Odour management plan

August 2022

EA

Bio Dynamic (UK) Ltd
Colwick Anaerobic Digestion Facility
Private Road No. 4
Colwick Industrial Estate
Nottingham
NG4 2JT

Revisions

This is a version controlled document. All changes are to be detailed below and a new version issued after changes are made.

Version control			
Version no.	**Date**	**Author**	**Comments on amendments**
01	24/07/2014	Robert Apaya	Initial version
02	17/12/2014	Robert Apaya	Revised after feedback from EA to update: 2.4 Site layout; Figure 4 – updated 2.5 Process summary Liquid waste handling; Rejected plastic packaging handling De-packaging & pre-treatment line details; Digestate handling 2.6 Process diagram; Figure 5 – updated 3 Inventory of odorous materials; Table 3 – updated; Table 4 – added 4 Odour risk assessment; Table 5 & Table 6 – updated 5.2 Routine maintenance and inspection 5.3 Management of odorous materials Pre-acceptance assessment; Waste acceptance Waste rejection; Digestate; Biogas 5.4 Containment of odorous materials Waste reception building 5.5 Abatement of odorous emissions Waste reception building Figure 6 & Figure 7 – added CHP unit
03	12/02/2015	Robert Apaya	5.6 Monitoring of odorous emissions SCADA system monitoring – added Digester sampling - added Figure 8, Figure 9 & Figure 10 – added 6.2 Highly odorous material 6.5 Maintenance of the air extraction system 6.6 Maintenance/failure of the odour abatement system 6.7 Foaming in the digester tanks – added 6.9 Power failure 7.5 On-site odour sniff test locations; Figure 11 – updated 8.1 Monitoring: Off-site odour sniff tests 8.2 Monitoring: Odour complaint form
04	09/10/2015	Robert Apaya	Figure 4 – updated SOP BIO013 – name changed; SOP BIO017, SOP BIO023 added OPS renumbered
05	27/01/2016	Robert Apaya	Revisions to text to reflect pre-treatment & de-packaging process changes on site Figures 4, 5, 8, 9, 11 – updated; Tables 2, 4 – updated
06	24/03/2016	Robert Apaya	Plastics baler added Figures 4, 5 – updated; Tables 2, 4 – updated SOP BIO027 added
07	26/05/2016	Robert Apaya	Rejected plastics processing updated Figure 4 – updated; Tables 2, 3, 4, 5 – updated
08	27/02/2017	Robert Apaya	SOP BIO005, BIO007, BIO018 & BIO027 renamed; SOP BIO035, BIO036, BIO037 added OPS BIO003 renamed; OPS BIO008 added
09	29/08/2017	Robert Apaya	Review after EA CAR005 SOP BIO001, BIO004 & BIO005 – updated OPS BIO005 – updated; OPS BIO030 added
10	05/02/2018	Robert Apaya	Review after 170920-001 Buffer tank accident Figure 1, Figure 4, Figure 8, Figure 9, Figure 11, Table 2 – updated EOP replacements: SOP BIO007 renamed EOP BIO002; SOP BIO010 renamed EOP BIO006; SOP BIO022 renamed EOP BIO008 & BIO009 OPS BIO032, EA BIO009, SOP BIO040, BIO041, BIO042- BIO046; OPS BON001 - added EOP BIO002, BIO003, BIO004, EOP BIO005 – added T&D BIO002, BIO005, BIO006 – added OPS BIO027; SOP BIO036 – removed Waste Coordinator – added Power failure replaced by Main services failure 2.5 Process summary – updated with Table 2
11	01/07/2019	Robert Apaya	Review after variation EPR/DP3935ER/V005 Figures 1, 4, 5, & & 11 – updated Table 3 – updated SOP BIO051 - added

12	31/08/22	Jo Chapman	Review and update to reflect changes at the site resulting from refurbishment and to support permit variation application.

Contents

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1 Introduction

1.1 Background

The Colwick Anaerobic Digestion facility has been designed and built by Bio Dynamic (UK) Ltd to provide an environmentally favourable alternative to the disposal of food waste in landfill. Up to 150,000 tonnes per year of food waste from local commercial sources (waste food originating from restaurants, catering facilities and commercial kitchens) is treated at the facility by harnessing anaerobic digestion (AD); the biochemical process by which naturally-occurring bacteria breakdown the organic matter in food waste in the absence of oxygen to produce biomethane (a source of renewable energy) and digestate (a nutrient-rich organic fertiliser).

The AD facility is designed to process odorous organic waste material so there is a potential for odour emissions to be generated during day-to-day operations, or as a result of unplanned events.

1.2 Scope

The purpose of this Odour management plan (OMP) is to identify all activities on site which could potentially generate odour emissions during normal day-to-day operations and to prepare for odour emissions caused by abnormal events or incidents. The OMP is intended to assess the risk of odour emissions from those activities or events, and to detail the appropriate operational, monitoring and contingency measures in use to ensure that those risks are controlled and minimised as far as is practicable.

The OMP forms part of the set of site management documents required by the environmental permit for the operation of the Colwick AD facility granted by the Environment Agency. In addition, the measures detailed within the OMP serve to discharge planning condition 14 of the AD facility's planning permission granted by Nottinghamshire County Council.

This document was originally written with reference to the Environment Agency's guidance documents *'H4 Odour Management Horizontal Guidance'*, March 2011; *'How to comply with your environmental permit'* version 6.0, June 2013 and '*How to comply with your environmental permit. Additional guidance for: Anaerobic Digestion*' version 1.0, November 2013. Updates have been made with reference to guidance available on www.gov.uk.

1.3 Review

The OMP is reviewed annually and updated, if required. Additional reviews may take place in response to planned changes in operational practices or in response to unplanned incidents on site.

2 Site information

2.1 Site location

The Bio Dynamic (UK) Ltd Colwick AD facility is located at:

Private Road No 4
Colwick Industrial Estate
Nottingham
NG4 2JT

National Grid reference SK 63429 39829

The AD facility sits on a plot measuring approximately 1.38 hectares located on a historic landfill; there are several other historic landfill sites within 500m of the site and a registered landfill site in operation at Trent Concrete, Private Road No 3, Colwick Industrial Estate for disposal of their own factory wastes approximately 500m north-west of the site.

The plot is bordered by a railway line to the north and east, an area of scrubland to the south-east and industrial units to the west and north-west which house other waste operations. The site and its surroundings are shown in Figure 1.

Figure 1 Site location: The Colwick AD facility and neighbouring premises. (1) Bio Dynamic (UK) AD Facility, (2) Netherfield Lagoons, (3) Canal & River Trust, (4) Merlin Environmental Ltd, (5) Enva England Ltd, (6) Tiger European (UK) Ltd, (7) Aggregate Industries UK Ltd, (8) NG4 Car Services Mechanik Nottingham, (9) Nottingham Powdercoating Ltd, (10) Enva England Ltd

2.2 Sensitive receptors

The immediate neighbours to the south-west and north-west of the site are a dry waste processing operation. Within 250m of the site there are a number of other industrial units to the north-west and west; the River Trent lies to the south (separated from the site by an area of scrubland); the Netherfield Lagoons Local Nature Reserve lies to the east (separated from the site by the railway tracks). The locations of other odour-sensitive receptors up to 1 km from the Colwick AD facility locations that may experience loss of amenity or nuisance are shown in Figure 2 and listed in Table 1.

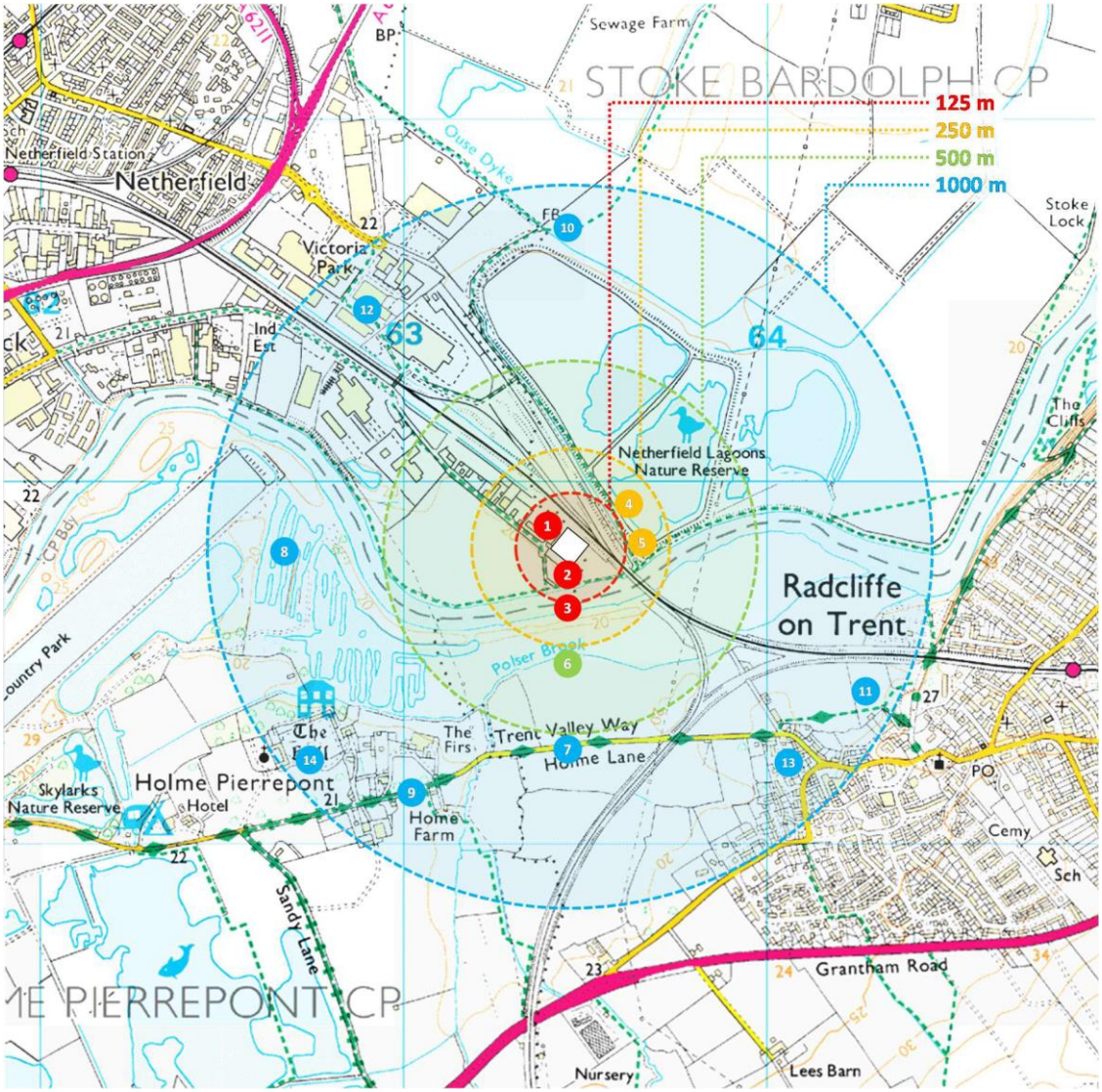


Figure 2 Odour-sensitive receptors up to 1 km from the Colwick AD facility (see Table 1 for receptor details)

RECEPTOR	DESCRIPTION	RECEPTOR SENSITIVITY	DISTANCE FROM SITE BOUNDARY	BEARING FROM SITE
1	Commercial premises: Colwick Industrial Estate	Medium	up to 1km	North west
2	Footpath: north bank of River Trent	Low	35m	South
3	River Trent	Low	50m	South
4	Netherfield Lagoons Local Nature Reserve	Low	125m to 1km	North east
5	Footpath: west boundary Netherfield Lagoons Local Nature Reserve	Low	130m	North east
6	Polser Brook	Low	230m	South
7	Trent Valley Way	Low	475m	South
8	Holme Pierrepont National Watersports Centre & Country Park	Medium	600m	West
9	Residential properties: Holme Lane, Holme Pierrepont	High	660m	South west
10	Footpath, Ouse Dyke	Low	800m	North
11	Wharf Lane Recreation Ground Radcliffe on Trent	Medium	800m	South east
12	Commercial premises: Victoria Retail Park	Medium	800m	North west
13	Residential properties: The Green & Main Road, Radcliff on Trent	High	810m	South east
14	Hotel: Holme Pierrepont Hall, Holme Pierrepont	High	900m	South west

Table 1 Odour-sensitive receptors up to 1km from the Colwick AD facility (see Figure 2 for receptor locations)

2.3 Wind direction

Data taken from the Elmdon Weather Station (the closest weather station with publically-available data) shows the wind is a prevailing south-westerly (see Figure 3). As a result, prevailing winds would carry potential odour emissions to the north-east of the site, away from residential properties and commercial premises, in the direction of the Netherfield Lagoons Local Nature Reserve.

