (1 ou_E/m^3).

2.2.2 An odour at a strength of 1 ou_E/m^3 is in reality so weak that it would not normally be detected outside the controlled environment of an odour laboratory by the majority of people (that is individuals with odour sensitivity in the "normal" range - approximately 96% of the population). As an odour becomes more concentrated, then it gradually becomes more apparent. Some guidance as to concentrations when this occurs can be derived from laboratory measurements of intensity. The following guideline values have been stated by DEFRA2 to provide some context for discussion about exposure to odours:

- 1 ou_E/m^3 is the point of detection;
- 5 ou_E/m^3 is a faint odour; and
- 10 ou_E/m^3 is a distinct odour.

2.2.3 It is important to note that these values are based on laboratory measurements and in the general environment other factors affect our sense of odour perception, such as:

- The population is continuously exposed to a wide range of background odours at a range of different concentrations, and usually people are unaware of there being any background odours at all due to normal habituation. Individuals can also develop a tolerance to background and other specific odours. In an odour laboratory the determination of detection threshold is undertaken by comparison with non-odorous air, and in carefully controlled, odour-free, conditions. Normal background odours such as those from traffic, vegetation, grass mowings etc, can provide background odour concentrations from 5 to 60 ou_E/m^3 or more.
- The recognition threshold may be about 3 ou_E/m^3, although it might be less for offensive substances or higher if the receptor is less familiar with the odour or distracted by other stimuli; and

- An odour which fluctuates rapidly in concentration is often more noticeable than a steady odour at a low concentration.

2.3 Odour Legislative Control

2.3.1 The main requirement with respect to odour control from industrial activities is the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. If a process is deemed potentially odorous then the relevant regulator will usually include an appropriate condition in the site's Environmental Permit to restrict impacts beyond the facility boundary.

2.3.2 Enforcement of the condition is by the relevant regulator, either the EA for Part A(1) processes, or the Local Authority for Part (A2) and B processes. If the regulator is satisfied that odour from a facility is causing pollution beyond the site boundary then they can serve an improvement notice that requires remedial works to be undertaken to reduce impacts to an acceptable level. The measures that are deemed appropriate will depend on the industry sector and site-specific circumstances and will take costs and benefits into account. Should appropriate actions not be taken by the operator then the regulator has a number of available options, cumulating in the revocation of the Environmental Permit and cessation of all activities on site

2.4 Odour Benchmark Levels

Environment Agency: H4

2.4.1 Whilst recently withdrawn, the H4 guidance[1] provides benchmark levels to assess relevant exposure to determine impacts from potential operations and practices regulated under the Environmental Permitting (England and Wales) Regulations (2018) and subsequent amendments.

2.4.2 Modelled concentrations above the relevant benchmark levels detailed in Table 1 would therefore indicate unacceptable odour exposure. Benchmark levels are stated as the 98th percentile (%ile) of hourly mean concentrations in ou_E over a year. This means benchmarks should not be exceeded for more than 2% of the hours in a year or approximately 175 hours per year. This takes account of a reasonable amount of tolerance that can be expected by subjects to occasional odours. EA odour benchmark levels are summarised in Table 1.

Table 1: Odour Benchmark Levels

Relative Offensiveness of Odour	Benchmark Level as 98th%ile of 1-Hour Means (ou_E/m^3)
Most Offensive Odours: Processes involving decaying animal or fish Processes involving septic effluent or sludge Biological landfill odours	1.5
Moderately Offensive Odours: Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting	3.0
Less Offensive Odours: Brewery Confectionery Coffee roasting Bakery	6.0

2.4.3 It is considered that odours from the facility would be similar to that for 'intensive livestock' and 'well aerated green waste composting' and therefore likely be classified as 'moderately offensive', in accordance with the criteria shown in Table 1.

2.5 Institute of Air Quality Management Guidance

2.5.1 The IAQM guidance[3] specifically deals with assessing odour impacts for planning purposes, namely potential effects on amenity. The assessment methodology outlined in the guidance has been utilised in throughout this report where relevant.

2.5.2 It is therefore considered that this is the most relevant current guidance for methodology for assessment.

2.6 National Planning Policy

2.6.1 The National Planning Policy Framework (NPPF) December 2024, as amended in February 2025[5] sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to this assessment:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *"Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality"*

2.6.2 The implications of the NPPF have been considered during the production of this report.

[5] National Planning Policy Framework, Department for Communities and Local Government, 2021

3.0 Methodology

3.1 Scope

3.1.1 The operation of the AD plant will result in odour emissions during normal operations. These were assessed in accordance with the following stages:

- Identification of odour sources;
- Identification of odour emission rates;
- Dispersion modelling of odour emissions; and
- Comparison of modelling results with relevant criteria.

3.1.2 The following Sections outline the methodology and inputs used for the assessment. This remains the same as the previous assessment.

3.2 Odour Sources

3.2.1 Potential odour sources were identified from the proposed process. These included:

- Air exhaust from the waste reception building, separation building and liquid storage tanks via the odour treatment plant and stack;
- Manures stored for up to 30 minutes outside the reception building;
- Exposed crops within silage clamps;
- Solid waste stored with the reception building;
- Liquid feedstocks stored within tanks via a vent;
- Exposed crops and solid wastes during transfer to the feeder;
- Exposed and agitated material within the feeder hopper;
- Emissions from liquid digestate storage lagoon vents; and
- Emission from road tankers at liquid digestate filling points.

3.2.2 The revised emission changes primarily relate to the sources of the OCU exhaust and the manure pad outside the reception building.

3.2.3 The AD process itself is sealed and therefore does not form a source of odour, or other emissions such as CH_4 or hydrogen sulphide (H_2S), under normal operation. Should releases of these compounds occur then this would indicate a fault with the plant and immediate remedial measures would be taken to eliminate the problem to avoid seriously affecting the AD process, with associated financial consequences for the operator. Odours created by the membranes themselves should not occur.

3.2.4 Liquid digestate created by the process will be transported off the site by road tankers at the collection point.

3.2.5 The digestate lagoon will be covered with an impermeable floating layer to control emissions. Residual emissions will be via vents surrounding the lagoons.

3.2.6 The proposals do not affect the number of tanker removals assessed in the 2024 Odour Assessment. These were predicated to range from approximately 3 loads per day during the winter and approximately 23 loads per day in the spring and late summer.

3.2.7 During tanker filling there is the potential for short term odour emissions from displaced air within the tanker. These emissions have been included within this assessment as they have the potential to affect the immediate locality over a short period although the contribution to annual mean concentrations will be very low.

3.2.8 Solid digestate will be stored within the separation building before removal from the site. These odours have therefore been accounted for within the building and vented through the OCU stack.

3.2.9 Additional emissions such as Carbon Dioxide (CO_2), H_2S and Particulate Matter (PM), Halstow Energy Limited have confirmed the plant Includes a raw gas treatment unit to remove such species from the system. The treatment plant effectively captures CO_2 emissions and scrubs both H_2S and PM emissions within the raw gas via adsorption methods, activated carbon and particulate filters. It should be noted that only H_2S is a potentially odourous emission.

3.2.10 Following the capture of CO_2 the raw gas in compressed and fed into the adsorption column where it passes through a bed of activated carbon, ensuring the complete removal of H_2S, and then to a downstream filter, which ensures a complete removal of PM matter. The remaining CO_2 is then condensed and enters a liquefier where it is cooled and enclosed within the collection vessel to the transfer pump.

3.2.11 Similarly, the engines, generators , boilers and flare will only emit products of combustion which do not typically have any associated odour. As such, they have not been considered as potential sources in the context of this assessment. Reference should be made to SHF.0174.006.AQ.R.001.P01 for the assessment of associated on-site pollutant emissions.

3.2.12 Feedstock delivery of crops, will only be undertaken for short-periods, with materials quickly compacted, covered and sealed once deposited in the clamps. Odour emissions from these sources are therefore likely to be short in duration and controlled effectively once the relevant materials are contained. However to assume a worst case, it was assumed that a 150 m^2 was constantly exposed at the face of the clamp.

3.2.13 Delivery of FYM will be deposited outside the waste reception building. This will be pushed into the building following arrival and the assessment has assumed a worst case of a 30 minute outside storage period. The building will be kept under negative pressure to ensure no fugitive emissions when the doors are open. This will be provided by a mechanical ventilation system providing 3 air exchanges per hour within the building. All extracted air within the building will be passed through the OCU and emitted via the 14 m high odour stack.