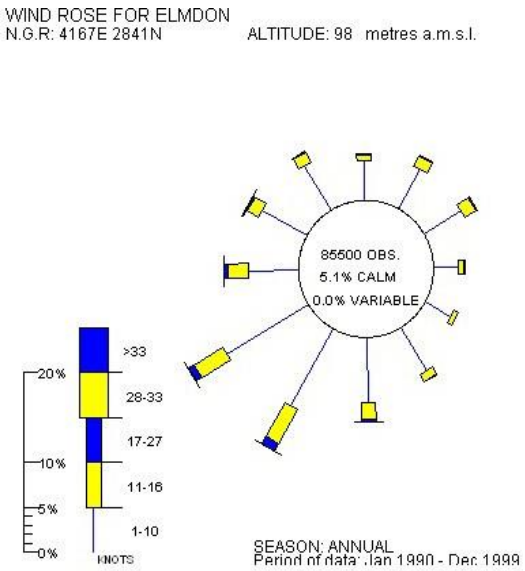


Figure 3 Wind rose data for Elmdon Weather Station, for the period Jan 1990-Dec 1999

2.4 Site layout

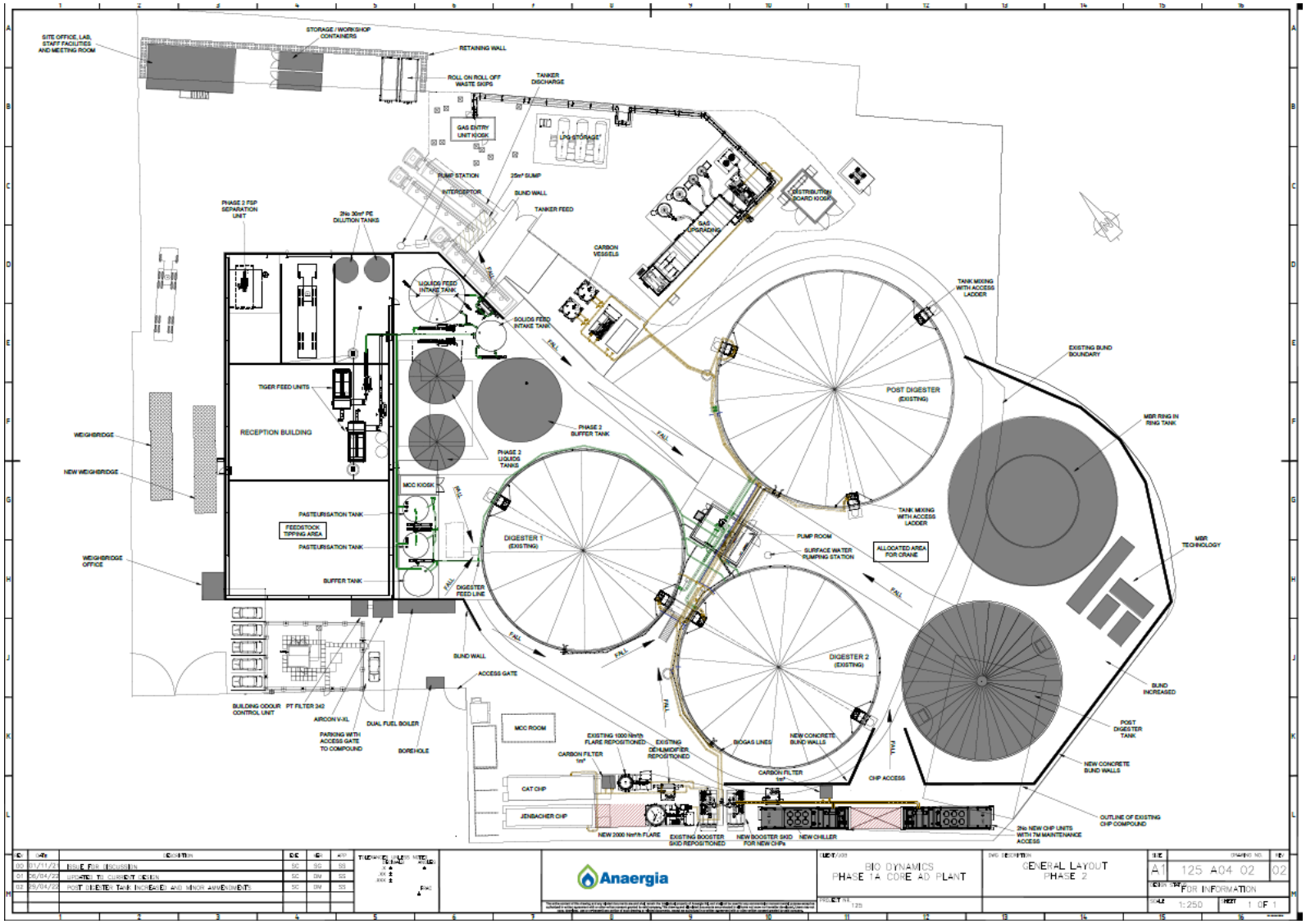


Figure 4 Site layout: The major structural components of the Colwick AD facility (HC1677-06d) (grey items are phase 2 proposed infrastructure not yet installed).

2.5 Process summary

PROCESS STEP	TITLE	DESCRIPTION
A	Waste import	Waste transfer information is checked and delivered solid waste material is tipped inside the waste reception building, inspected for compliance with the facility's specification and added to the waste stockpile. Liquid waste is pumped directly into the liquid waste reception tanks.
B	Waste de-packaging & pre-treatment	Delivered solid waste is de-packaged, shredded and diluted with water, liquid waste or wash down water/leachate, if necessary. The particle size of the mixture is reduced to 12mm or less by passing through a screen. The organic waste mixture is pre-heated in the pre-pasteurisation tank.
B1	Waste export	A proportion of the depackaged mixed waste is exported from site for use as a feedstock at other AD plants.
C	Pasteurisation & post-pasteurisation	Fresh waste is heated to above 70 °C for a minimum of 1 hour in 10m^3 tank. Samples of pasteurised waste material are taken for microbiology testing to ensure pathogen destruction. Pasteurised waste cools in the buffer tanks.
D	Anaerobic digestion	Pasteurised waste is pumped to the digesters where it is processed in a two step process consisting of two primary digesters, and one secondary digester. It is held and for approximately 28days; biogas is collected in gas domes on top of these tanks.
E	Storage – CAT 3 digestate	Digested material is stored in digester tank 3, before being tankered off site for use as an agricultural biofertiliser. Samples of digestate are taken for microbiology testing before export to ensure no recontamination has occurred during storage.
F	*Digestate separation**	*A vertical screen press separates the solid digestate residue from the liquid fraction. (* Not currently taking place)*
F1	*Digestate treatment by MBR**	*The digestate is treated via an MBR technology system in a dedicated MBR treatment tank, and final effluent arising from the process discharged to surface water* *(* Not currently taking place)*
G	Biogas, electricity & heat	Biogas is used to generate renewable heat and electricity in four CHP engines. The heat is used to maintain the temperature of the pasteurisation tanks & the digester tanks (the pre-pasteurisation tank is heated using steam from an external boiler). The electricity generated is used to power the AD facility & the surplus exported to the national grid. Biogas is also exported for upgrading to biomethane at an adjacent facility
H	Export	Rejected plastics from the Tiger Cesaro de-packaging machines are collected in a skip & exported for recycling or disposal at a suitably-licensed facility. Digestate is tankered off site by a specialist contractor for use on land as an agricultural fertilizer.

Table 2 Summary of the process steps for waste ABP material at the Colwick AD facility

2.6 Process diagram

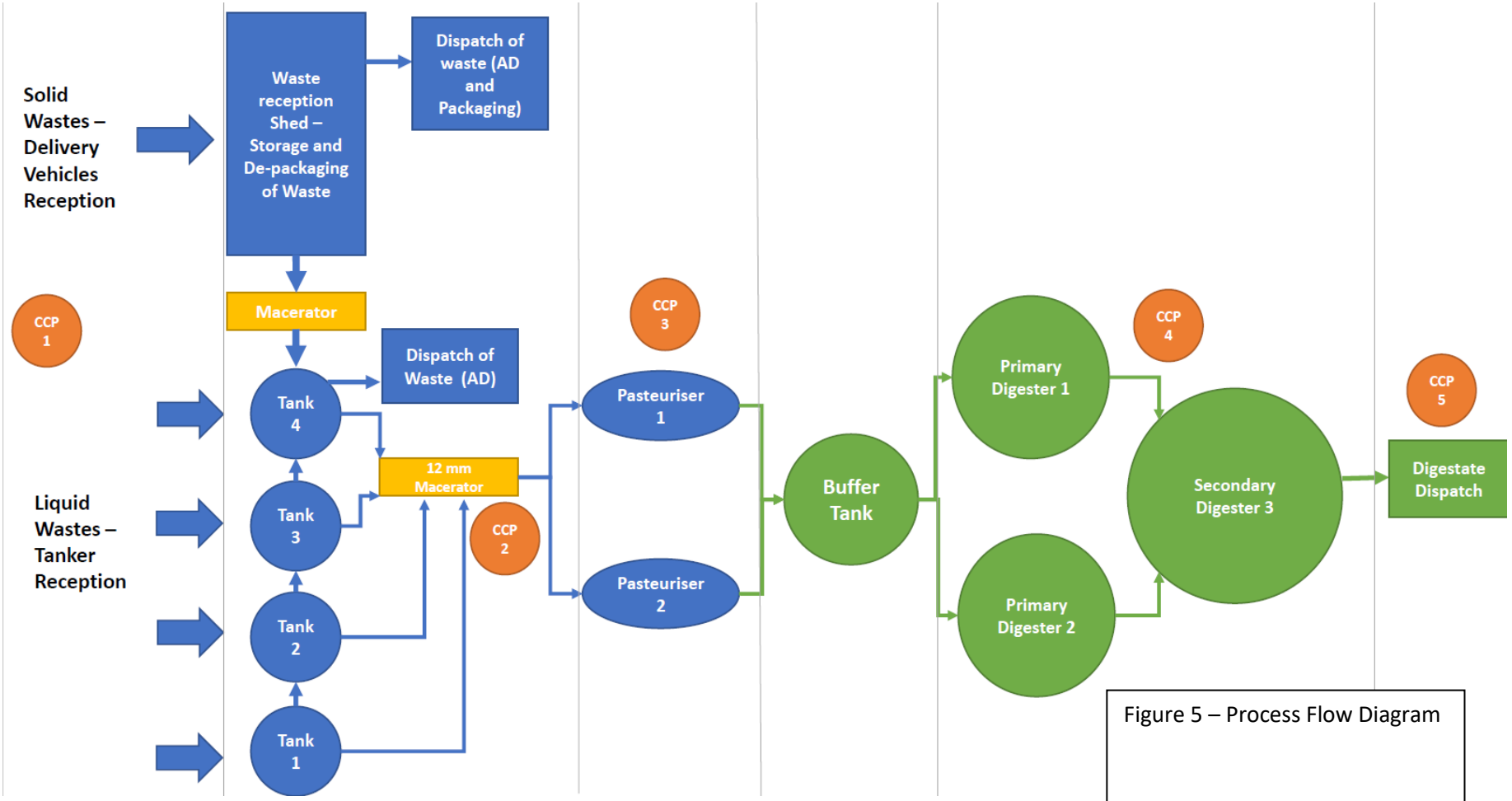


Figure 5 – Process Flow Diagram

3 Inventory of odorous materials

During normal operations the sources of odorous materials at the AD facility relate to the reception, handling and processing of the incoming fresh waste material and the storage, handling and export of the products of the digested waste; biogas and digestate. The design of the AD facility coupled with routine operational control measures are capable of managing emissions from these materials as far as is practicable.