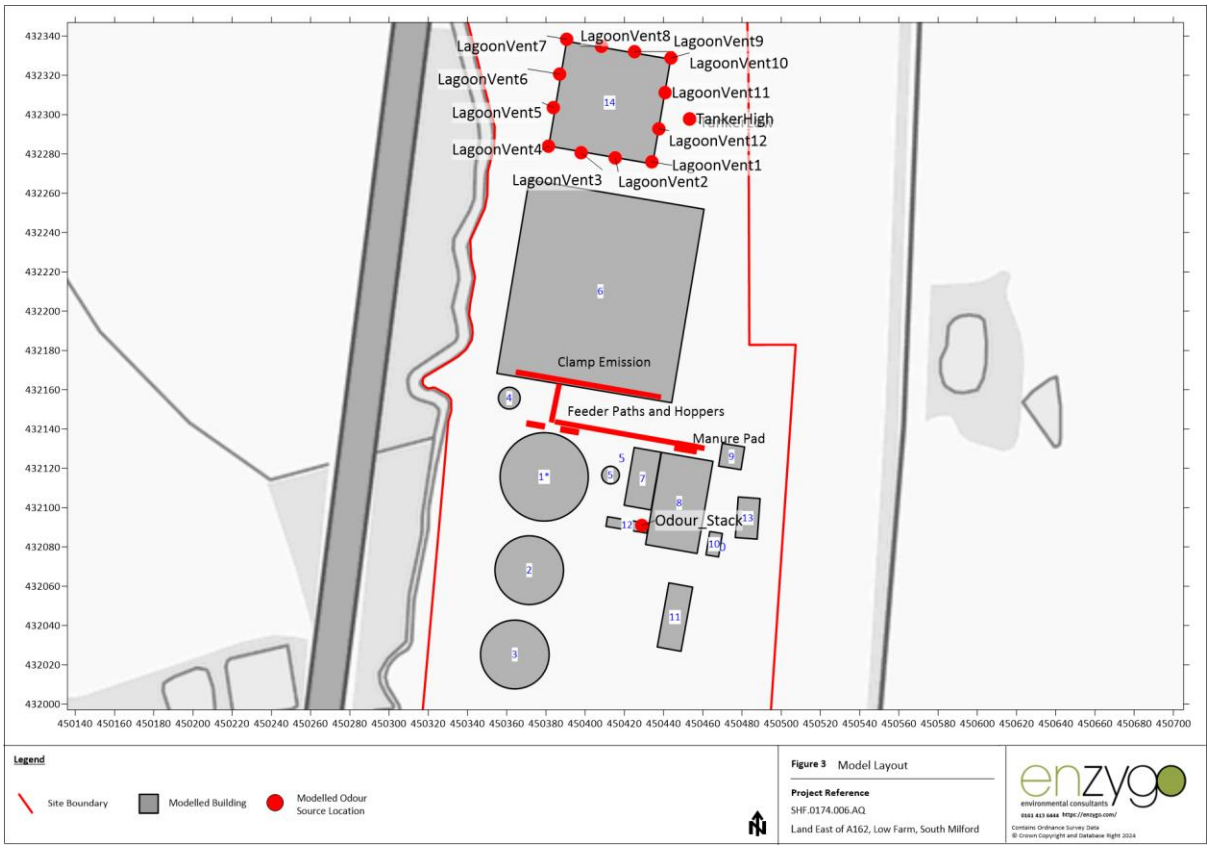
3.2.14 The total volume flow through the OCU stack was based on the estimated free volume within the reception and separation buildings of 70% of the total volume (estimated as 6720 m^2 and 2719.5m^2 respectively) and 3 air exchanges per hour.

3.2.15 Feedstock will be transferred from the clamps by loader into the feeding unit for 2 hourly periods each day.

3.2.16 Liquid feedstocks will be stored within 2 enclosed tanks which will vent to the OCU.

3.2.17 Figure 3 shows the emission locations and buildings included within the model.

Figure 3: Emission Locations



3.3 Odour Stack

3.3.1 The air extracted from the reception and separation buildings and liquid storage tanks for digestate and slurry will also be emitted through dedicated stack following treatment for odours and ammonia. Air will be extracted from the buildings at a rate of 3 air exchanges per hour. The process conditions associated with the odour stack, as provided by Halstow Energy Limited , are detailed in Table 2.

Table 2: Odour Stack Process Conditions

Parameter	Unit	Value
Approx. Stack Location	NGR	450429, 432091
Stack Height	m	14.0
Stack Exit diameter	m	0.8
Exit Temperature	˚C	15 (ambient)
Volumetric flow rate	m^3/s	7.866
Flue gas efflux velocity	m/s	15.649

a: Referenced wet gas flow rate from technical data sheets

3.4 Dispersion Modelling

3.4.1 Dispersion modelling was undertaken using ADMS 6 (v6.0.0.1), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd which is widely accepted by the EA and local authorities across the UK.

3.5 Modelling Scenarios

3.5.1 The scenarios considered in the modelling assessment are summarised in Table 3.

Table 3: Dispersion Modelling Scenarios

Pollutant	Modelled As	
	Short Term	Long Term
Odour	98th%ile 1-hour mean	n/a

3.5.2 Since the facility is not operational, it was not possible to monitor site specific emissions. In the absence of such information for specific odour sources, these were based on a review of existing literature and odour monitoring data reported at similar AD plants and are therefore considered to provide representative inputs for an assessment of this nature.

3.5.3 Odour emission rates are summarised in Table 4. Where a variation in odour rates was researched, the higher rate was used to provide a robust assessment, these are highlighted in **bold.**

Table 4: Odour Emission Rates

Source	Odour Emission Rate	Unit	Reference
Maize Silage	20.0	$ou_E/m^2/s$	Odournet UK Ltd(1)
Maize	18.7	$ou_E/m^2/s$	REC Ltd(2)
Maize, rye, barley, sugar beet, fodder beet, grass and other whole crops	**20.0**	$ou_E/m^2/s$	ADAS(3)
Chicken	**77.0**	$ou_E/m^2/s$	Sniffer (4)
Chicken	75.0	$ou_E/m^2/s$	Odournet UK Ltd(5)
Duck manure	20.0	$ou_E/m^2/s$	Sniffer (4)
Cattle manure	0.8	$ou_E/m^2/s$	Odournet UK Ltd(5)
Pig manure	1.35	$ou_E/m^2/s$	Odournet UK Ltd(5)
Slurry Pit (Winter)	1.83	$ou_E/m^2/s$	AMEC (8)
Slurry Pit (Summer)	3.62	$ou_E/m^2/s$	AMEC (8)
Dewatered Digestate	2.8	$ou_E/m^2/s$	Odournet UK Ltd(6)
Dewatered Digestate	**10.0**	$ou_E/m^2/s$	Odournet UK Ltd(5)
Liquid Digestate	**1.0**	$ou_E/m^2/s$	University of Liège and Universidad Politécnica de Valencia(7)
Liquid digestate tanker vehicle	**10,000**	ou_E/m^3	Odournet UK Ltd(6)

Notes:

(1) Odour Impact Assessment for a proposed Crop CHP Plant at Stoke Bardolph, Nottinghamshire, Odournet UK Ltd;

(2) Odour Assessment Biomass Renewable Energy Unit Spring Farm, Taverham, Resource and Environmental Consultants Ltd.

(3) An Odour Impact Study for a Proposed Agricultural Anaerobic Digester at Cleat Hill Farm, Haunton,ADAS;

(4) Sniffer ER26: Final Report March / 2014, SCAIL-Agriculture update;

(5) Odour Impact Assessment for a proposed Anaerobic Digestion facility near Kenninghall, Norfolk, Odournet UK Ltd

(6) Odour Impact Assessment for a proposed Anaerobic Digestion facility in Chatteris, Cambridgeshire, Odournet UK Ltd

(7) Multi-method Monitoring of Odor Emissions in Agricultural Biogas Facilities, Jacques Nicolas, Gilles Adam, Yolanda Ubeda, Anne-Claude Romain, University of Liège and Universidad Politécnica de Valencia

(8) Residential Development Odour Assessment, High Harrington, AMEC

3.5.4 As indicated in Table 3 the maximum odour emissions would be derived from chicken manure. FYMs are proposed to be a mix of manures. As shown in Table 4 the odour emission rate for cattle, pig and duck manure is much lower than that for chicken manure. However to ensure a robust assessment, all odour emissions from the manures from the outside pad, transfer route and feeder were assumed to be that from chicken manure. Actual emissions are likely to be much less than this.

3.5.5 To use a highly conservative approach an emission of 77 $ou_E/m^2/s$ has been used to represent manure odour emissions and in this assessment.

3.5.6 Emissions from the reception buildings, separator building and liquid slurry and liquid digestate tanks will be passed through the OCU and vented via the dedicated odour stack. The environmental permit will have an emission limit of 1,000 ou_E/Nm^3 and all emissions from these sources were assumed to be at this maximum to provide a worst case assessment. The removal of odours at the OCU will be designed to ensure that this limit is not exceeded,

3.5.7 Table 4 shows that maize, grass and rye and similar feedstocks are likely to have comparable odour generating characteristics. As such, an emission rate of 20 $ou_E/m^2/s$ was applied to all energy crops in the dispersion model.

3.5.8 The feeders would cause increased emissions due to agitation and, as such, a factor of 10 was applied to these area emissions.

3.5.9 The slurry tank emissions used the higher (summer) value as a constant emission from the surface area within the tank to use a conservative estimate. The almost complete enclosure within the tank would provide a high level of odour control and a minimum 50% reduction was assumed for this source. Residual gases are emitted ambiently into the OCU.

3.5.10 Liquid digestate in the lagoons will be completely covered by impermeable floating plastic sheets which will reduce emissions considerably by avoiding exposure to meteorological conditions. Again, to use a robust assessment this was considered to give a reduction of 50%.

3.5.11 To avoid over pressurisation, residual gases will be released via vents around the perimeter of the lagoons. The lagoon is estimated to provide twelve 0.15 m diameter vents. The emissions were therefore based on an emission rate of 0.5 $ou_E/m^2/s$ over the measured lagoon areas and then divided equally as point source emissions from the vents.

3.5.12 Following separation to solid portion of the digestate remains in a clamp within the reception building and whose emissions are vented via the odour control unit and stack. The digestate is regularly removed from the site by tractor/trailer.

3.5.13 The emission rates shown in Table 4 were utilised with additional information provided by Halstow Energy Limited to define emissions within the dispersion model. These are summarised in Table 5.

Table 5: Emissions

Source	Odour Emission	Unit	Characteristics
Silage Clamps	20.0	$ou_E/m^2/s$	c. 150 m^2 of silage exposed constantly within clamp
Reception Building	Maximum ELV via OCU Stack		
Manure Pad	77.0	$ou_E/m^2/s$	50 m^2 stored for 30 minutes on arrival
Transfer from Silage Clamps to Feed Hoppers	20.0	$ou_E/m^2/s$	1 hour transfer from clamps to feeder twice per day
Transfer from Reception Building to Feed Hoppers	77.0	$ou_E/m^2/s$	1 hour transfer from clamps to feeder twice per day
Agitated silage material within Feeder Hopper	200.0	$ou_E/m^2/s$	c. 25 m^2 agitated exposed material in each feeder for 2 hour period per day
Agitated manures material within Feeder Hopper	770.0	$ou_E/m^2/s$	c. 25 m^2 agitated exposed material in each feeder for 2 hour period per day

Source	Odour Emission	Unit	Characteristics
Slurry and liquid digestate within tanks	Maximum ELV via OCU Stack		
Liquid digestate lagoon vents	0.5	$ou_E/m^2/s$	c. 3,000 m^2 lagoon area emitted as 125 ou/s per vent (assumed 12 vents)
Liquid digestate tanker filling point	88.89	ou_E/s	16 m^3 tank air expelled over 1800 seconds.
OCU Stack	1,000	ou_E/Nm^3	Assumed at 0°C = 1,055 at 15°C Flow based on 3 air exchanges from reception and separation buildings = 7.866 m^3/s = **8298 ou_E/s**

3.5.14 The emission characteristics summarised within Table 5 include the following assumptions:

- The area of the silage clamp constantly uncovered represents an exposed face of the silage along its entire length. The uncovered clamp area will vary throughout operation depending on the levels and type of stored feedstock. As such, the assumption that 2 clamps will be exposed at all times is considered to provide a conservative over estimation;
- The emissions for FYMs are given for undiluted manures and based on 100% poultry manure to provide a worst case condition. In reality solid feedstock would be a mixture of manures with a lower odour potential;
- The feedstock transfer routes from the proposed clamps to the dry feeder was modelled as a c. 2 m wide area source;
- The liquid digestate collection points cause emissions as air expelled from the tankers when filled. Tankers are assumed to be 16 m^3 capacity and a filling time of 30 minutes has been used to calculate an air flow rate from the tanker of 29 m^3 / 1800 s = 0.0089 m^3/s; and
- All odour emissions were at ambient velocity and temperature as a robust assumption.

3.6 Time Varied Emissions

3.6.1 Emissions for the silage and solid feedstocks were assumed to be constant at full capacity, with the plant in operation 24-hours per day, 365-days per year. Emission releases from the liquid feedstock tanks were also assumed to be constant from all three vents.

3.6.2 The filling of the feeder unit, as well as the transfer of feedstock from the silage and FYM is understood to occur for approximately twice and for a maximum of 2 hours per day. A time-varied file was therefore applied to represent these conditions.

3.6.3 The collection of liquid digestate from the designated points will occur for approximately 18 times per day in March and August and twice per day at other times of the year.

3.6.4 Storage on the outside pad was assumed as a worst case of for a 30 minute period. Manure materials will typically be brought to the site up to 5 times per day. For robustness this was assumed to be deposited 7 days per week between the hours of 7 am and 7pm. These are considered conservative assumptions based on material masses.

3.6.5 Modelling of all sources is therefore considered to provide conservative short-term pollutant concentration predictions which do not account for periods of reduced workload.

3.7 Assessment Extents

3.7.1 Ambient concentrations were modelled over the following area using the gridded output function with ADMS-6 model:

- NGR: 449040, 431300 to 452360, 434040.

3.7.2 Results were subsequently used to produce contour plots within the Surfer® visualisation software package.

3.7.3 Sensitive receptor locations in the vicinity of the AD plant were identified following a desk top survey and assigned a relevant sensitivity based on the appropriate land use category.

3.7.4 The IAQM document Guidance on the Assessment of Odour for Planning[3] provides descriptions of relevant sensitivity as summarised in Table 6.

Table 6: Odour Receptor Sensitivity

Sensitivity	Description
High	**Surrounding land where:** • Users can reasonably expect enjoyment of a high level of amenity; and • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land • Examples may include residential dwellings, hospitals, schools/education and tourist/cultural
Medium	**Surrounding land where:** • Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • People would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land • Examples may include places of work, commercial/retail premises and playing/recreation fields
Low	**Surrounding land where:** • The enjoyment of amenity would not reasonably be expected; or • There is transient exposure, where the people would reasonably be expected to present only for limited periods of time as part of the normal pattern of use of the land. • Examples may include industrial use, farms, footpaths and roads

3.7.5 Sensitive receptor locations surrounding the facility were identified from a desk-top study. These were modelled at the minimum height of relevant exposure. These are the same locations as the previous assessment and are summarised in Table 7.

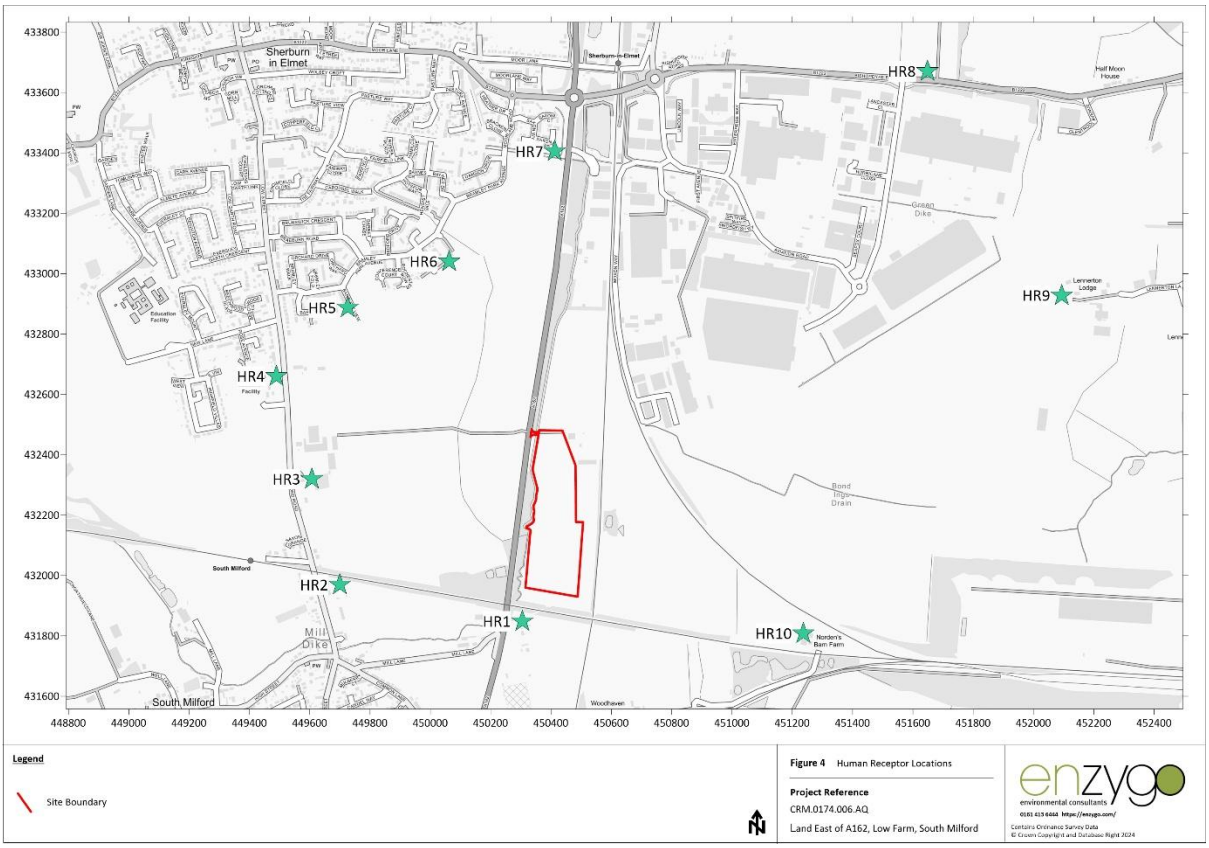
Table 7: Sensitive Human Receptors

Receptor		Use	NGR (m)		Distance from Centre of Site (m)	Height (m)
			X	Y		
HR1	Mill Lane, South Millford	Residential	450305.1	431848.1	386	1.5
HR2	Craglands, South Millford	Residential	449699.2	431969.0	765	1.5
HR3	Home Lea Cottage	Residential	449607.5	432319.2	823	1.5

Receptor		Use	NGR (m)		Distance from Centre of Site (m)	Height (m)
			X	Y		
HR4	22 Milford Road/Primary School	Residential/ School	449489.4	432659.7	1,034	1.5
HR5	10 Bartlett View, Sherburn in Elmet	Residential	449726.1	432886.8	968	1.5
HR6	25 Egremont Place, Sherburn in Elmet	Residential	450062.1	433040.2	900	1.5
HR7	Saxon Mews, Sherburn in Elmet	Residential	450412.9	433404.5	1,189	1.5
HR8	Ashfield	Residential	451647.9	433670.0	1,901	1.5
HR9	Lennerton Lodge	Residential	452093.9	432927.7	1,816	1.5
HR10	Norden's Barn Farm	Residential	451236.8	431807.9	910	1.5

3.7.6 The sensitive locations identified in Table 7 represent worst-case locations, i.e., the locations at which air quality impacts from the proposals are expected to be the greatest. Figure 4 shows the location of sensitive human receptors.

Figure 4: Human Receptor Locations



3.7.7 It should be noted that surrounding land use is predominantly agricultural so silage and FYM odours and a higher level of tolerance and existing background odours would reasonably be expected. Many of the receptors are working farms however some receptors represent a group of properties and range of uses and have therefore been classified as the highest sensitivity in that group.

3.8 Terrain Data

3.8.1 Areas of complex terrain have potential to affect the dispersion of pollutants which vary dependent on the height and location of modelled emission sources.

3.8.2 Ordnance Survey Landform Panorama terrain data processed within the ADMS-6 model and covers the AD plant and surround receptor locations.