Odorous materials, the quantities routinely held within the AD facility and measures used to manage these quantities are detailed in Table 3. Measures used to reduce, contain and treat odour emissions from these odorous materials as far as is practicable are further discussed in Table 5 and section 5.

Additional sources of odorous materials may arise during exceptional operations such as the failure of control measures or operational processes and/or equipment breakdown. These odorous materials, the quantities which are likely to be held within the AD facility and measures used to manage these quantities are detailed in Table 4. Measures used to reduce, contain and treat odour emissions from these odorous materials as far as is practicable are further discussed in Table 6 and section 6.

3.1 Inventory of odorous materials during routine operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
PROCESS STEP A: WASTE IMPORT					
Site access road & weighbridge	Food waste; delivered	Fresh food waste	Unpleasant	2885 tonnes/week average Mon to Sat deliveries	• Pre-acceptance & arrival procedure (*SOP BIO001, SOP BIO002*) to specify customer waste management prior to delivery to reduce odour potential of waste & to exclude highly odorous wastes • Waste delivered & weighed/recorded to avoid exceeding operational capacity & minimise volume of odorous material on site
Waste reception building	Solid food waste; delivered	Fresh food waste	Unpleasant	2885 tonnes/week maximum Mon to Sat deliveries	• Waste delivered & weighed/recorded to avoid exceeding operational capacity & minimise volume of odorous material on site • Waste is delivered directly into the waste reception building in a pile distinct from existing stockpiles & is inspected during & after delivery (*SOP BIO003*) • Highly odorous material is quarantined & rejected (*SOP BIO004*)
	Solid food waste; stockpiled	Fresh food waste	Unpleasant	400 tonnes maximum storage capacity for solid material in shed	• Stockpile visually monitored by Site Manager • Waste is routinely processed as soon as possible after delivery to minimise volumes of odorous material on site • All wastes processed within 24 hours of delivery
External liquid waste reception tanks	Liquid waste; Stored and displaced air vented from tanks	Fresh food waste	Unpleasant	c. 1500m^3 storage capacity across a number of tanks Mon to Sat deliveries	• Volume monitored by Site Manager using SCADA system • Waste is pumped directly from tankers via a sealed coupling into theenclosed liquid waste reception tank (*SOP BIO012*)

Table 3 (page 1 of 4) Inventory of odorous materials during routine operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
PROCESS STEP B: WASTE DE-PACKAGING & PRE-TREATMENT, B1 WASTE EXPORT					
Waste reception building	Solid food waste; handled & shredded	Fresh food waste	Unpleasant	Average 400tpd	• Waste is routinely processed as soon as possible after delivery to minimise volumes of odorous material on site • All waste processed within 24 hours of delivery
	Wash down water/leachate	Fresh food waste	Mildly unpleasant	c. 4m^3 storage capacity	• Waste water /leachate drains directly into self-contained drainage system & underground storage sumps from waste reception building floor • Waste water/leachate is regularly recirculated into the process to dilute solid waste material preventing build up/stagnation & reducing odour potential
	Rejected waste packaging	Fresh food waste	Mildly unpleasant	Dependent on wastes accepted. 1 skip in storage area for storage of packaging at any one time.	• Primary packaging waste is typically washed clean of >97 % organic material as part of the de-packaging process & therefore has a low odour potential; Unacceptable/acceptable levels of food waste remnants on rejected plastic packaging identified during processing (*SOP BIO027*) • Primary plastic packaging waste is stored for export inside the waste reception building; secondary/tertiary packaging is stored in the dedicated area away from the waste stockpile • Packaging waste is removed as needed, or at least weekly (*SOP BIO011, SOP BIO027*) [* *assuming an average of 10% packaging for delivered solid food waste*]
	Waste Export	Fresh food waste/displaced air from tankers removing wastes	Unpleasant	Average of 55 tonnes a day of depackaged waste exported to third party sites via tanker for processing.	• Depackaged liquid wastes exported from site for use as feedstock at third party sites.

Table 3 (page 2 of 4) Inventory of odorous materials during routine operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
PROCESS STEP C: PASTEURISATION & POST-PASTEURISATION					
External Pasteurisation tanks (x2)	Food waste slurry/displaced air from units on filling/when processing waste	Fresh food waste	Unpleasant	50m³/hour average Continuous processes	• Volume monitored by Site Manager using SCADA system • Processed food waste slurry stored in enclosed pasteurisation tanks 1 & 2 and pumped in sealed pipework directly into buffer tank.
Buffer tank/s	Food waste slurry; displaced air from tank on filling	Food waste	Unpleasant	188m³ Phase 2 tank 1000m3 storage	• Volume monitored by Site Manager using SCADA system • Pasteurised food waste cools in enclosed buffer tank and pumped directly into digester tanks1 & 2 via sealed pipework
PROCESS STEPS D & E: ANAEROBIC DIGESTION & STORAGE – DIGESTATE					
Digester tanks 1, 2 and 3	Digestate	Ammonia, Sulphides	Mildly unpleasant	c. 13,000m³ storage across all three tanks	• Volume monitored by Site Manager using SCADA system • Processed/digesting food waste stored in enclosed tanks & moved in sealed pipework • AD process within digester tanks sampled and monitored to maintain stable conditions & reduce odour potential (*SOP BIO040*, *OPS BON001*)
PROCESS STEP G: BIOGAS, ELECTRICITY & HEAT					
Digester tanks 1, 2 and 3 – Gas domes	Biogas	Sulphides	Unpleasant	c. 8000m³ storage maximum	• Volume monitored by Site Manager using SCADA system • Biogas analyser triggers automatic air injection in response to unstable anaerobic conditions to reduce H_2S generation at source • Biogas collected in gas-tight tanks & drawn into CHP engines for combustion of odorous compounds or exported to adjacent biogas upgrading facility for upgrading to biomethane.
Biogas pipelines	Biogas condensate	Ammonia based odours	Unpleasant	variable	• Condensate collected in dedicated sealed collection system and passed back into the process.

PROCESS STEP H: EXPORT					
Digestate discharge area	Digestate/displaced air from vacuum tankers	Ammonia, Sulphides	Mildly unpleasant	44m³ per tanker maximum	• Volume monitored by Site Manager using SCADA system • AD process within digester tanks sampled and monitored to maintain stable conditions & reduce odour potential (*SOP BIO040*, *OPS BON001*) • Digestate is pumped directly from storage tanks via a sealed coupling into tankers (*SOP BIO021*) • Odour abatement unit to be installed

Table 3 Inventory of odorous materials during routine AD process operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
GENERAL OPERATIONS					
Rainwater harvesting tanks/borehole water tanks	Rainwater	Earthy	Mildly unpleasant	120m^3 storage across all tanks	• Surface water drainage directed to a sealed storage tank • Regular, frequent recirculation into de-packaging & pre-treatment process prevents build up/stagnation & minimises volume of odorous material on site
Red diesel tank	Red diesel	Diesel	Mildly unpleasant	c. 1.36m^3 storage	• Storage tank inside waste reception building
Cesspit	Sewage/foul water	Domestic sewage	Unpleasant	C. 10m3 storage	• Sealed, buried tank • Regularly emptied by specialist contractor

Table 3 Inventory of odorous materials during general operations

3.2 Inventory of odorous materials during exceptional operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
PROCESS STEP A: WASTE IMPORT					
Waste reception building	Highly odorous food waste; quarantined	Deteriorating food waste;	Very unpleasant	400 tonnes/day storage maximum 24 hours maximum	• Pre-acceptance procedure (*SOP BIO001*) to specify customer waste management prior to delivery to reduce odour potential of waste & to exclude highly odorous wastes • Waste is delivered directly into the waste reception building in a pile distinct from existing stockpiles & is inspected during & after delivery (*SOP BIO003*) • Highly odorous material is quarantined & rejected (*SOP BIO004*) within 24 hours • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4
	Solid food waste; stockpiled due to equipment/ operational failure	Fresh food waste; ammonia	Unpleasant	400 tonnes/day storage maximum 24 hours maximum	• Stockpile visually monitored by Site Manager • Waste deliveries to be diverted to another facility until fault is repaired • Stockpiled waste to be exported to another disposal facility if fault cannot be repaired within 24 hours (*EOP BIO006*, *EOP BIO009*) • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002*, *OPS BIO004* & *SOP BIO017*) • Critical spares kept on site for key items of plant & equipment (*OPS BIO032*) • Daily/weekly checks of plant & equipment (*SOP BIO023*) • Maintenance contract in place with on-site servicing/repairs within 12 hours • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4

Table 4 (page 1 of 2) Inventory of odorous materials during exceptional operations

LOCATION	ODOROUS MATERIAL	ODOUR DESCRIPTION	HEDONIC TONE	QUANTITY	INVENTORY MANAGEMENT & CONTROL MEASURES
PROCESS STEP B: WASTE DE-PACKAGING & PRE-TREATMENT					
Waste reception building	Contaminated rejected plastic packaging; stockpiled due to equipment/ operational failure	Deteriorating food waste; sulphides	Very unpleasant	1 skip in reception area for storage of packaging material	• Unacceptable/acceptable levels of food waste remnants on rejected plastic packaging identified during processing; unacceptably contaminated plastic packaging to be re-processed (*SOP BIO027*) Rejected plastic packaging which cannot be re-processed after 24 hours (due to quality controlfailure or equipment failure) to be sent for disposal before it becomes highly odorous
Liquid waste reception tanks	Macerated food waste; unprocessed due to equipment/ operational failure	Deteriorating food waste; sulphides	Very unpleasant	c. 1500m^3 storage capacity across a number of tanks	• Hydrogen sulphide inhibitor added to waste at depackaging stage and pumped forwards into process to decrease H_2S levels in tanks (*EOP BIO004*) • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002*, *OPS BIO004* & *SOP BIO017*) • Critical spares kept on site for key items of plant & equipment (*OPS BIO032*) • Daily/weekly checks of plant & equipment (*SOP BIO023*) • Maintenance contract in place with on-site servicing/repairs within 12 hours • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4
PROCESS STEPS D & E: ANAEROBIC DIGESTION & STORAGE – DIGESTATE					
Digester tanks 1, 2 and 3	Digestate; stockpiled due to export freeze	Ammonia, Sulphides	Mildly unpleasant	c. 13,000m^3 storage across all three tanks	• Volume monitored by Site Manager using SCADA system • Processed/digesting food waste stored in enclosed tanks & moved in sealed pipework • Digestate which cannot be exported (due to quality control failure or lack of available deployments) is sent for incineration using "fluidised bed combustion" designed for wet materials • Digestate is pumped directly from storage tanks via a sealed coupling into tankers (*SOP BIO021*)

Table 4 (page 2 of 2) Inventory of odorous materials during exceptional operations

4 Odour risk assessment

Odours can arise from routine operations in which odorous materials are handled, from the failure of operational processes and/or equipment or as a result of other abnormal events. The odour risk assessment takes each of these circumstances into account as part of an on-going process. It is reviewed and updated, if required, in response to changes in operational practices which impact on odorous emissions or materials.