3.9 Building Effects

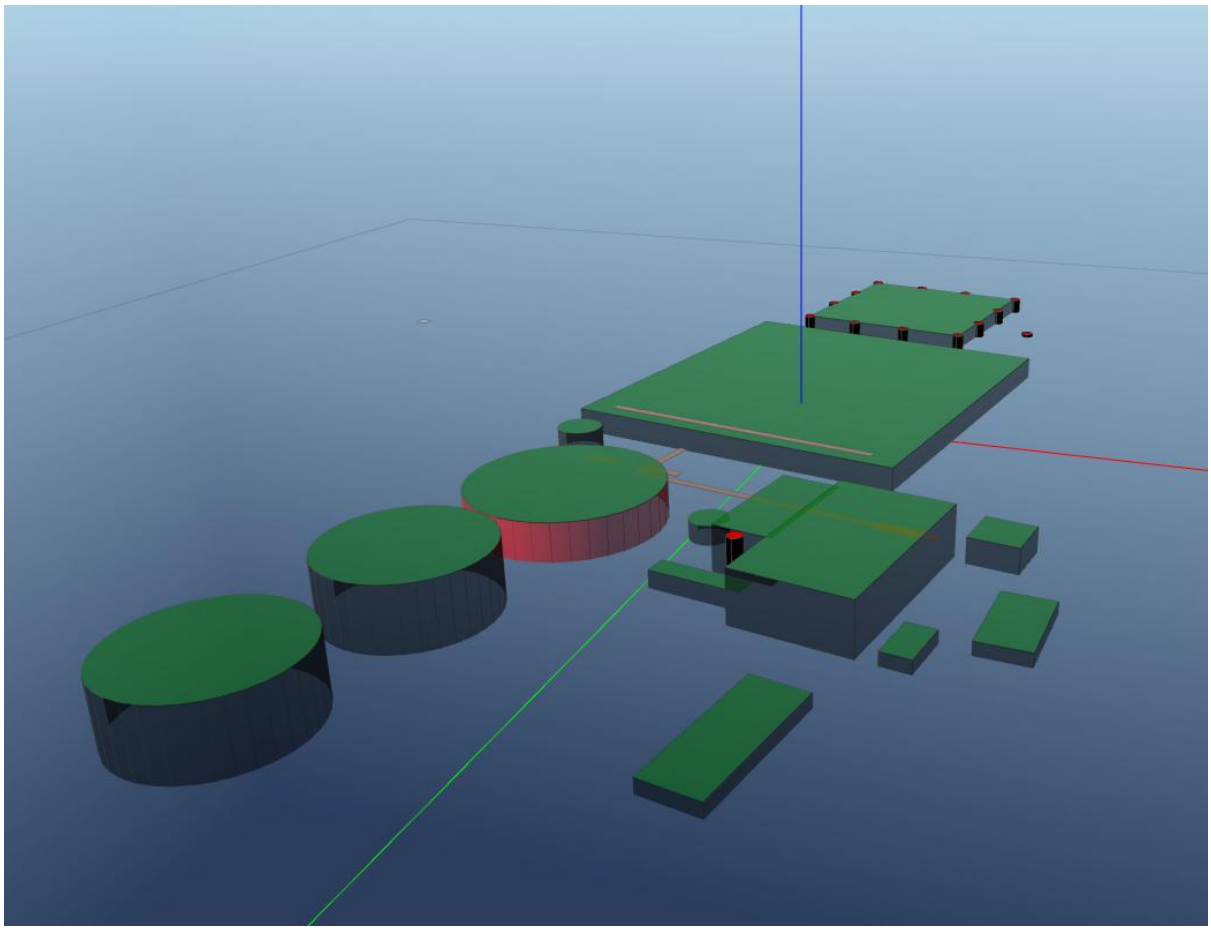
3.9.1 Buildings can influence the dispersion of pollutant and may lead to increases to ground level concentrations. A review of adjacent buildings was therefore undertaken and subsequently included within the model and are summarised in Onsite building heights were provided by the project architect and considered to an accurate representation.

Table 8: Building Geometries.

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
1	Digestor	450379.1	432115.7	9.0	45.0	Circular	N/A
2	Post Digester 1	450371.5	432068.2	14.0	35.0	Circular	N/A
3	Post Digester 2	450364.1	432025.3	14.0	35.0	Circular	N/A
4	Effluent Tank	450361.3	432155.7	6.1	11.1	Circular	N/A
5	Separation Liquid Tank	450412.9	432116.6	4.5	9.0	Circular	N/A
6	Silage Clamps	450407.8	432210.1	6.0	99.9	90.42	189.5
7	Separator Building	450429.3	432114.7	10.5	29.8	13.92	189.9
8	Feedstock Reception	450448.0	432102.4	12.0	47.6	26.68	189.9
9	Office and Control Building	450474.7	432126.0	6.0	11.7	11.55	189.1
10	NG Generators	450465.8	432081.4	3.0	12.1	6.51	189.2
11	CO2 Capture	450445.8	432044.3	3.0	33.2	12.35	190.3
12	Odour Control System	450421.4	432091.2	4.0	5.0	21.04	189.4
13	Biomethane Upgrading Plant	450482.9	432094.7	3.0	20.7	11.18	184.1
14	Digestate Lagoon	450374.3	432141.9	4.5	54.1	53.80	189.7

3.9.2 Figure 3 shows a graphical representation of the modelled building layout and the ADMS 6 model input. A 3D image of the model inputs is also shown in Figure 5.

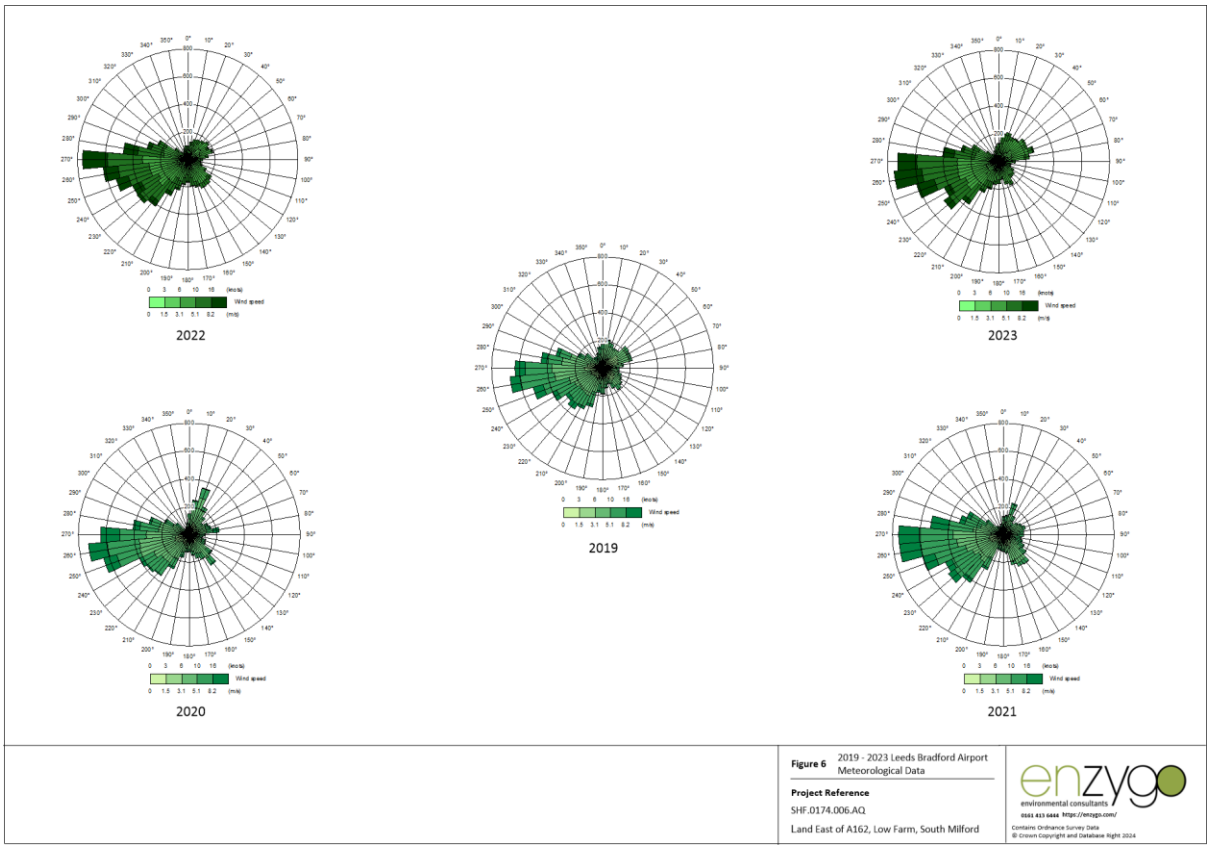
Figure 5: 3D Image of Modelled Buildings and Emission Sources



3.10 Meteorological Data

3.10.1 Similar to the original assessment, hourly sequential data used in this assessment was obtained from Leeds/Bradford Airport meteorological station, located 30 km northwest of the AD facility at approximate NGR: 423110, 441590. This was updated to use the 5 years from 2019 to 2023 inclusive. Figure 6 shows the wind roses of utilised meteorological data.

Figure 6: Meteorological Data



3.10.2 The application site and meteorological station, both sites are located within similar rural contexts. The choice of this parameter therefore provides a suitable representative of metrological conditions across the modelled domain.

3.10.3 Maximum emissions across the five years of meteorological data (2019 – 2023) were utilised to account for varying meteorological conditions. All meteorological data used in the assessment was provided by ADM Ltd.

3.11 Roughness Length

3.11.1 The specific roughness length (z_0) values specified with ADMS-6 are summarised in Table 9.

Table 9: Utilised Roughness Length

Location	Roughness length (m)	ADMS Description
Application Site and Meteorological Station	0.2	Agricultural (min)

3.11.2 Both the AD facility and meteorological station are located within rural locations and surrounded by agricultural fields. Given the surrounding area is void of significant building structures, which could increase turbulence, a value of 0.2 m is considered appropriate for the morphology of the assessment area.

3.12 Monin-Obukhov Length

3.12.1 The Monin-Obukhov length values are summarised in Table 10.

Table 10: Utilised Monin-Obukhov Lengths

Location	Monin-Obukhov length (m)	ADMS Description
Application Site and Meteorological Station	10	Small Towns <50,000

3.12.2 The application of Monin-Obukhov values considers the effect of heat production in populated areas which will influence atmospheric stability. The rural context of both the AD facility and meteorological site suggest a stable conditions and a value of 10 m is deemed appropriate.

3.13 Roughness Length

3.13.1 The specific roughness length (z_0) values specified with ADMS-6 are summarised in Table 11.

Table 11: Utilised Roughness Length

Location	Roughness length (m)	ADMS Description
Application Site and Meteorological Station	0.2	Agricultural (max)

3.13.2 Both the AD facility and meteorological station are located within rural locations and surrounded by agricultural fields. Given the surrounding area is void of significant building structures, which could increase turbulence, a value of 0.2 m is considered appropriate for the morphology of the assessment area.

3.14 Monin-Obukhov Length

3.14.1 The Monin-Obukhov length values are summarised in Table 12.

Table 12: Utilised Monin-Obukhov Lengths

Location	Monin-Obukhov length (m)	ADMS Description
Application Site and Meteorological Station	10	Small Towns <50,000

3.14.2 The application of Monin-Obukhov values considers the effect of heat production in populated areas which will influence atmospheric stability. The rural context of both the AD facility and meteorological site suggest a stable conditions and a value of 10 m is deemed appropriate.

3.14.3 All meteorological data used in the assessment was provided by ADM Ltd.

3.15 Significance of Odour Impacts

3.15.1 The significance of impacts was assessed through the interaction of the predicted 98th%ile of 1-hour mean odour concentrations and receptor sensitivity, as outlined in the IAQM guidance[3]. The relevant assessment matrix for "moderately offensive odours" as defined in Section 2.4 is summarised in Table 10.

Table 13: Odour Impact Descriptors

Odour Exposure Level as 98th%ile of 1-Hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Greater than 10	Moderate	Substantial	Substantial
5 - 10	Slight	Moderate	Moderate
3 - 5	Negligible	Slight	Moderate
1.5 - 3	Negligible	Negligible	Slight
0.5 - 1.5	Negligible	Negligible	Negligible

Odour Exposure Level as 98th%ile of 1-Hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Less than 0.5	Negligible	Negligible	Negligible

3.15.2 The IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is moderate or substantial, the effect is likely to be considered significant, whilst if the impact is slight or negligible, the impact is likely to be considered not significant.

3.15.3 It should be noted that this is a binary judgement of either it is significant or it is not significant. This has been considered to determine the overall magnitude of potential odour impacts associated with the facility.

3.16 Modelling Uncertainties

3.16.1 Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and
- Variability - randomness of measurements used.

3.16.2 Whilst uncertainty in the model inputs and parameters cannot be fully reduced, the analysis of maximum emissions across the five years of meteorological data (2017 – 2021) provides sensitivity analysis which sufficiently accounts for variations in modelled predictions. Additionally, worse case assumptions regarding the application of emission rates within the model also minimise podetial uncertainties. As such, a sufficient degree of confidence can be placed in the results.

3.17 Dispersion Modelling Report Requirements

3.17.1 Table 14 provides the checklist of dispersion modelling report requirements.

Table 14: Dispersion Modelling Report Requirements

Item	Location within Report
Location map	Figure 1
List of odours modelled and relevant odour guidelines	Section 3.2, Section 2.3 and Section 2.4
Details of modelled scenarios	Section 3.5
Model description and justification	Section 3.3
Special model treatments used	Section 3.0
Table of emission parameters used	Table 4; Table 5
Details of modelled domain and receptors	Section 3.7, Figure 4
Details of meteorological data used	Section 3.10
Details of terrain treatment	Section 3.8
Details of building treatment	Section 3.9, Table 8

4.0 Assessment

4.1 Sensitive Receptor Results

4.1.1 Predicted odour concentrations at receptor locations are summarised in Table 15. Odour concentrations are presented as a 98th%ile of 1-hour mean values over the relevant assessment year. The maximum concentration over the 5 year meteorological dataset has been used to determine the overall assessment significance.

Table 15: Predicted Odour Concentrations Digestate

Receptor		Predicted 98th%ile 1-hour Mean Concentration (ou_E/m^3)					
		2019	2020	2021	2022	2023	5-Year Max
HR1	Mill Lane, South Millford	1.32	1.40	1.47	1.27	1.35	1.47
HR2	Craglands, South Millford	0.23	0.19	0.22	0.24	0.22	0.24
HR3	Home Lea Cottage	0.13	0.14	0.15	0.12	0.11	0.15
HR4	22 Milford Road/Primary School	0.10	0.11	0.10	0.09	0.08	0.11
HR5	10 Bartlett View, Sherburn in Elmet	0.22	0.25	0.17	0.15	0.13	0.25
HR6	25 Egremont Place, Sherburn in Elmet	0.37	0.23	0.38	0.35	0.32	0.38
HR7	Saxon Mews, Sherburn in Elmet	0.13	0.12	0.20	0.18	0.21	0.21
HR8	Ashfield	0.07	0.07	0.08	0.07	0.07	0.08
HR9	Lennerton Lodge	0.13	0.10	0.18	0.14	0.20	0.20
HR10	Norden's Barn Farm	0.23	0.18	0.24	0.22	0.20	0.24

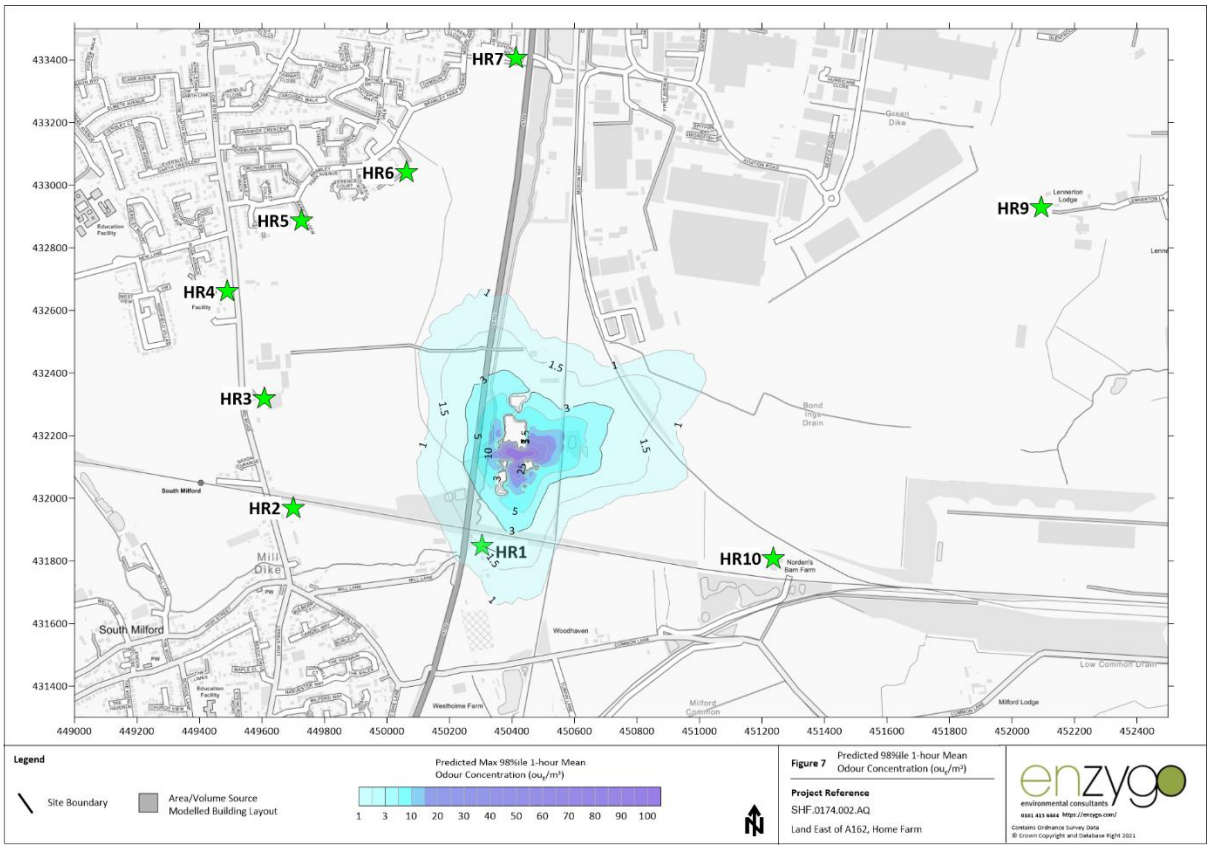
4.1.2 As indicated in Table 15, predicted odour concentrations were below the appropriate odour benchmark of 3.0 ou_E/m^3 at all highly sensitive receptor locations throughout the considered modelling years.

4.1.3 The highest predicted odour concentration was also below the 1.5 ou_E/m^3 (1.47 ou_E/m^3 at Mill Lane South Milford).

4.1.4 In addition, as robust assumptions have been used for the odour emissions from materials, a maximum permitted emission from the OCU stack and a maximum 5 year impact produced it is considered that actual odour impacts will be less than those predicted in Table 15.