Odour emissions may be fugitive emissions, point source emissions or accidental/emergency emissions. The risks from point source emissions and fugitive emissions from routine operations are controlled and mitigated by the general operational and maintenance measures identified in Table 5 and discussed on page 27.

An increased risk of emergency/accidental emissions and additional fugitive emissions may be caused by failure of control measures, failure to follow standard operating procedures, equipment failure, or accidents or during maintenance periods. The odorous emissions which could result as a consequence and the actions to taken in response are detailed in Table 6 and on page 41.

4.1 Odour risk assessment – Routine operations

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Waste delivery to site: Fugitive release of odours	Commercial premises: Neighbouring/On route	Air	• All delivery vehicles fully enclosed to minimise fugitive release of odour • Waste carriers to ensure vehicles are properly enclosed during delivery • Pre-acceptance & arrival procedure (*SOP BIO001, SOP BIO002*) to specify customer waste management prior to delivery to reduce odour potential of waste & to exclude highly odorous wastes	Unlikely 2	Negligible 1	Low 2
Waste reception/stockpiling: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Waste is delivered directly into the enclosed waste reception building • Unloading only occurs when the vehicle is fully inside the building & the vehicle door has automatically closed • Waste routinely processed as soon as possible after delivery • All wastes processed within 24 hours of delivery or diverted to another suitable facility (*EOP BIO006*, *EOP BIO009*) • Primary packaging waste is typically washed clean of >97 % organic material, exported as needed, or at least weekly (*SOP BIO011, SOP BIO027*) • Waste reception building maintained under negative pressure to avoid odour escaping • Waste reception building air is extracted continuously & discharged to air via odour control system. • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4 • Site Manager responsible for ensuring SOPs are implemented effectively	Unlikely 2	Significant 2	Moderate 4
Waste reception (liquids): Fugitive release of odours	Commercial premises: Neighbouring	Air	• Waste is pumped directly from tankers via a sealed coupling to liquid waste reception tanks • Displaced air from tank filling is passed through a carbon filtration system to abate odours • Dedicated below ground collection sump for small spillages • Any spillages cleaned up immediately after tanker has departed (*SOP BIO012, EOP BIO003*) • Site Manager responsible for ensuring SOPs are implemented effectively	Highly unlikely 1	Significant 2	Low 2

Table 5 (page 1 of 3) Odour risk assessment, management and control measures during routine operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Wash down water/leachate: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Wash down water/leachate drains directly into self-contained drainage system & underground storage sump from waste reception building floor • Waste water/leachate is regularly recirculated into the process to dilute solid waste material preventing build up/stagnation & reducing odour potential • Waste reception building maintained under negative pressure to avoid odour escaping • Waste reception building air is extracted continuously & discharged to air via odour control system.	Unlikely 2	Negligible 1	Low 2
Waste handling/processing: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Waste handling & processing occurs in the enclosed waste reception building • Vehicle door only open for vehicle entry/exit; closes automatically • Personnel doors have self-closing hinges • Waste routinely processed as soon as possible after delivery • All wastes processed within 24 hours of delivery or diverted to another suitable facility (*EOP BIO006*, *EOP BIO009*) • Processed food waste stored in enclosed tanks & moved in sealed pipework • Waste reception building maintained under negative pressure to avoid odour escaping • Waste reception building air is extracted continuously & discharged to air via two-stage odour control system, supplemented by forced ventilation • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4 • Site Manager responsible for ensuring SOPs are implemented effectively	Unlikely 2	Significant 2	Moderate 4
Pasteurised food waste: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Displaced air from pasteurisers is passed through an odour abatement unit prior to discharge to atmosphere	Highly unlikely 1	Significant 2	Low 2
Digestate storage on site: Fugitive release of odours	Commercial premises: Neighbouring	Air	• All pipework, tanks & vessels constructed from materials fit for purpose • All pipework, tanks, vessels & bunds are inspected & maintained weekly (*OPS BIO002*) • Daily sniff tests carried out in the vicinity of the digester tanks to monitor potential fugitive odour release (*EA BIO005*) • LDAR in place across site to detect and repair small gas leaks from	Highly unlikely 1	Serious 3	Moderate 3

Table 5 (page 2 of 3) Odour risk assessment, management and control measures during routine operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

			pipework and plant • Site Manager responsible for ensuring SOPs are implemented effectively			

Table 5 (page 3 of 3) Odour risk assessment, management and control measures during routine operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Biogas storage on site: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Biogas analyser triggers automatic air injection in response to unstable anaerobic conditions in digesters to reduce H_2S generation atsource • Digesters designed with a twin-skinned upper membrane to be gas-tight to maintain anaerobic conditions • Daily sniff tests carried out in the vicinity of the digesters to monitor potential fugitive odour release (*EA BIO005*) • Waste deliveries to be diverted to another facility until fault is repaired • LDAR in place across site to detect and repair small gas leaks from pipework and plant • Flare operations available for controlled burn of excess biogas if needed.	Highly unlikely 1	Serious 3	Moderate 3
CHP exhaust stacks: Odorous emissions	Commercial premises: Neighbouring/On route	Air	• CHP engines operated/regularly maintained according to manufacturer's instructions (*OPS BIO002*, *OPS BIO006*, *OPS BIO007* & *SOP BIO024*, *SOP BIO025*) • Ensure efficient combustion conditions to decompose odorous biogas components & reduce potential for creation of odorous substances • CHP engines' management systems constantly monitor performance • Site Manager responsible for ensuring SOPs are implemented effectively	Highly unlikely 1	Negligible 1	Very low 1
Digestate and waste export from site:Fugitive release of odours	Commercial premises: Neighbouring/On route	Air	• All tankers fully sealed to minimise fugitive release of odour • Digestate is pumped directly from final digester via a sealed coupling into tankers on hard standing (*SOP BIO021, SOP BIO033*) • Any spillages cleaned up immediately after tanker departure (*SOP BIO005, EOP BIO003*) • Displaced air from vacuum tankers passed through a carbon filter prior to release to atmosphere to abate odours. • Site Manager responsible for ensuring SOPs are implemented effectively	Unlikely 2	Negligible 1	Low 2
Rainwater harvesting/storage: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Surface water drainage directed to a sealed storage tank • Regular, frequent recirculation into de-packaging & pre-treatment process prevents build up/stagnation & reduces odour potential	Highly unlikely 1	Negligible 1	Very low 1

Table 5 (page 3 of 3) Odour risk assessment, management and control measures during routine operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

4.2 Odour risk assessment – Exceptional operations

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Failure of vehicle access door closure	Commercial premises: Neighbouring	Air	• Vehicle door to be closed manually as specified in equipment manual • Waste to be diverted to another facility until fault is repaired (*EOP BIO009*)	Highly unlikely 1	Significant 2	Low 2
Failure of equipment (de-packaging/pre-treatment/processing)	Commercial premises: Neighbouring	Air	• Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002*, *SOP BIO023, SOP BIO037*) • Critical spares kept on site for key items of plant & equipment (*OPS BIO032*) • Regular visual checks of plant & equipment (*OPS BIO004* & *SOP BIO023*) • Maintenance contract in place with on-site servicing/repairs within 12 hours • Waste deliveries to be diverted to another facility until fault is repaired • Stockpiled waste to be exported to another disposal facility if fault cannot be repaired within 24 hours (*EOP BIO006*, *EOP BIO009*) • Waste handling & processing occurs in the enclosed waste reception building • Waste reception building maintained under negative pressure to avoid odour escaping • Waste reception building air is extracted continuously & discharged to air via odour control system. • Ferric hydroxide added to feedstock and pumped forwards intopre-pasteurisation tank to decrease H_2S levels in tanks (*EOP BIO004*)	Highly unlikely 1	Significant 2	Low 2
Failure of waste reception building odour control units	Commercial premises: Neighbouring	Air	• Waste is routinely processed as soon as possible after delivery to minimise volumes of odorous material on site • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002* & *SOP BIO013*) • Regular visual checks of plant & equipment (*OPS BIO005* & *SOP BIO013*) • Maintenance contract in place with on-site servicing/repairs within 12 hours • Two carbon filters at the site, one serving the main reception shed and one the liquid waste tanks so there is the facility to maintain operations for part of operations if one unit is inoperable. • Waste deliveries to be diverted to another facility until fault is repaired • Stockpiled waste to be exported to another disposal facility if fault cannot be repaired within 24 hours (*EOP BIO006*, *EOP BIO009*) • Increased frequency of odour monitoring during failure to assess impact	Highly unlikely 1	Significant 2	Low 2

Table 6 (page 1 of 4) Odour risk assessment, management and control measures during exceptional operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Quarantined waste: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Quarantined waste is isolated & stored temporarily in the designated area in the enclosed waste reception building (*SOP BIO003* & *SOP BIO004*) • Quarantined waste is rejected & exported to an alternative suitable disposal facility as soon as possible, or within 24 hours of delivery • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4 • Waste reception building maintained under negative pressure to avoid odour escaping • Waste reception building air is extracted continuously & discharged to air via odour control system. • Site Manager responsible for ensuring SOPs are implemented effectively	Highly unlikely 1	Serious 3	Moderate 3
Contaminated rejected plastic packaging; equipment/operational failure	Commercial premises: Neighbouring	Air	• Unacceptable/acceptable levels of food waste remnants on rejected plastic packaging identified during processing; unacceptably contaminated plastic packaging to be re-processed (*SOP BIO027*) • Rejected plastic packaging which cannot be re-processed after 24 hours (due to quality control failure or equipment failure) to be sent for disposal before it becomes highly odorous • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002* & *OPS BIO004*) • Fixed gas detector continuously monitors for NH_3, CO, H_2S & CH_4	Unlikely 2	Negligible 1	Low 2

Table 6 (page 2 of 4) Odour risk assessment, management and control measures during exceptional operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Foaming in digester tanks: Fugitive release of odours	Commercial premises: Neighbouring	Air	• Daily sampling & monitoring to control digester performance & minimise factors that amplify foaming & respond to changing digester tank conditions (*SOP BIO040*) • Consistent organic loading rate maintained • Consistent material movement to maintain material volume allowing 500mm freeboard capacity to reduce potential for foam to block gas collection pipes/pressure relief valves • Circulating pumps & heaters fully mix the material distributing fresh waste material & anaerobic breakdown products evenly to prevent stagnation, scum layer formation & entrainment of biogas bubbles • Daily visual inspection for foam formation on the surface of the material using viewing ports in digester tanks (*SOP BIO017*) • Exceptional operating procedure in case of foaming event (*EOP BIO005*)	Unlikely 2	Serious 3	High 6
Failure of gas seals (digester tanks): Fugitive release of odours	Commercial premises: Neighbouring	Air	• All pipework, tanks & vessels constructed from materials fit for purpose • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002* & *SOP BIO017*) • Regular visual checks of plant & equipment (*OPS BIO003*, *SOP BIO017 & SOP BIO035*) • Digester tanks designed with a twin-skinned upper to be gas-tight to maintain anaerobic conditions • Waste to be diverted to another facility until fault is repaired (*EOP BIO009*) • Increased frequency of odour monitoring during failure to assess impact • Site Manager responsible for ensuring SOPs are implemented effectively • LDAR carried out at the site regularly to detect and repair small leaks from joins and seals.	Highly unlikely 1	Serious 3	Moderate 3
Digester tanks pressure release valves	Commercial premises: Neighbouring	Air	• Pressure relief valves operate during emergency only • Requires biogas pressure 4 times normal & failure of all other safeguards • LDAR carried out at the site regularly to detect and repair small leaks from joins and seals. • Proactive maintenance and monitoring of PRV operation and seating.	Highly unlikely 1	Serious 3	Moderate 3