4.1.5 Predicted 5 year maximum 98^{th} %ile odour contours over the study area are represented in Figure 7 and shows that all sensitive locations are not within the maximum 1.5 ou_E/m^3 contour and no adverse odours would impact on the commercial/industrial areas to the north east of the site.

Figure 7: Predicted Maximum Odour Concentrations



Impact Significance

4.1.6 The significance of predicted odour impacts at the sensitive receptors based on 5-year maximum concentrations is summarised in Table 16. It should be noted that the IAQM guidance[3] has been compiled on the assumption that the odour in question is deemed moderately offensive. As shown in Table 1, odours from the proposed facility would be categorised within the 'moderately offensive' category.

Table 16 Predicted Impact Significance at Receptors

Receptor		Maximum Concentration (ou$_E$/m^3)	Odour Exposure Range (ou$_E$/m^3)	Receptor Sensitivity	Significance of Impact
HR1	Mill Lane, South Millford	1.47	0.5 - 1.5	High	Negligible
HR2	Craglands, South Millford	0.24	Less than 0.5	High	Negligible
HR3	Home Lea Cottage	0.15	Less than 0.5	High	Negligible
HR4	22 Milford Road/Primary School	0.11	Less than 0.5	High	Negligible
HR5	10 Bartlett View, Sherburn in Elmet	0.25	Less than 0.5	High	Negligible
HR6	25 Egremont Place, Sherburn in Elmet	0.38	Less than 0.5	High	Negligible
HR7	Saxon Mews, Sherburn in Elmet	0.21	Less than 0.5	High	Negligible
HR8	Ashfield	0.08	Less than 0.5	High	Negligible
HR9	Lennerton Lodge	0.20	Less than 0.5	High	Negligible
HR10	Norden's Barn Farm	0.24	Less than 0.5	High	Negligible

4.1.7 As indicated in Table 16, the significance of odour impacts as a result of the AD facility was predicted to be negligible at all sensitive receptor locations. All impacts are also predicted to be below the most sensitive odour benchmark of 1.5 ou_E/m^3.

4.1.8 The results show an improvement on the previous assessment at the closest receptor (HR1) as well as HR10. Other less impacted locations show very slight increase in odour but impacts remain negligible.

4.1.9 Based on the assessment results, the overall odour impact associated with the proposed activities remain as **not significant**, in accordance with the stated methodology and the IAQM impact descriptors listed in Table 13.

4.1.10 In addition, as robust assumptions have been used for the odour emissions from materials and in particular manure, and that maximum permitted limits have been used for the OCU stack, it is considered that maximum odour impacts would be less than those predicted.

5.0 Conclusions

5.1.1 Enzygo Limited was commissioned by Halstow Energy Limited to undertake an updated Odour Assessment to support of Section 73 application for the construction and operation of an Agricultural Anaerobic Digestion (AD) Plant on agricultural land to the land east of A162, Low Farm, South Milford, Sherburn in Elmet.

5.1.2 The updated impact assessment is being undertaken as a review the original odour quality assessment, considering revisions to the site layout, plant/equipment revisions and updated meteorological and emissions data.

5.1.3 During the operation of the plant there is the potential for impacts at sensitive locations due to odour emissions from a number of sources at the plant. An Odour Assessment was undertaken to consider effects in the vicinity of the site. The emissions from the operation of the proposals will be subject to required controls and emissions limits within the Environmental Permitting regime.

5.1.4 Potential odour emissions were defined based on the proposed plant operation and a review of literature and emissions used at similar facilities. Where appropriate robust assumptions were made to give an increased confidence in the results.

5.1.5 These were represented within a dispersion model produced using ADMS 6 and using 5 years' meteorological data. The magnitude of impacts at sensitive receptor locations in the vicinity of the site were predicted.

5.1.6 The proposals will result in the removal or control of other odour sources in the vicinity of the site and the closest sensitive receptors. These potential improvements have not been included within the assessment to provide a robust assessment.

5.1.7 Predicted odour concentrations were negligible at all sensitive receptors in the vicinity of the site for all modelling years and also below the most sensitive odour benchmark of 1.5 ou_E/m^3.

5.1.8 The results show an improvement on the previous assessment at the closest receptor.

5.1.9 As such, given the robust assumptions made for odour emissions, maximum permitted emissions for odour stack emissions and the use of maximum 5 year concentrations, the overall potential for odour impacts generated by the AD facility can be considered to remain as **not significant**.

5.1.10 The revised AD facility is therefore not considered to represent a constraint to planning permission with regard to odour.

6.0 Abbreviations

%ile	Percentile
AD	Anaerobic Digestion
ADM	Atmospheric Dispersion Modelling
CERC	Cambridge Environmental Research Consultants
CH_4	Methane
CO_2	Carbon Dioxide
CHP	Combined Heating and Power
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EPUK	Environmental Protection UK
FYM	Farmyard Manure
H_2S	Hydrogen Sulphide
IAQM	Institute of Air Quality Management
NGR	National Grid Reference
ou_E	European Odour Unit
z_0	Roughness Length

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APPENDIX B ODOUR COMPLAINTS FORM

ODOUR COMPLAINT REPORT FORM	
Time and date of complaint:	
Name and address of complainant:	
Telephone number of complainant:	

Date of odour:	
Time of odour:	
Location of odour, if not at 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 NE):	
Complainant's description of odour: What does it smell like?	
Intensity (see Reference Table 1):	
Duration (time):	
Constant or intermittent in this period:	
Does the complainant have any other comments about the odour?	
Are there any other 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 likely to be from your activities?	
What was happening on site at the time the odour occurred?	
Operating conditions at time the odour occurred (e.g. flow rate, pressure at inlet and pressure at outlet):	
Actions taken:	

Form completed by:	Date:	Signed;

Odour Intensity	Description
1	No detectable odour
2	Faint odour (barely detectable, need to stand still and inhale facing into wind.
3	Moderate odour (odour easily detectable while walking and breathing normally, possibly offensive)
4	Strong odour (bearable, but offensive odour – will my clothes hair/smell?)
5	Very strong odour (malodorous)

APPENDIX C ODOUR REPORTING FORM

ODOUR REPORTING FORM		
Name of Assessor:		
Confirm Compliance with Reference Table 1:		
Survey Timings	Date	
	Start Time	
	Finish	
Location of Sniff Test :		
Weather Conditions (dry, rain, fog, snow etc)		
Wind Direction (e.g from the SW)		
Wind Strength (none, light, steady, strong, gusting)		
Cloud Cover (%)		
Temperature (°C)		
Precipitation		

Location [1]	Odour Intensity [2]	Odour Extent [3]	Odour Description [4]	Receptor Sensitivity [5]

Sketch

Provide a sketch of test and source locations

[1]What site boundary points / sensitive receptor?
[2]Refer to Reference Table 2
[3]Refer to Reference Table 3
[4]Describe the character of the odour (e.g. rotten eggs, musty, earthy, drains etc)
[5]Refer to Reference Table 5

Notes;

If odour intensity is judged as 3 or above at any external location within the site boundary the Site Manager must be immediately notified

The extent of the plume should be investigated as follows:

Four suitable locations downwind of the biofilter beds / drying plant but internal to the site boundary will be chosen to clarify that the impact is not detectable at the site boundary and able to create an offsite impact.

In the event that the odour is detectable at the site boundary, an offsite investigation will be required in the direction of the prevailing wind and closest sensitive receptor. Continue toward the site until a faint odour is detectable.

Select further assessment points at right angles to the plume axis and equidistant from the facility to determine extent of plume.

REFERENCE TABLE 1	
Requirements for Assessor	
Assessor has not been exposed to waste related odours for previous 30 minutes	
Assessor has not smoked or consumed strongly flavoured food or drink in previous 30 minutes	
Scented toiletries should not be applied immediately before or during assessment.	
Vehicle used for assessment should not contain deodoriser and care should be taken concerning odour in windscreen wash.	
Reference Table 2	
Odour Intensity	Description
1	No detectable odour
2	Faint odour (barely detectable, need to stand still and inhale facing into wind.
3	Moderate odour (odour easily detectable while walking and breathing normally, possibly offensive)
4	Strong odour (bearable, but offensive odour – will my clothes hair/smell?)
5	Very strong odour (malodorous)
Reference Table 3	
Odour Extent	Description
1	Local and transient (only detected during brief periods when wind drops or blows)
2	Transient as above, but detected away from site boundary
3	Persistent but fairly localised
4	Persistent and pervasive up to 50m from site boundary
5	Persistent and widespread (odour detected > 50m from site boundary
Reference Table 4	
Receptor Sensitivity	Description
1	Low (e.g. footpath, road)
2	Medium (e.g. industrial or commercial workplaces)
3	High (e.g. housing, pub/hotel etc)

APPENDIX D RESPONSIBLE PERSONS

Control Measure	Responsible Persons	
	Implementation on-site	Overall Manager
Receipt and Management of Odourous Materials In accordance with Section 3.1.		
Engaging your Neighbours In accordance with Section 3.6.		
Response to Complaints In accordance with Section 3.7.		
Meteorological Conditions In accordance with Section 4.2		
Olfactory Monitoring In accordance with Section 4.3		
Internal Odour Monitoring In accordance with Section 4.4		
Further Monitoring In accordance with Section 4.5.		
Record Keeping In accordance with Section 4.6.		
Complaint and Corrective Action Monitoring In accordance with Section 5.		

APPENDIX E ODOUR CONTROL UNIT TECHNICAL DETAILS

Quotation no:	1741	Valid through:	2025-12-31	Customer:	Engie UK
Date	2025-12-01	Our ref:	Emanuel Andersson	Your ref:	Phil Morris



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.

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Introduction

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

The following design is suggested to be designed for the application. The outlet gas will meet the following criteria:

- Odour concentration less than 1 000 OU/m3 from the chimney.

No	Component	Power Installed/Normal operation	Material
1	Sulphared Compact 1500 + support fan – treating 1 500 m3/h.	1,1/ 0,7 kW	Stainless steel AISI 316L
1	NH3 Scrubber + support fan - treating 13 470 m3/h	7,5/5,4 kW	GRP
2	UV reactor of model Frej with 10 lamp frames – treating 50 406 m3/h	16/15,0 kW per reactor	Reactor, lamp frames, stainless steel AISI 304 Control panel, ballast cabinets stainless steel AISI 304. C4 corrosion protection level.
2	Carbon filter 2x8 - treating 50 406 m3/h		Stainless steel AISI 304
1	Main fan. IP54 - treating 103 670	30/21,0 kW	Stainless steel AISI 304
1	Piping between equipment		
1	Drainpipes with water trap		
1	Instrumentation for control and monitoring		

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Process description

Expected inlet odour concentration values

Before Sulphared	
< 150 000 OU/m3	
Before NH3 Scrubber	
< 24 000 OU/m3	
< 100 ppm NH3	
Before ColdOx	
< 11 000 OU/m3	
< 5 ppm NH3	
	Outlet ColdOx
	< 1 000 OU/m3

Process description:	
Process gas flow:	50 406 m3/h
Process temperature:	< 40 °C
Pressure drop from customer plant:	500 Pa in total assumed for before and after Centriair system
Atex Zone:	None. Centriair equipment is not designed to operate in ATEX zones.

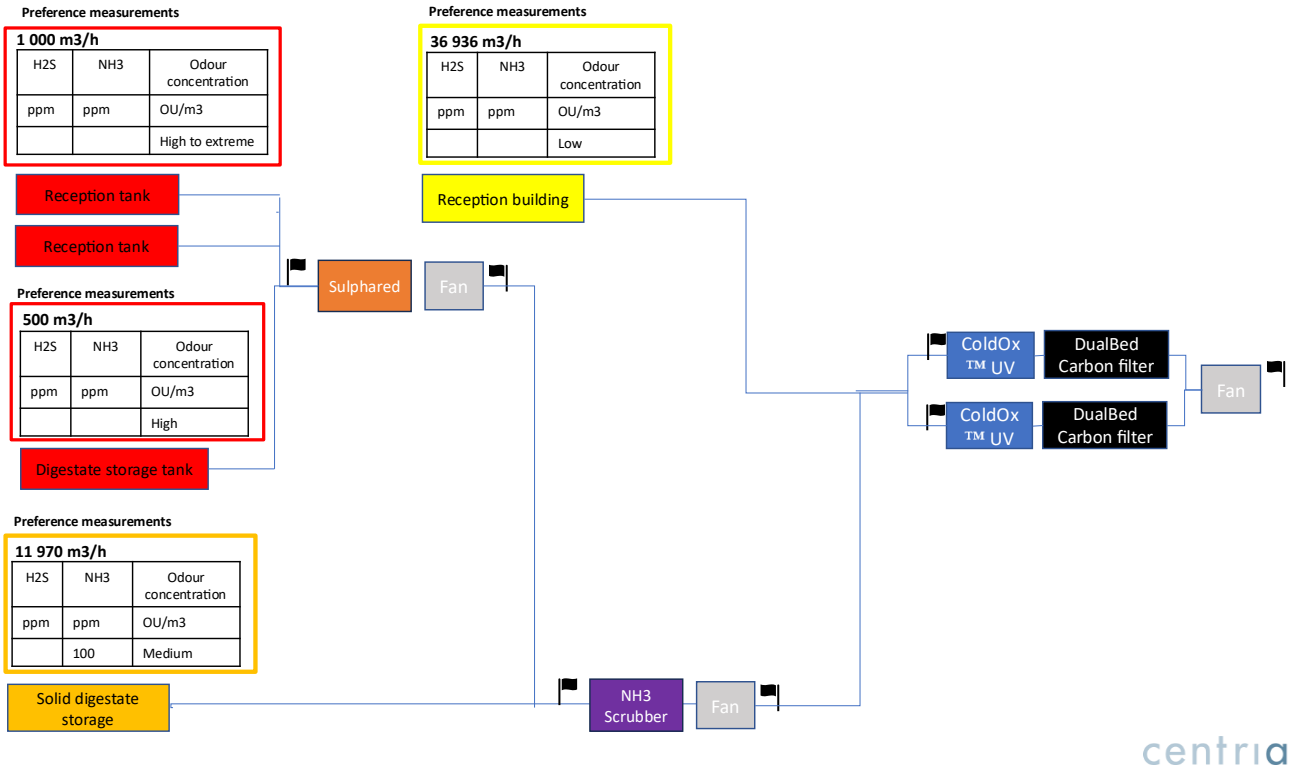
The odour treatment is described according to the feedstock plan (see appendix D) provided by the

In order to maintain a guaranteed performance below 1 000 OU/m3, the odour treatment is designed for the substrates and processes for the current installation. Hence, if the quantity or type of substrate is changed fundamentally from the existing plan, Centriair should be consulted to ensure that the system can maintain the guaranteed level 1 000 OU/m3.

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Odour mapping & Conceptual design

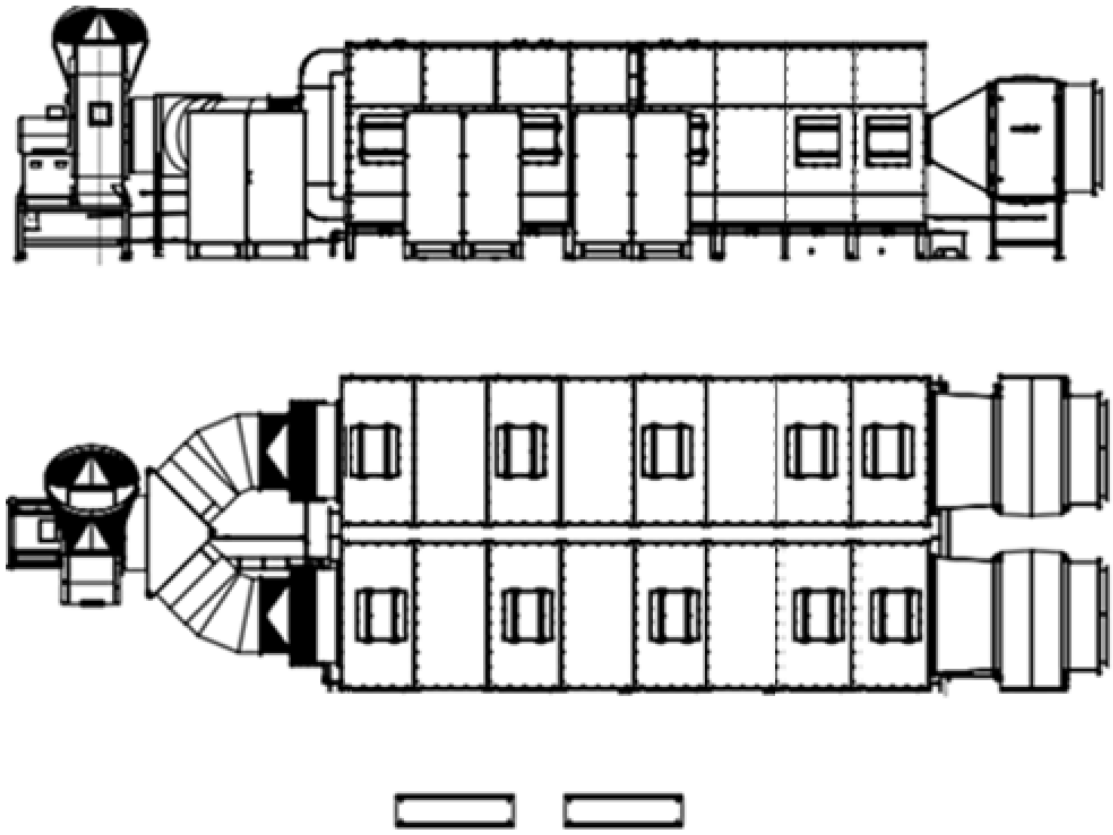
Below is the odour mapping and conceptual design for the odour treatment system.



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Overall footprint

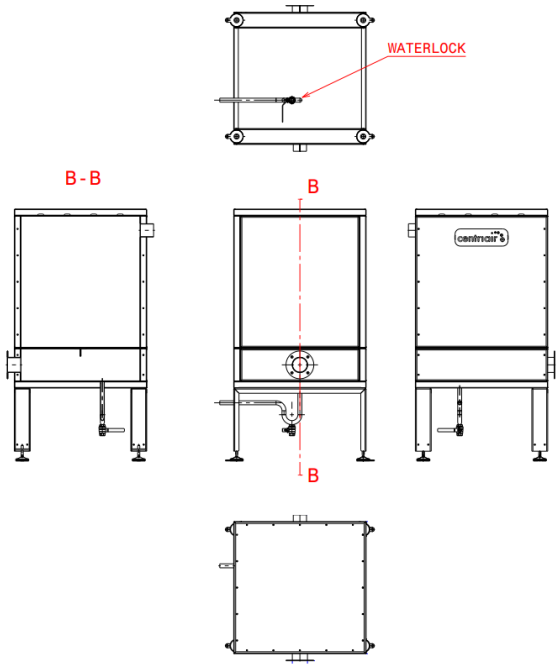
ColdOx™-system – treating 50 406 m3/h:
The proposed ColdOx™-system's footprint is preliminary 16 meters long. The width is 5 meters. Please note that a width of minimum of 8 meters is space necessary for service operations and the height is 3 meters. See an example of a similar layout below.



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Sulphared Compact 1 500 – treating 1 500 m3/h:
The Sulphared compact 1 500's footprint is approx. 1,5 meter long. The width is a minimum of 1,5 meter, please note that 2 meters width is necessary for service operations, and the height is 2,0 meters.