Table 6 (page 3 of 4) Odour risk assessment, management and control measures during exceptional operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

HAZARD	RECEPTOR	PATHWAY	RISK MANAGEMENT & CONTROL MEASURES	PROBABILITY (of odour exposure)	SEVERITY (of odour exposure)	OVERALL RISK (after controls)
Emergency gas flare stacks	Commercial premises: Neighbouring	Air	• Biogas diverted to emergency gas flare during maintenance/emergency only • High temperature combustion (1000 °C for 0.3 seconds) effectively destroys odorous compounds in biogas • Plant & equipment operated/regularly maintained according to manufacturer's instructions (*OPS BIO002* & *OPS BIO007*) • Sufficient capacity from flares to manage all gas produced at the site if required	Highly unlikely 1	Negligible 1	Very low 1
Mains services failure (Power)	Commercial premises: Neighbouring	Air	• Vehicle door to be closed manually as specified in equipment manual (*EOP BIO006*) • All items of plant & equipment default to safe mode; all pumps shut down • SCADA system server automatically switches to an uninterruptable power supply (lasting approximately 1 hour) allowing for data back-up & controlled system shut down • Pressure relief valves operate when biogas pressure 4 times normal & failure of all other safeguards • Waste deliveries to be diverted to another facility if fault cannot be repaired within 12 hours • Stockpiled waste to be exported to another disposal facility if fault cannot be repaired within 24 hours (*EOP BIO006*, *EOP BIO009*)	Highly unlikely 1	Significant 2	Low 2

Table 6 (page 4 of 4) Odour risk assessment, management and control measures during exceptional operations.
Probability (1 = Highly unlikely; 2 = Unlikely; 3 = Likely); Severity (1= Negligible; 2 = Significant; 3 = Serious); Overall risk (after controls) = probability x severity

5 Procedures for managing operational odours

5.1 Standard operating procedures

Operational procedures on site are run according to a set of standard operating procedures (SOPs). The Site Manager and Site Operatives are fully trained on the requirements of the OMP; SOPs relating to specific tasks on site also reiterate odour control measures where they are relevant. All records of employee training are held in the Weighbridge Office (see *T&D BIO002: Training register – Internal* and *T&D BIO005: Training record – Standard operating procedures*).

5.2 Routine maintenance & inspection

Preventative maintenance plan

A preventative maintenance and visual inspection system forms part of routine operations on site (see *OPS BIO002: Preventative maintenance plan*). This includes regular plant and equipment maintenance as required by manufacturers (monthly, quarterly and annually); additional visual inspections of other key items of plant and equipment for signs of damage or failure are made as part of daily and weekly inspections of site infrastructure. Procedures are in place for maintenance and inspection of vehicles, all pre-treatment and de-packaging line equipment, the buffer and storage tanks, the digester tanks, all bunds, the control and power systems, and the CHP engines (see *SOP BIO017: Digester tanks – Visual checks & maintenance*, *SOP BIO023: Waste reception building - Visual checks & maintenance*, *SOP BIO024: Control room - Visual checks & maintenance*, *SOP BIO025: Power island - Visual checks & maintenance*, *SOP BIO037: De- packager & shredder – Visual checks & maintenance, SOP BIO042: Digester tanks – De-gritting, SOP BIO043: Gas detection system - Visual checks & maintenance, SOP BIO044: Vehicles - Visual checks & maintenance* and *SOP BIO046: Pipework – Visual checks & maintenance*).

Maintenance records

In addition to the service contracts for maintenance of plant and equipment by external contractors site records are also be kept of the maintenance carried out on all major items of equipment. Checklists are used when inspections have been carried out and the results of these inspections and any actions taken are recorded (see *OPS BIO004: Waste reception building – Weekly visual checks*, *OPS BIO006: Control room – Weekly visual checks*, *OPS BIO007: Power island – Weekly visual checks* and *OPS BIO008: De-packager & shredder Weekly visual checks*). Records are also kept to ensure that supplies of key spare parts and consumables are available (in particular drive belts, bearings, seals and wear parts for the Tiger Cesaro and the attritor) – see *OPS BIO032: Critical spares list*).

5.3 Management of odorous materials

Poor management of the quantity and quality of odorous materials on site can increase their potential for odorous emissions. Controls exist on the volume and condition of these materials from before their arrival on site and throughout their on-site processing.

Pre-acceptance assessment

Pre-acceptance arrangements for waste deliveries are detailed in *SOP BIO001: Pre-acceptance waste assessment.* Waste material arriving at the Colwick AD facility is covered by waste supply contracts pre-arranged between Bio Dynamic (UK) and the waste supplier directly or through specialist waste brokers.

Only waste types on the list of permitted wastes in the environmental permit (EPR/DP3935ER Schedule 2, table S2.2) and included in the ABP approval for the site, or non-ABP are considered by the Colwick AD facility.

Information on potential new waste streams is gathered using the form *OPS BIO020: Waste pre-acceptance information*, including the nature of the waste material, the conditions under which the waste has been stored prior to delivery and the quantity, and frequency of the proposed deliveries. For atypical waste material a representative sample of the waste is collected for pre-acceptance checks in order to analyse and characterise the material. All proposed waste streams are assigned a unique reference number identifying the waste producer, the location the waste originates from, the EWC code and ABP category of the waste, the physical state of the waste, the waste carrier and the waste broker (if applicable).

The information provided is assessed by the Site Manager. The decision whether ultimately to accept or reject the material is taken by the Site Manager and is recorded in every case (see *OPS BIO019: Waste suppliers register*). The pre-acceptance arrangements ensure that only waste streams suitable for treatment by anaerobic digestion arrive at the facility at times when there is adequate capacity to accept and treat the waste without causing undue issues, particularly in regard to odour.

Waste acceptance

The AD facility typically accepts deliveries of food waste material during Monday to Friday 06.00 to 16.00 (under certain circumstances some deliveries may be accepted on Saturday). All waste deliveries are transported to the AD facility using licenced waste carriers. All waste vehicles entering or leaving the AD facility are fully enclosed; solid organic waste is transported in dedicated, enclosed waste collection and delivery vehicles; liquid waste is delivered in sealed tankers. The quantity of all incoming waste is recorded using a weighbridge.

The procedure following the arrival of waste deliveries at the AD facility is detailed in the standard operating procedure *SOP BIO002: Importing waste.* All waste deliveries must be accompanied by the correct documentation from the supplier and waste carrier and must be accurately described by the appropriate EWC code and ABP category. The waste transfer information accompanying each delivery is checked by the Waste Coordinator who transfers the key information from the waste producer's waste transfer document onto a standard electronic form *OPS BIO025: Waste in – Delivery information*. Waste deliveries with incomplete or incorrect waste transfer information, or waste deliveries which are not pre-registered are automatically rejected and cannot be processed further by the Waste Coordinator. Completed *OPS BIO025* forms are printed and signed by the Waste Coordinator and the vehicle driver as a record of the delivery.

Waste handling

The procedures followed during and after the delivery of waste at the site are detailed in *SOP BIO003: Handling solid waste deliveries, SOP BIO004: Rejecting & quarantining waste deliveries* and *SOP BIO012: Handling liquid waste deliveries*. A Site Operative is assigned responsibility for monitoring each delivery.

Waste deliveries vehicles are brought directly into the waste reception building. A high speed vehicle door equipped with an automatic door sensor in the northern gable end of the building provides access

and egress exclusively for waste delivery vehicles. Waste material is only unloaded once the vehicle is fully inside the waste reception building and the vehicle door has automatically closed.

Liquid waste is delivered by tankers which enter the waste site and couple up directly into the liquid waste reception tanks. Deliveries are made from on an impermeable concrete surface external to the building.

Solid waste delivery vehicles drive forwards into the building and reverse into the waste reception bay under the supervision of a trained banksman. The waste reception bay is fully enclosed within the building and can comfortably hold one day's worth of solid waste material.

Housekeeping measures in the waste reception building are in place to maintain cleanliness and to help manage potential sources of odour. Before exiting the waste reception building waste vehicles park in the vehicle wash down area in front of the vehicle access door where the wheels and undercarriage are washed down and disinfected, in accordance with standard operating procedure *SOP BIO005: Cleaning & inspecting waste vehicles* to prevent odorous materials being accidentally transferred outside. The de-packaging and pre-treatment equipment and concrete floor of the waste reception building are cleaned daily to remove any debris (see *SOP BIO006: Cleaning & inspecting plant & equipment* and *OPS BIO001: Daily cleaning & inspections*). Wash down water collected in the waste reception building sump is regularly added to the treatment process. Any spillages outside of the stockpile area are cleaned up immediately.

Under normal operating conditions waste is processed as soon as possible after delivery; all wastes are processed within 24 hours of delivery. If waste cannot be routinely processed within 24 hours it is exported to other AD facilities for use

Waste rejection

The circumstances for rejecting waste are detailed in *SOP BIO004: Rejecting & quarantining waste deliveries*. Waste may be rejected before delivery if it is accompanied by incorrect and/or incomplete waste transfer documents, or if the delivered waste stream has not been through the pre-acceptance checks.

During or after delivery, partial or complete waste deliveries must be quarantined if the supervising Site Operative and the Site Manager identify them as highly odorous and/or in an advanced state of deterioration or unacceptably contaminated with contrary material, and therefore unsuitable for processing. The Site Manager is authorised to reject the entire load, or just the contraries/highly odorous wastes and waste in the area surrounding if they can safely be removed by hand. The removal of contraries by hand is permitted only where they can safely be removed without presenting a health and safety risk to the Site Operative; where they present no risk to animal health; where they have not caused chemical or biological contamination of the remaining waste; or where they do not constitute unacceptable levels of contamination as defined in the contract with the waste carrier or the waste supplier. If contraries can be successfully removed under these circumstances the load will not be rejected.

Contaminated loads or contraries/highly odorous wastes and the waste surrounding them must be moved to the correct rejected loads container or the dedicated quarantine area until arrangements can be made for collection and disposal at a suitably licensed facility. All equipment and surfaces contaminated by

contraries/highly odorous wastes must be thoroughly cleaned before further use, in accordance *with SOP BIO006: Cleaning & inspecting plant & equipment*.

The removal by hand of ABP category 1 or 2 waste is not permitted under any circumstances; if category 1 or 2 contraries are present at any point the entire load must be quarantined and rejected and the vehicle driver must be issued with written notification of the requirement to steam clean and/or disinfect the vehicle before it is used for further loads (see *OPS BIO026: Rejected delivery notification*). The Environment Agency and the Animal & Plant Health Agency must be informed immediately. Any equipment and surfaces contaminated by category 1 or 2 ABP material must be cleaned in accordance with exceptional operating procedure *EOP BIO002: Cleaning & disinfection after handling ABP category 1 or 2 material* after the load has been removed from the waste reception building, with the approval of the regulators. If the regulators require the quarantined rejected waste to remain on site for longer than 48 hours, the stockpiled waste is monitored automatically for the risk of rising levels of ammonia by the fixed gas detector installed in the waste reception building. If an alarm is triggered at any point the building must be evacuated in accordance with *EOP BIO004: Hazardous gases*.

The Site Manager must investigate to determine how and why the non-permitted waste was not identified and rejected before delivery and make any necessary changes to standard operating procedures.

Rejected loads are documented in each case (*OPS BIO023: Rejected deliveries register*) and the waste carrier and/or waste supplier is notified (see *OPS BIO026: Rejected delivery notification*).