NH3 Counter Current Scrubber 13 470 m3/h:
The proposed acid scrubber's footprint: Diameter: 1,3 m, and height: 6,0 m.

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Detailed system specification

UV Specification:

Description :	The UV reactor is the first treatment stage, built together with the active carbon filter. Lamp life is approximately 16 000 hours. Basic control setup is start/stop signal from your system and running and error signal back to your system. Control and safety solution includes pressure guard for the UV as well as door switches. Equipment prewired with “plug and play” to minimize site wiring. Automatic flushing system of lamps, CIP (Clean in Place). Safety switches with alarm system in case of lamp failure. Controls and signaling see Appendix D.
Note:	The ballast panel should be positioned within 10 meter cable length from the UV reactor.
Electrical connection:	380-400 V/50 A three phase + Neutral 50 Hz
Weight:	Total weight of one reactor including support and lamp frames is 580 kg.
Process gas flow:	50 406 m^3/h
Maximal operating temp:	40 °C.
Control system:	PLC Siemens S7 1200

Active Carbon Specification:

Description:	Active Carbon filter with medium residence time due to the initial treatment and combination effects from oxidation + carbon. Dual carbon beds to minimize pressure drop.
Material:	Stainless steel AISI 304
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.
Other:	Centriair has the right to decide which type of activated carbon that operates.

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Fan Specification:

Description:	Industrial centrifugal fans from stainless steel driven by frequency inverter. Fans come with VFD system to regulate the airflow changes. **The fan is designed assuming 500 Pa pressure drop in the ducts before and after the ColdOx® System (total 500 Pa).** The exact pressure drops in the ducts to our system must be specified before ordering the final fan. This will have to be done already at the detailed design stage. **Please revert if additional pressure capacity is needed.**
Electrical connection:	380-400 V

SulphaRed Specification:

Description:	SulphaRed filter with medium residence time Dual carbon beds to minimize pressure drop.
SulphaRed volume:	1 500 kg
Pressure drop:	< 100 Pa
Dimensions:	1 500 x 1 500 x 2 000 mm
Material:	Stainless steel 316L

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NH3 Scrubber:

Description: NH3 removal counter current scrubber is operated at an acidic pH-value by adding H2SO4 to the washing water in order to remove ammonia and other alkaline components. The system is designed for a 24 h/day operation without shut down besides maintenance.

Including:

- Scrubber made from GRP
- Packing material
- Droplet separator
- Recirculation pump
- Circulation pipe incl. spraying nozzles
- Pressure gauge
- Level control for the pump sump
- Dry-run protection for the pump
- Heater for the sump
- Automatic blow down with
- Conductivity measurement
- In- and outlet flange for exhaust air.
- Control cabinet

Doing station – Dosing of acid (H2SO4 96%) equipped with:

- Dosing cabinet
- Dosing pump
- Suction and dosing line
- pH probe
- Measuring and control devices
- Leakage sensor

Excluded:

- Chemicals and storage tanks

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Appendix A: Scope of Delivery

Project delivery Scope of Scandinavian Centriair System (Sup = Supplier, Pur = Purchaser	Centriair Scope	
Equipment	Included	Excluded
ColdOx UV	☑	☐
Media	☑	☐
Lamps	☑	☐
Carbon Filter	☑	☐
Main fan	☑	☐
Skid and railings	☐	☑
Chimney	☐	☑
Critical Spare Parts	☑	☑
Heat Tracing	☑	☐
Local certifications for works	☐	☑
Sulphared Compact 1 500 + support fan	☑	☐
Option: Service dampers	☐	☑
NH3 Scrubber + support fan	☑	☐
Drain box for Coldox System	☑	☐
Spent CIP water connection to owner utility	☐	☑
Option: Ducting design	☐	☑
VFD cabinets	☑	☐
Electrical Wiring & Installation		
Cables between Centriair system components (max 10 meters)	☑	☐
Fieldbus connection to the main control panels	☐	☑
Electrical feed to Centriair Control Cabinets	☐	☑
Ducting		
Connection between Centriair components	☑	☐
Connections beyond Centriair components	☐	☑
Foundation		
Structural reinforcements	☐	☑
Water Supply	☐	☑
Drain	☐	☑

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Project delivery Scope of Scandinavian Centriair System (Sup = Supplier, Pur = Purchaser	Centriair Scope	
Transportation	Included	Excluded
Transportation FCA, as specified in quote	☑	☐
Off-loading from incoming transport and storage on site.	☐	☑
Import tarrifs and customs duties - Not applicable	☐	☑
Installation		
Electricity, heating and light supplies during installation	☐	☑
Lifting gear with operator for the installation of the system.	☐	☑
Storage on site prior to installation	☐	☑
Local certification of our engineers to perform works on site - Not applicable	☐	☑
Other items		
ATEX Classification	☐	☑
All local permits, certification for installation team - Not applicable	☐	☑
Bank Guarantee costs	☐	☑
Travel & accommodation costs for work	☑	☐
Odour measurements	☐	☑
Additional items not specified in the proposal	☐	☑

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Appendix B: Standard documentation

Document
P&ID
Instrument list
Valve List
Motor List
Cause and effect matrix (Loop List and Interlocks)
Technical specifications (Fan etc)
Interface list
Instrument Equipment Specification (datasheets)
General arrangement drawing (PDF)
Footprint and load and inteface Drawing
Spare part List
Circuit diagrams
Power consumption list
Cabin Arrangement drawings
Signal list (Alarms etc)
Declaration of conformity
Operation and Maintenance documentation
Take over protocol (Signed with ev punches)

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Appendix C: Standard Communication & Signal Interface

Doc. Type List
Doc. Name Fielbus communication

Centriair					Client			
Siemens					**XXX**			
s7-1200					XX-xxxx			
Modbus TCP server				RD=READ	Modbus TCP client			
192.168.24.11/24				WR=WRITE				
				Modbus TCP				
Address	**Type**	**Function**	**comment.**	**Signal**	**Type**	**Function**	**comment.**
1.0	Bit	System ready	1=OK	--> RD	Bit	System ready	1=OK
1.1	Bit	System running	1= running	--> RD	Bit	System running	1= running
1.2	Bit	RemoteControl	1= remote active	--> RD	Bit	RemoteControl	1= remote active
1.3	Bit	Reset alarm	pos edge	<-- WR	Bit	Reset alarm	1=reset
1.4	Bit	Start	pos edge	<-- WR	Bit	Start	1=start
1.5	Bit	Stop	pos edge	<-- WR	Bit	Stop	1=stop
1.6	Bit	com watchdog	Set bit	<-->RD/WR	Bit	com watchdog	reset bit
1.7	Bit	A-alarm active	0=OK	--> RD	Bit	A-alarm active	0=OK
1.8	Bit	B-alarm active	0=OK	--> RD	Bit	B-alarm active	0=OK
1.9	Bit			SPARE			
1.10	Bit			SPARE			
1.11	Bit			SPARE			
1.12	Bit			SPARE			
1.13	Bit			SPARE			
1.14	Bit			SPARE			
1.15	Bit			SPARE			
2	WORD	spare1	Project specific	--> RD	WORD	spare1	Project specific
3	WORD	spare2	Project specific	--> RD	WORD	spare2	Project specific
4	WORD	spare3	Project specific	--> RD	WORD	spare3	Project specific
5	WORD	spare4	Project specific	--> RD	WORD	spare4	Project specific
6	WORD	spare5	Project specific	--> RD	WORD	spare5	Project specific
7	WORD	spare6	Project specific	--> RD	WORD	spare6	Project specific
8	WORD	spare7	Project specific	--> RD	WORD	spare7	Project specific

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Appendix D: Feedstock plan

Culture_Corn_Silage	**12 080**	16
Culture_Rye_Silage	**13 750**	18
Animal dejections_Chicken_Manure	**7 500**	10
Animal dejections_Cattle_Manure	**4 000**	6
Animal dejections_Pig_Manure	**5 100**	7
Fruit & Vegetable & derivatives _Potato_Vegetable	**6 000**	8
Animal dejections_Cattle_Slurry	**5 000**	7
Animal dejections_Horse_Manure	**4 000**	5
Fruit & Vegetable & derivatives _Sugar Beet_PulpMash	**0**	
Bakery waste__Bread	**0**	
Cereale & processed Crops _Rapeseed_Presscake	**0**	
Dairy waste__Whey_diluted	**1500**	2
Dairy waste__Whey_concentrated	**6000**	8
Fruit & Vegetable & derivatives _Mixed Vegetable_Vegetable	**3000**	4
Culture residues & Green Waste_Sugar beet_Pulpmash_pressed		
	67 930	91

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Appendix E: Overall consumption

The information about the consumption is conservative.

Water consumption UV reactor

The CIP from the UV reactors: (2)*22 l/day = 44 l/day

Consumables ColdOx system & Sulphared

Maintenance work	Quantity	Type	Interval (months)	TOTAL GBP	Total per year GBP
Carbon Filter					
Change of carbon	10 000	[kg]	~ 18-24	35 200	17 600
UV lamps					
Replacement of lamps	200	[pcs]	~ 24	13 200	6 600
Sulphared					
Change of Sulphared	1 500	[kg]	~ 12-18	3 900	2 600

** Please note that the carbon & Sulphared life time is only an estimate, calculated based on previous experience.*

Water consumption Packed NH3 Scrubber

The water consumption assuming 13 470 m3/h @ 100 ppm NH3 24 hours each day drift hours. 10% blowdown concentration.

NH3 Scrubber: 38 L/hour + Evap. losses

Consumables Packed NH3 Scrubber

The sulphuric acid consumption assuming 13 470 m3/h @ 100 ppm NH3 24 hours each day drift hours. 96% acid concentration.

Type	l/h			
96% Acid	1,67			

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