Waste storage

All solid waste material is brought directly into and unloaded inside the waste reception building; the solid waste reception bay is fully enclosed within the building and is able to hold one day's worth of solid wastematerial. Liquid waste material is pumped directly into the liquid waste reception tanks located in the external tank farm. Displaced air from these tanks on filling is passed through a carbon filter to abate emissions prior to release to atmosphere.

Storage of waste on site is temporary and minimised as far as possible. Under normal operating conditions waste is processed as soon as possible after delivery; all wastes are processed within 24 hours of delivery. The Site Manager is responsible for monitoring stockpile capacity and process throughput. If waste cannot be routinely processed within 24 hours due to capacity issues it will be exported; in the event of equipment failure orother exceptional operational conditions preventing processing within the 24 hour limit, scheduled deliveries will be diverted, and stockpiled material will be exported to third party sites for use as an AD feedstock in other APHA approved and permitted facilities.

Material removed during the de-packaging and pre-treatment process (segregated secondary and tertiary packaging, rejected primary plastic packaging and ferrous metal objects) may be temporarily stored in the waste reception building in labelled, dedicated containers/areas for up to one week before export for recycling or disposal at another facility. Primary plastic packaging waste is stockpiled inside the waste reception building in a dedicated skip for export for recycling or disposal at another facility. During the de-packaging process the rejected plastics are visually assessed for remnants of food waste; any plastic packaging contaminated with unacceptable levels of food waste is re-processed (see *SOP BIO027: Plastics*). Secondary and tertiary packaging is stored in the dedicated area/skip in the waste reception building away from the waste stockpile. Only secondary and/or tertiary packaging whichhas not been in contact with animal by-products is collected for recycling.

Digestate

All material movements after the pasteurisation step are controlled and monitored by the AD facility's SCADA system. The digestion process is monitored as the organic material breaks down during approximately 28 days to ensure the resulting digestate is stable with low odour potential. The digestate is regularly exported from the AD facility by direct transfer to tankers using a specialist contractor (see *SOP BIO021: Exporting digestate*). The digestate is sent for land spreading for use as an agricultural fertilizer. The operator is a certified producer of quality digestate according to the PAS110 standard.

Digestate is sampled for chemical and physical contaminants as part of the application for a new deployment, including the percentage of plastics. Digestate which is not suitable for land spreading due to contaminants will be exported to the SecAnim Ltd which uses "fluidised bed combustion" to incinerate fluids and wetter-than-normal material like digestate.

Biogas

Hydrogen sulphide generation is reduced at source using microbial- desulphurisation, in which very small quantities of air are injected via a non-return valve into the biogas collected above the digestate surface. By adding small, controlled amounts of oxygen to the digesters microbes can be used to oxidise hydrogen sulphide generated during digestion. Desulphurisation netting is installed within the digester tanks to increase the surface area on which the microbes can live.

This technique is used as an alternative to hydrogen sulphide scrubbers and can reduce hydrogen sulphide concentrations by up to 80%. The biogas analyser monitors and records the concentrations of methane, carbon dioxide, oxygen and hydrogen sulphide in the biogas as it is drawn from the digesters. Air injection is triggered automatically by low levels of methane or high levels of hydrogen sulphide which can indicate unstable anaerobic conditions within the digesters. The operator also has the facility to dose waste feedstocks with ferric hydroxide which is a further mechanism for managing H_2S levels in biogas.

5.4 Containment and treatment of odorous materials

Waste reception building

The waste reception building is a steel-framed structure measuring 48m x 23m x 11.36m high (to the roof apex). The lower parts of the walls are constructed from concrete; the upper walls and roof are covered with steel-cladding. The building is comprised of eight sections along its length; each section can be repaired or replaced individually if required. The walls are continuous going to the concrete floor with no gaps.

The concrete floor of the waste reception building has an internal sealed drainage collection system. Leachate and wash waters generated in this area drain to low point collection sumps. The liquid collected in the sumps is pumped back into the onsite process and subject to full treatment in the AD process.

A high-speed vehicle door equipped with an automatic door sensor in the northern gable end of the building provides access and egress exclusively for waste delivery vehicles. Waste material is only unloaded onto the waste reception bay once the vehicle is fully inside the waste reception building and the vehicle door has automatically closed. The waste reception area is fully enclosed within the building.

There are three personnel doors allowing access to the waste reception building; two in the southern end of the building and one in the north eastern corner of the building allowing employees access to welfare facilities. Foot dips are in use at all personnel access points to prevent transfer of waste material outside the building. All personnel doors have self-closing hinges.

The waste reception building's air management system maintains the building under negative pressure in order to contain odorous air. Air is extracted via an internal extraction system which achieves 3 air changes per hour to the operational area to prevent the build-up of odours and gases; the system is also designed to allow for a higher number of air changes within the building where there is possibility of higher or more acute odour release. Air from within the building is discharged via a carbon filter odour abatement unit.

Once the waste material enters the pasteurisation step of the pre-treatment process it remains contained in sealed tanks and pipework. All material movements from this point onwards are via pumps and valves

controlled and monitored by the SCADA system. Individual items of plant and equipment also have local, manual overrides and emergency stop buttons.

Digester tanks

Each digester is topped with a twin- skinned upper membrane with an internal supporting framework forming the domes where biogas is collected at the top of the tanks. A rubber sealing ring creates an air-tight seal where the dome membrane joins the tank walls and prevents fugitive biogas emissions. Abatement of odorous emissions. The digesters are fitted with under/over pressure relief valves which will vent biogas in emergency situations.

Waste reception building

Air extracted from the waste reception building is drawn away from the vehicle access door and the area of highest potential odour, the solid waste reception stockpile, an extraction fan. The extracted air is drawn through an odour abatement units located alongside an external wall of the waste reception building before being vented to atmosphere.

The abatement unit is an Aircon H adsorption filter which contains activated carbon media through which air is passed prior to release. The unit is fitted with a sampling point to allow sampling and monitoring of activated carbon to determine when the media is spent and in need of changing. The unit is subject to ongoing proactive maintenance and monitoring to ensure optimum performance at all times.

Tank Farm

The external liquid waste reception tanks, buffer tanks and pasteurisation units all have the potential to create impacts by venting of displaced air to atmosphere on filling. All the current tanks (and intended phase 2 tanks) will vent via a carbon filter unit to abate air prior to release to atmosphere.

The abatement unit is an Aircon V adsorption filter which contains activated carbon media through which air is passed prior to release. The unit is fitted with a sampling point to allow sampling and monitoring of activated carbon to determine when the media is spent and in need of changing. The unit is subject to ongoing proactive maintenance and monitoring to ensure optimum performance at all times.

Digestate/Waste offtake Point

Air released to atmosphere from vacuum tankers filling with digestate/waste for export from the site have the potential to create odours. Vacuum tankers will couple up to carbon filter unit when loading with digestate or waste and displaced air from tankers will be passed through this filter to abate emissions prior to release to atmosphere.

CHP engines

The biogas is passed through a gas drier to remove moisture from the biogas before the CHP engines. Removal of water from the biogas helps to optimise the combustion process in the engine, prevents condensation and helps protect the engine from the acid. The incoming biogas is cooled, allowing the moisture and particulates to be removed, and then re-heated and re-pressurised before being drawn into the engines. It is possible to not only remove the water vapour by this method, but to also reduce components such as residual hydrogen sulphide, helping to improve the gas quality. The condensate collected is recirculated to digesters. The CHP engines' exhaust gases are released to atmosphere via the engine exhaust stacks.

There is little potential for odorous emissions from the exhaust stacks of the CHP engines due to the high combustion temperature, which effectively destroys odorous compounds in the biogas. Emissions from the CHP engines are monitored and reported as required by the environmental permit.

5.5 Monitoring of odorous materials

SCADA system monitoring

Processes after de-packaging and pre-treatment are monitored and controlled via a dedicated SCADA (Supervisory Control and Data Acquisition) system, which uses programmable logic controllers (PLCs) connected to sensors and equipment in the system (the Tiger Cesaro de-packager and shredder is controlled from its local PLC). A range of process data is sent to the SCADA system which issues control commands in response to these data. The data are also presented to employees on the SCADA system's human machine interface (HMI) screens, allowing them to monitor and control the process. The SCADA system continually operates the facility including running pre-treatment line equipment, the pasteurisation process, opening/closing valves and starting/stopping pumps for material movements and monitoring process conditions within the digester tanks.

The SCADA system server is located in the Weighbridge Office. The system runs with WinCC software, a PC-based operator control and monitoring networked system which is linked to the main SCADA HMI control screen housed in the Weighbridge Office. Access to make operational changes can only be made using the HMIs with appropriate secure login details.

The system warns the operator of any abnormal readings or situations; any deviations beyond set operational limits for measured parameters will raise an automatic alarm. Alarms are displayed on the Weighbridge Office HMI screen and are configured so that operators must acknowledge them.

A number of key operational devices monitored by the SCADA system are also linked to audio/visual alarms in the event that employees are not in front of the HMI screen. Klaxons with flashing lights are located in the waste reception building, outside the control room and outside the employee welfare facilities. The SCADA system HMI identifies the abnormal readings or situation; employees must acknowledge the alarm and take the necessary actions detailed in *SOP BIO045: SCADA system*.

Additional alarms triggered which are not monitored by the SCADA system are also signalled locally via lights and sirens on the equipment itself. The CHP engines' engine management systems constantly monitor their own performance. Any fault will trigger a shutdown sequence (for example, a drop in gas pressure will cause the engines to stop). A flashing external alarm light which is clearly visible on site will alert employees to any faults. The gas engines (CHP 2) are also monitored online by themanufacturers' operations and maintenance support who will respond to any alarms triggered.

Digester sampling

Anaerobic digestion of the food waste depends on the interplay between bacteria which produce acids, bacteria which degrade acids and archaea which produced methane. The breakdown of the organic matter within the digester tanks occurs in four steps: hydrolysis, acidogenesis, acetogenesis and methanogenesis.

In the initial hydrolysis step complex organic molecules found in food waste such as proteins, fats and carbohydrates are broken down into simpler organic molecules such as amino acids, fatty acids, and sugars.

In the second step, acidogenesis, bacteria convert the hydrolytic products of the first step into short chain volatile fatty acids (VFAs), ketones, alcohols, ammonia, hydrogen and carbon dioxide. The primary products of the acidogenesis step are the VFAs including formic acid, acetic acid, propanoic acid, butanoic acid and pentanoic acid. Accumulation of these VFAs creates an acidic environment in the digester tank. Hydrogen, carbon dioxide and some acetic acid generated during the acidogenic step are used directly by methanogenic bacteria in the final step of the anaerobic digestion process.

In the third step, acetogenesis, the remaining products of the acidogenic step, the VFAs, ketones and alcohols are converted into hydrogen, carbon dioxide and acetic acid.

In the final step, methanogenesis, the products of the acetogenic step (and some of the intermediate products from the hydrolytic and acidogenic steps) are converted into methane and carbon dioxide. Some carbon dioxide and hydrogen can also be converted into methane and water.

Figure 6 Schematic of the AD process steps; (1) hydrolysis (2) acidogenesis (3) acetogenesis (4) methanogenesis

Characterising and managing feedstock is the first step in controlling conditions within the digester (see *SOP BIO001: Pre-acceptance waste assessment*). For example, protein-rich feedstock is broken down during the anaerobic digestion process producing ammonium nitrogen. Over-use of protein-rich feedstock could cause a build-up of ammonium nitrogen which, in its free form, inhibits anaerobic bacteria.

On-site laboratory equipment also allows daily measurements of the performance of the digesters to ensure conditions remain optimal and odour potential is managed, although not all inhibitory factors are easily monitored.

The level of hydrogen within a digester is a good indicator of the stability of the anaerobic digestion process. The conversion of propionate to acetate during the acetogenic step is only energetically achievable at a low hydrogen partial pressure; this is achieved when the hydrogen-producing bacteria and the methanogenic archaea which consume hydrogen are balanced, which indicates a stable digester tank environment. However, the low partial pressure of hydrogen involved means that it is difficult to measure.

Alternatively, as intermediate breakdown products of the anaerobic digestions process odorous VFAs concentrations of the order of hundreds of mg/l can be expected in a stable digester tank. The time-dependent accumulation of VFAs produced by acidogenic bacteria indicates how the biology within the digester tank is developing and is relatively straightforward to measure.

In a stable digester the effect of the VFAs is countered by the action of methanogenic archaea, which ultimately convert VFAs into carbon dioxide and methane. Acidogenic bacteria grow at a faster rate than methanogenic archaea. An uneven or sudden increase in the organic loading rate, or an organic loading rate which is consistently too high can lead to a sudden increase in VFAs; under such conditions the acidogenic bacteria (which can tolerate a wide pH range of 4.5 to 8.5) rapidly convert the fresh waste material into VFAs before the population of methanogenic archaea (which thrive within a narrower pH range of 6.6 to 7.2) can increase and convert the VFAs into carbon dioxide and methane. This build-up of VFAs lowers the pH to a level toxic to methanogenic archaea, and so inhibits the production of biogas.

A change in pH is therefore an indication that conditions within the digester tank have already destabilised. The alkalinity or buffering capacity of the digester is a measure of its ability to resist changes in pH (a measure of the concentration of hydrogen ions in a solution) by absorbing excess hydrogen ions

so that the pH does not drop and inhibit the process. Bicarbonate ions are the major source of buffering capacity which maintain the digesters' pH in the range suitable for methanogenic archaea. The concentration of bicarbonate ions in the solution phase is related to the production of carbon dioxide by methanogenic archaea; although most of it moves into the gas phase, it is relatively water-soluble.

The FOS/TAC ratio measures the accumulation of VFAs in the sample (expressed as the concentration of acetic acid) relative to the buffering capacity or alkalinity (expressed as the equivalent concentration of calcium carbonate). In a well-buffered system, the buffering substances bind and release excess hydrogen ions without a major impact on the pH. In an unstable digester the accumulation of VFAs overcomes the buffering capacity within the tank, and the pH drops to a level toxic to methanogenic archaea.

Monitoring the FOS/TAC ratio within the tanks can be used to moderate the organic loading rate, in order to control the residual VFA concentration and, by extension, the pH (see *SOP BIO040: Sampling digestate for FOS-TAC ratio analysis* and *OPS BIO030: FOS-TAC ratio - Sampling & analysis results*). Additional sample measurements include the pH, percentage dry matter, ammonia, CO_2 and H_2S. Supplemental biological monitoring is provided by wider specialist biological support within the Anaergia service portfolio. Foaming detection is a combination of these measurements and visual inspection through the tank windows (see section 6.7).

6 Procedures for managing exceptional odours

Emergency/accidental emissions and additional fugitive emissions may be caused by failure of control measures, failure to follow standard operating procedures, equipment failure, or accidents or other operational incidents.

6.1 Exceptional operating procedures

A set of exceptional operating procedures (EOPs) are used to establish how to respond in the event of an accident or incident and form part of *EA BIO003: Accident management plan*; the Site Manager and Site Operatives are fully trained on the requirements of the both the OMP and AMP. EOPs relating to incidents where odour may be a factor reiterate odour control measures where they are relevant. All records of employee training are held in the Weighbridge Office (see *T&D BIO002: Training register – Internal* and *T&D BIO006: Training record – Exceptional operating procedures*).

6.2 Highly odorous material

Highly odorous waste material delivered to the AD facility is isolated and quarantined in the waste reception building in accordance with *SOP BIO003: Handling solid waste deliveries* and *SOP BIO004: Rejecting & quarantining waste deliveries*. The owner of the waste would be contacted to investigate whether pre-acceptance conditions regarding the storage and transport of waste have been followed, and would be invited to inspect the waste. The waste would be rejected and exported to an alternative suitable disposal facility as soon as possible, or within 24 hours of delivery. Rejected loads, the reasons for rejection and the actions taken are recorded (see *OPS BIO023: Rejected deliveries register, OPS BIO026: Rejected delivery notification*).

6.3 Quarantined waste

If the regulators require quarantined rejected waste to remain on site for longer than 48 hours, the stockpiled waste is monitored automatically for the risk of rising levels of ammonia by the fixed gas detector installed in the waste reception building. Ammonia is a colourless gas with a characteristic pungent smell. It occurs naturally at low levels throughout the environment, released from the natural breakdown of organic waste matter. Microbial action degrades proteins breaks them down into amino acids, which then undergo deamination to release nitrogen, typically in the form of ammonia (NH_3). Ammonia gas does not remain in the environment for long; it rapidly reacts to form ammonium compounds. Although exposure to ammonia from the environment is not considered to pose a risk to human health, local concentrations of ammonia may be higher where a lot of waste is stockpiled in an enclosed space for an extended period.

Ammonia is an irritant and irritation increases with concentration. Breathing in low levels of ammonia may cause irritation to the eyes nose and throat. High levels of ammonia may cause burns, swelling in the airways, lung damage and can be fatal.

If an alarm is triggered at any point the building must be evacuated in accordance with *EOP BIO004: Hazardous gases*.

6.4 Maintenance/failure of de-packaging & pre-treatment equipment

De-packaging and pre-treatment line equipment undergoes daily inspections before operations begin (see *OPS BIO001: Daily cleaning & inspections*) and regular planned maintenance in accordance with manufacturer's instructions (see *SOP BIO023: Waste reception building – Visual checks & maintenance*, *SOP BIO037: De-packager & shredder – Visual checks & maintenance, OPS BIO004: Waste reception building – Weekly visual checks, OPS BIO008: De-packager Weekly visual checks* and

OPS BIO002: Preventative maintenance plan – Waste reception building). In the event of a major failure of plant or equipment, maintenance contracts are in place which provide on-site servicing and repairs within 12 hours. Waste deliveries would be diverted to another facility until any faults are repaired. If faults cannot be repaired within 24 hours then stockpiled material will be exported under a reciprocal agreement with another AD facility (see *EOP BIO006: Main services failure, EOP BIO009: Exporting waste - Exceptional operations*, *OPS BIO022: Exporting & importing waste - Exceptional operations* and *EA*. Routine waste acceptance and processing will not recommence until any faults have be rectified.

For some items of equipment such as the Tiger Cesaro, critical spare parts are maintained on site in order to minimise the need to divert waste in the event of an equipment failure (see *OPS BIO032: Critical spares list*).

6.5 Maintenance/failure of air extraction system

The air extraction system consists of fans that can be easily seen and visually monitored in the course of daily activities. The condition of the fans is visually inspected daily. Maintenance contracts are in place which provide on-site servicing and repairs within 12 hours. During this time de-packaging and pre-treatment operations would be suspended to reduce the odour potential within the building. If necessary, waste deliveries would be to be diverted to another facility until the fault is repaired.

6.6 Maintenance/failure of the odour control system

There are two units at the site, one serving the reception shed, and the other serving the liquid waste tanks. It is unlikely that both units will fail at the same time, and in the eventuality of downtime of one of the units, the operator will maintain operations at the AD facility using infrastructure associated with the unaffected unit. If the reception shed unit is unavailable, then the shed doors will remain close to contain odours within the building and deliveries of liquid material will be prioritized. Maintenance contracts are in place which provide on-site servicing and repairs within 12 hours. During this time de-packaging and pre-treatment operations would be suspended to reduce the odour potential within the building. If necessary, waste deliveries would be to be diverted to another facility until the fault is repaired.

In the unlikely event that both units failed, waste deliveries would be to be diverted to another facility until the fault is repaired. If the faults cannot be fixed within 24 hours then stockpiled material will be exported to another AD facility.

6.7 Foaming in digester tanks

Inconsistent or excessive organic loading the digesters can lead to incomplete digestion of food waste by the microorganisms within digesters, destabilising the anaerobic conditions within the tanks which results

in the accumulation of volatile fatty acids. Excessive organic loading causes an increase in the numbers of acidogenic bacteria (which convert the fresh waste material into VFAs) which is outmatched by the growth in the numbers of methanogenic archaea (which ultimately convert the VFAs into CH_4 and CO_2) leading to a build-up of VFAs within the digester. These VFAs and a surplus of hydrophobic compounds in the fresh food waste act as surfactants or foaming agents, which combine with biogas bubbles produced in the digesters and are likely to instigate and contribute to the development excessive foam within the tanks.

Excessive foaming can cause several problems within the tanks including; clogged mixing pumps, creating temperature fluctuations and stagnant regions with no active digestion of fresh waste material; blocked gas collection pipework reducing the efficiency of biogas capture from the digesters; blocked pressure relief valves leading to over-pressurisation and structural failure of the digester tanks and fugitive release of odours.

Measures are in place to prevent excessive foaming in the first instance. Daily sampling and monitoring is used to control the performance of the digesters and to minimise the factors that amplify foaming in the tanks by maintaining a consistent organic loading rate and responding appropriately when monitoring results indicate changing digester tank conditions (see *SOP BIO040: Sampling digestate for FOS-TAC ratio analysis*).

SCADA system monitoring ensures that material is added to and removed from the digester tanks consistently to maintain the material volume at a level which reduces the potential for foam to block gas collection pipes or pressure relief valves by allowing for 500mm freeboard capacity.

The digester tanks are each equipped with three circulating pumps controlled from the SCADA system and heaters to keep the material fully mixed, distributing both fresh waste material and anaerobic breakdown products evenly and preventing the formation of cool spots in the material mass and stagnation leading to formation of a layer of floating scum.

These measures are supplemented by visual inspection for foam formation on the surface of the material inside the digester tanks using dedicated viewing ports set at the top of the tanks, and high-level alarm sensors inside the digesters. In exceptional situations if evidence of foaming is found it can be brought under control by applying and anti-foaming agent to the digester tanks or managed by exporting digestate to reduce the volume of material in the tanks (see exceptional operating procedure *EOP BIO005: Digester tanks – Foaming*).

6.8 Failure of digester tank

The digester tanks are visually inspected as part of weekly operations (see *SOP BIO017: Digester tanks – Visual checks & maintenance*). Biogas pressure in the gas domes is continually monitored by the SCADA system. An abnormal loss of pressure in a digester, which may indicate a gas leak, generates a SCADA system alarm; this will be investigated and repairs carried out immediately. If an immediate repair is not possible, waste deliveries will be to be diverted to another facility until any faults are repaired.

6.9 Maintenance/failure of CHP engines

An emergency gas flare is available for the thermal destruction of the biogas in the event of unavailability of the CHP engines or insufficient volume in the biogas storage units. Usage of, and emissions from the emergency gas flare is monitored and reported as required by the environmental permit (see *EA BIO022: Schedule 4 monitoring & reporting*).

6.10 Main services failure

If a power failure occurs for any reason during or directly after a waste delivery the vehicle access door must be immediately closed using the manual procedure specified in the equipment manual, to prevent the release of odorous air and/or the ingress of vermin. The Site Manager must contact Bio Dynamic (UK)'s external maintenance contractors to advise them of the power failure and to get assistance in determining the cause of the incident and the likely length of time for repair work. If either CHP engine is down the Site Manager should contact the suppliers; if there is a wider problem the electricity distribution network operator should be contacted (see *OPS BIO044: Contacts - Emergency & non-emergency*).

If the incident cannot be resolved within 12 hours, the Site Manager must arrange for further waste deliveries to be diverted to another facility for processing until repairs have been completed. If the incident cannot be resolved within 24 hours, the Site Manager must arrange for stockpiled waste to be sent to another suitable facility (see *EOP BIO006: Main services failure* and *EOP BIO009: Exporting waste - Exceptional operations*).

All items of plant and equipment default to a safe mode during a power failure and pumps will shut down. The SCADA system server automatically switches to an uninterruptable power supply, which provides back-up power for approximately 1 hour; this allows time for process data to be properly backed-up and for the system to execute a controlled shut down sequence.

In the unlikely event that power cannot be restored and the process brought under control, the emergency gas flare can be used to burn off biogas during periods of abnormal operation if the CHP engines are unavailable or if there is insufficient biogas storage volume. In an emergency, pressure relief valves on the digester tanks (where biogas will continue to be generated) will vent the biogas to atmosphere. However, venting will not be triggered unless gas pressure reaches 4 times normal.

7 Odour monitoring & reporting

7.1 Sniff tests

Daily monitoring of odour on site is carried out by employees using sniff tests to check the ambient air to help ensure effective odour control on site (see *EA BIO005: Daily odour sniff tests*). To help mitigate adaption to odours on site, employees who are not involved in daily waste processing operations are also used to carry out sniff tests where practicable.

Sniff test monitoring is carried out at agreed monitoring locations on site (see Figure 11). Any abnormal odours are investigated to identify the source; remedial action is taken immediately to ensure the odour is not detectable at the site boundary. If an odour complaint is received the number and frequency of sniff tests would be increased and the Site Manager would investigate and identify any equipment or processes which may be the cause (see *SOP BIO041: Complaints*).

In the event of equipment failure, accident or any other abnormal event that could lead to an odour emission travelling beyond the site boundary, additional monitoring will be performed at locations both on and off-site to ensure the operational procedures are adequate and pre-empt any possible complaints (see *EA BIO006: Off-site odour sniff tests* and page 47). If a problem is identified that cannot be immediately rectified, the Environment Agency will be notified.

The Site Manager is responsible for ensuring monitoring is carried out and that appropriate action is taken where required.

7.2 Meteorological monitoring

Local weather conditions are monitored using an onsite weather meter. Data on wind speed and direction and temperature are reported and recorded continuously. This data can be used in the event of odour complaints in order to establish conditions on site at the time of a complaint and to help identify possible sources of off-site odours, and to inform the timing and management of higher risk onsite activities.

7.3 Community engagement

Part of the ongoing operations of the facility may include regular liaison with the neighbours, if required. This may include open days and local liaison groups as appropriate.

7.4 Odour complaints process

Odour complaints from the local community may be received by the AD facility in person, by telephone, by email or via Gedling Borough Council, Nottingham County Council or the Environment Agency. The Site Manager is notified of all odour complaints.

Community members who contact the AD facility directly but who also want to make a complaint to either the Gedling Borough Council or the Environment Agency would be given the appropriate contact details:

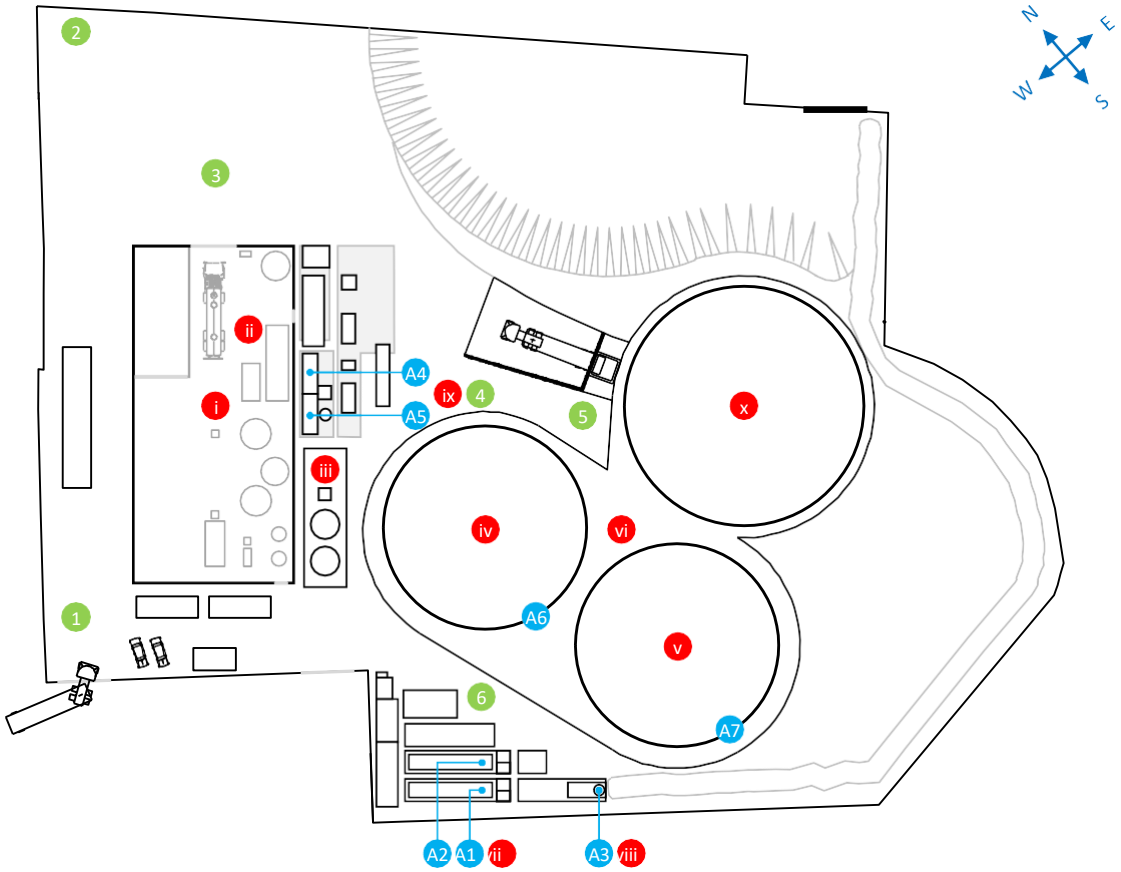
Environment Agency	**Gedling Borough Council**
Incident Hotline: 0800 807060	0115 9013972 Email: environmentalhealth@gedling.gov.uk

The details of all odour complaints are recorded (see *SOP BIO041: Complaints* and *EA BIO007: Odour complaint record* - page 48) by employees. All complaints are investigated as soon as possible by the Site Manager in order to identify the source of the odour. The Site Manager must establish weather conditions at the time of the complaint, whether operational processes are under control, whether odour containment measures have failed or whether odour treatment measures have failed. Any abnormal odours on site and their causes must be recorded and remedial action must be taken immediately.

If no odour is detected on site then an employee must go to the area that the complaint was made from (if known) to investigate any possible off-site sources of odour. If the off-site odour is subsequently determined as originating from the site, remedial action must be taken to prevent further odour emissions. This remedial action may include diverting waste deliveries to another appropriate facility until the issue can be resolved.

Whether the odour complaint is substantiated as originating from the AD facility or not, the complainant would be contacted and informed of the outcome of the investigation and any remedial actions taken. The Environment Agency would also be notified of the odour complaint and its outcome. All records relating to odour complaint are retained in the Weighbridge Office.

7.5 On-site odour sniff test locations



KEY

INFRASTRUCTURE

i. Waste reception building
ii. Fixed gas detector
iii. Buffer tanks' bund
iv. Anaerobic digester tank 1 (AD1)
v. Anaerobic digester tank 2 (AD2)
vi. Main bund
vii. CHP 1 & 2
viii. Emergency gas flare
ix. Odour control units 1 & 2
x. Category 1 digestate storage tank

POINT SOURCE EMISSIONS TO AIR

A1. CHP 1 exhaust stack
A2. CHP 2 exhaust stack
A3. Emergency gas flare stack
A4. Odour control unit 1 vent
A5. Odour control unit 2 vent
A6. Pressure relief valve (AD1)
A7. Pressure relief valve (AD2)

DAILY ODOUR SNIFF TEST LOCATIONS

1. Site entrance (Main)
2. North corner
3. Vehicle access door
4. Odour control units 1 & 2
5. Category 1 digestate discharge
6. Bund west side

Figure 11 Site plan showing the locations of point source emissions to air and on-site daily odour sniff tests

8 Monitoring & reporting forms

8.1 Off-site odour sniff tests

EA > MONITORING & REPORTING				EA BIO006
Off-site odour sniff tests			**Off-site monitoring** must be carried out to ensure all emissions to air, land and water from the operation of the AD facility are in accordance with the Colwick AD facility's **environmental permit**.	biodynamic
REFERENCE NO: Bio Dynamic (UK)	**DATE:**		These sniff tests should be carried out **during abnormal operations** on site or **in response to odour complaints**.	

TIME OF TEST			
DURATION OF TEST			
LOCATION OF TEST			
WEATHER CONDITIONS *Dry, rain, fog, snow, etc.*			
TEMPERATURE *°C or very warm, warm, mild, cold, etc.*			
WIND STRENGTH *None, light, steady, strong, gusting, etc.*			
WIND DIRECTION			
ODOUR INTENSITY [1]			
ODOUR FREQUENCY *C: Constant, I: Intermittent*			
ODOUR DURATION			
ODOUR DESCRIPTION *What does it smell like?*			
ODOUR SOURCE *Is the source evident? If Y, specify*			
RECEPTOR SENSITIVITY [2] *L: Low, M: Medium, H: High*			
NAME & COMMENTS			

SKETCH PLAN: Location of the sniff tests & potential odour source(s)

N

1 ODOUR 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. [Ref: German Standard VDI 3882, Part 14]

2 RECEPTOR SENSITIVITY – L: Low (e.g. footpaths, roads); **M**: Medium (e.g. industrial or commercial workplaces); **H**: High (e.g. residential housing, pubs, restaurants, hotels)

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8.2 Odour complaint record

EA > MONITORING & REPORTING		EA BIO007
Odour complaint record		
REFERENCE NO: Bio Dynamic (UK)	**REFERENCE NO:** Environment Agency	

COMPLAINT TAKEN BY	
Name:	Date complaint received:
Job title:	Time complaint received:

COMPLAINT MADE BY			
Name:		Telephone:	
Address:		Email:	
Receptor sensitivity	☐ Low	☐ Medium	☐ High

ODOUR COMPLAINT DETAILS		
Odour description:		Date odour detected:
		Time odour detected:
Odour duration:		
Odour frequency:	☐ Constant	☐ Intermittent
Odour intensity:	☐ 0 – No odour	
	☐ 1 – Very faint odour	☐ 4 – Strong odour
	☐ 2 – Faint odour	☐ 5 – Very strong odour
	☐ 3 – Distinct odour	☐ 6 – Extremely strong odour
	Unknown	

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EA > MONITORING & REPORTING		EA BIO007
Odour complaint record		
REFERENCE NO: Bio Dynamic (UK)	**REFERENCE NO:** Environment Agency	

COMPLAINT INVESTIGATED BY	
Name:	Date complaint received:
Job title:	Time complaint received:

WEATHER At time of odour complaint	
Weather:	Wind direction:
Temperature:	Wind strength:

OPERATIONS/ACTIVITIES At time of odour complaint	
On-site:	Off-site:

OUTCOME OF INVESTIGATION Possible causes of odour			
Complaint upheld?	☐ No	☐ Yes (in full)	☐ Yes (in part)
Further action needed?	☐ No	☐ Yes (specify)	
Further action & outcome:			

RESPONSE TO COMPLAINANT	
Name:	Date:
Job title:	Time:

RESPONSE TO ENVIRONMENT AGENCY		
EA informed?	☐ No	☐ Yes
Name:		Date of response:
Job title:		Time of response:

SIGNATURE Investigator
Date: