Air Quality Impact Assessment

Brains Farm, Wincanton, Anaerobic Digestion Plant

Japan Environmental Development & Investment UK Limited

CRM.0169.001.AQ.R.002

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Air Quality Assessment - CRM.0169.001.AQ.R.002

Project:	Brains Farm, Wincanton, Anaerobic Digestion Plant
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Tables and Figures

Non-Technical Summary

i. Enzygo Limited was commissioned by Japan Environmental Development and Investment UK Limited to undertake an air quality dispersion modelling assessment to support a bespoke Environmental Permit application relating to an anaerobic digestion facility located at Brains Farm, Moor Lane, Wincanton.

ii. The operation of the plant has potential to cause air quality impacts at sensitive locations due to onsite combustion sources. Air Quality dispersion modelling was undertaken to consider air emissions impacts in the vicinity of the site. Emission concentrations were defined using maximum permitted limit values based on the expected plant operations and where necessary a review of technical data sheets and literature.

iii. Model inputs were based on robust operating parameters and supplemented, where necessary, with robust assumptions. Results were processed and assessed against industry standard significance criteria.

iv. The dispersion modelling results indicated that the relevant screening criteria was met at all sensitive human receptors and impacts were screened as insignificant. Impacts on ecological receptors were also screened as insignificant.

v. Based on the predictions and the use of worst-case emissions, it is considered that overall air quality impacts associated with the operation of facility would be not significant.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Limited (Ltd) was commissioned by Japan Environmental Development & Investment (JEDI) UK Ltd to undertake detailed air quality dispersion modelling to support a bespoke environmental permit application for a proposed anaerobic digestion (AD) plant at Brains Farm, Wincanton (the 'Facility').

1.1.2 This updated report responds to the Environment Agency's (EA) request for additional information (ref: EPR/FP3628SH/A001) by providing a quantitative assessment of emissions from the Biogas Upgrading Unit (BUU). The assessment covers emissions expected to be released, including ammonia (NH_3), volatile organic compounds (VOCs), and hydrogen sulphide (H_2S).

1.2 Site Location and Context

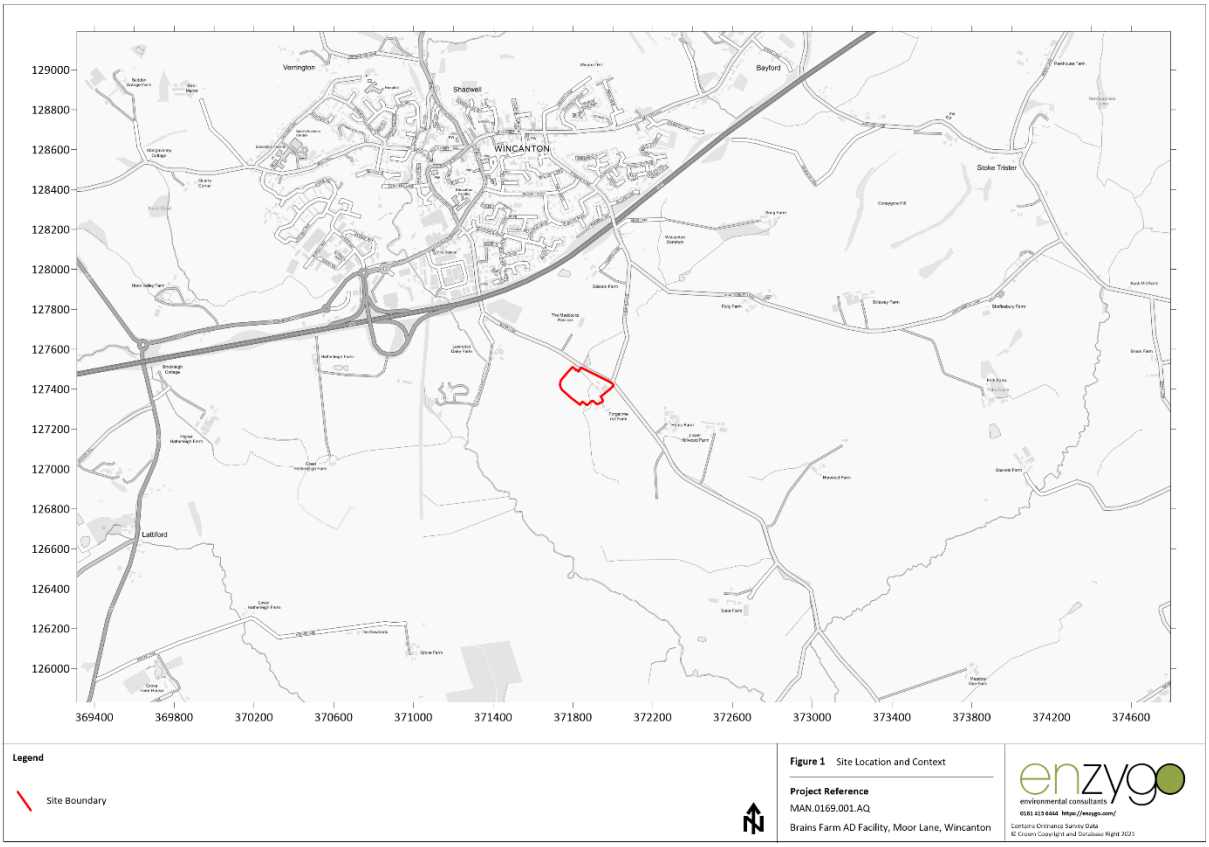
1.2.1 The Facility is located on land at Brains Farm of Moor Lane, Wincanton, BA9 9RA, at the approximate National Grid Reference (NGR): 371860, 127420 situated approximately 550 m north west of the town of Wincanton.

1.2.2 The site currently comprises a combination of arable agricultural land, agricultural buildings, a residential property, concrete hardstanding, and drainage ditches. The site is bound by Moor Lane to the north with a pond, recreational sports fields, and tennis courts beyond. The site is also bound by Moor Lane to the East with agricultural fields beyond the road. The south and west of the site is bound by agricultural fields.

1.2.3 The site is surrounded by agricultural areas with sparsely distributed working farms and residential properties in the vicinity of the site. The nearest residential property is Forget me Not Farm situated adjacent to the southeast boundary of the Facility.

1.2.4 Figure 1 shows a map of the site location and surrounding area.

Figure 1: Site Surrounding



1.3 Facility Operations

1.3.1 The proposed Facility will operate an AD process fuelled by biomass feedstock in form of energy crops, farmyard manures (FYM) and vegetable and fruit wastes. The majority of the biogas produced by the AD process will be upgraded for injection into the gas grid.

1.3.2 The annual mass of waste types to be processed at the Facility are summarised in Table 1

Table 1: Proposed Feedstocks and Annual Throughputs

Feedstock	Annual Quantity in Tonnes
Maize	15,750
Grass	4,750
Whole Crop Silage	2,850
Broiler and Layer Manure	10,000
Straw Mixed Pig and Cattle Manure	7,500
Vegetable and Fruit Waste	2,750
Straw	4,500
Top Bales of Straw	1,900
Liquid Digestate	26,650
Solid Digestate	20,810

1.3.3 A Combined Heat and Power (CHP) unit is proposed, which will utilise natural gas as a fuel and operate for up to 8,500 hours per annum. The CHP will provide heat and power to the process and have a net rate thermal input of 2.11MWth.

1.3.4 A biogas boiler, which will operate for up to 1,500 hours per annum, will utilise biogas as a fuel. The boiler will provide supplementary heat to the facility. It will have a net rated thermal input of 0.577MWth.

1.3.5 A diesel fuelled generator, with a net rated thermal input of 410 kWth will be utilised on site in the case of electrical failure. As back up, it will be utilised for less than 50 hours per annum. An emergency flare is also proposed which will only operate during periods of breakdown or maintenance of the BUU and/or biogas boiler.

1.3.6 The Facility comprise will comprise of the following primary elements:

- Acceptance and storage of energy crops in silage clamps;
- Acceptance and storage of agricultural manure and vegetable and fruit waste;
- Digestion of crops, vegetable and fruit waste and agricultural manures;
- Biogas collection, storage, and treatment;
- Combustion of natural gas in a CHP plant;
- Combustion of biogas in an auxiliary biogas boiler;
- Treatment of biogas in a BBU stack;
- Emergency diesel generator;
- Emergency flare operation; and
- Transfer of digestate via pipes to tankers.

1.3.7 Combustion emissions have potential to cause increases in ground level pollutant concentrations and cause impacts at sensitive human and ecological locations within the vicinity of the site. An Air Quality Assessment has therefore been undertaken to assess the significance of these impacts in line with the requirements of the Environmental Permitting (England & Wales) (Amendment) (No.2) Regulations 2016.

1.3.8 This report details the results and conclusions of the quantitative air quality impact assessment.

2.0 Legislation, Guidance and Environmental Standards

2.1 Guidance

2.1.1 The following legislation and guidance will be considered during the preparation of the Air Quality Assessment:

- The Environmental Permitting (England and Wales) (Amendment) Regulations 2016;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs (DEFRA), 2007[1];
- The Air Quality Standards (Amendment) Regulations, updated on 31st December 2016;
- Local Air Quality Management Technical Guidance 2022 LAQM (TG22), DEFRA, 2022[2];
- SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, EA, Updated 5th July 2022[3]
- Air emissions risk assessment for your environmental permit, EA, updated on 21st May 2024[4]; and
- Environmental permitting: air dispersion modelling reports, EA, updated on 26th March 2024[5].

2.2 Environmental Quality Standards

2.2.1 The modelling assessment will be undertaken against relevant long-term and short-term environmental standards. The assessment levels, limit values, objectives and target values which are applicable to this assessment are summarised in Table 2 with relation to human health receptors.

Table 2: Environmental Quality Standards for Human Exposure

Pollutant	Environmental Quality Standards	
	Concentration (µg/m³)	Averaging Periods
Nitrogen dioxide (NO_2)	40	Annual mean, not to be exceeded
	200	1-hour mean; not to be exceeded more than 18 times a year
Sulphur Dioxide (SO_2)	125	24-hour mean; not to be exceeded more than 3 times a year
	350	1-hour mean; not to be exceeded more than 24 times a year
	266	15-min mean; not to be exceeded more than 35 times a year
Carbon monoxide (CO)	10,000	8-hour running mean, not to be exceeded
Total Volatile Organic Compounds (TVOC)	5	Annual mean
	30	24-hour mean

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
[2] Local Air Quality Management Technical Guidance 2022 LAQM (TG22), DEFRA, August 2022.
[3] https://www.gov.uk/government/publications/sr2021-no-6-anaerobic-digestion-facility-including-use-of-the-resultant-biogas-installations/sr2021-no-6-anaerobic-digestion-facility-including-use-of-the-resultant-biogas-installations
[4] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[5] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

Pollutant	Environmental Quality Standards	
	Concentration (µg/m³)	Averaging Periods
Hydrogen Sulphide (H_2S)	140	Annual mean
	150	24-hour mean
Ammonia (NH_3)	180	Annual mean
	2,500	1-hour mean

2.2.2 The annual and hour limits set out for H_2S and NH_3 are Environmental Assessment Levels (EALs) set out in the EA guidance[4]. EALs represent a pollutant concentration in ambient air at which no significant risks to human health are expected. The remaining pollutants are assessed against their respective Ambient Air Directive (AAD) Limit Values, either under EU directives or UK law.

2.2.3 These criteria are collectively referred to as Environmental Quality Standards (EQSs). Table 3 summarises the advice provided in the DEFRA guidance LAQM (TG22)[2] on where the EQSs apply.

Table 3: Where EQS Apply

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour and 8 hour mean	As above together with hotels, and gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	As above, kerbside sites (for example, pavements of busy shopping streets), parts of car parks, bus stations and railway stations etc. which are not fully enclosed, and any location where members of the public might reasonably be expected to spend one hour or more	Kerbside sites where the public would not be expected to have regular access

2.3 Ecological Critical Levels

2.3.1 The assessment of impacts upon ecological designations will be undertaken in accordance with the EA guidance[4]. Predicted impacts will be compared against appropriate Critical Loads (CLDs) and Critical Levels (CLVs) obtained from the UK Air Pollution Information System (APIS)[6] to determine significance.

2.3.2 Table 4 presents the CLVs considered within this assessment. CLVs have been assigned based on worse case sensitivity.

[6] http://www.apis.ac.uk/

Table 4: Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m³)	Averaging Periods
NO_x	30	Annual mean
	75 - 200	24-hour mean
SO_2	10[a] - 20[b]	Annual mean
NH_3	1[a] - 3[b]	Annual mean

a: Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity

b: For all higher plants (all other ecosystems)

2.3.3 CLDs used in this assessment are detailed in Section 4.2 for nutrient nitrogen and acidity which refers to deposition of pollutants, while a CLVs refers to pollutant concentrations in the atmosphere.

3.0 Dispersion Modelling Inputs

3.1 Emission Sources

3.1.1 The following sources have been considered in the assessment and reflect the relevant emission points at the proposed Facility:

- A1 - Natural gas fuelled CHP Engine;
- A2 - Biogas boiler;
- A3 - Emissions from the Emergency High Temperature Flare Stack;
- A4 - BUU Stack;
- A5 - Emergency diesel generator; and
- Process Vents and Pressure Release Valves.

3.1.2 Emission sources A3 (Flare), A5 (Emergency Generator) and the Process Vents and Pressure Relief Values will operate infrequently and typically during emergency scenarios, either a result of system failure or abnormal gas production. Given their reduced operating schedules, impacts from these sources are considered insignificant and were not assessed further in the AQA.

3.1.3 Table 5 provides the locations of modelled emission sources.

Table 5: Stack Locations

Emission Source		NGR	
		X	Y
A1	CHP Engine	371873.0	127378.9
A2	Biogas Boiler	371873.1	127385.1
A4	Biogas Upgrading Unit	371892.1	127364.2

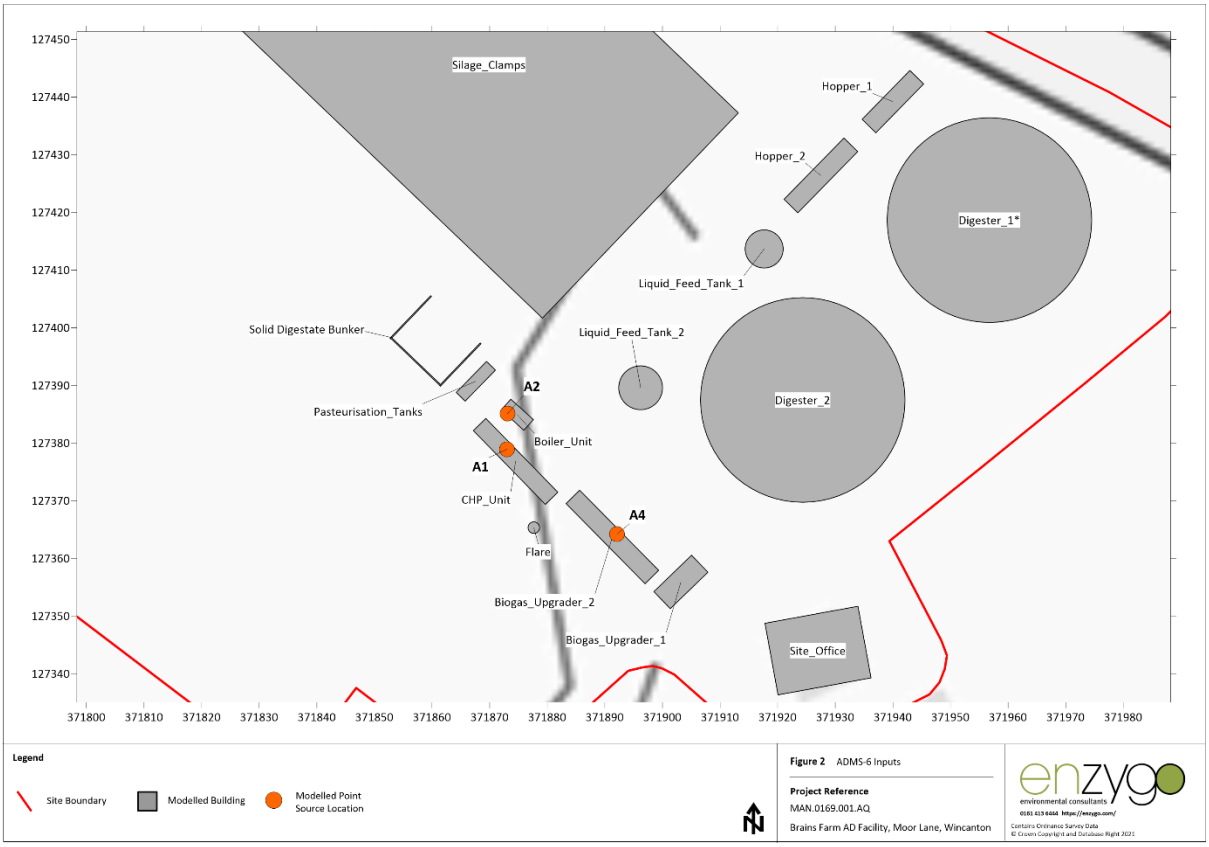
3.2 Dispersion Modelling

3.2.1 The information detailed in this section were entered into the ADMS 6 (v6.0.0.1) software, which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. Outputs were processed to predict pollutant concentrations in the vicinity of the site to allow comparison against relevant impact significance criteria.

3.2.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages

3.2.3 Figure 2 shows a graphical representation of the modelled air pollution sources.

Figure 2: ADMS-6 Modelling Inputs



3.3 Modelling Scenarios and Emissions

3.3.1 The pollutant species and averaging periods considered relevant to this assessment are summarised in Table 6. Unless stated modelled pollutant species and average periods relate to human exposure.

Table 6: Dispersion Modelling Scenarios

Pollutant	Modelled As	
	Long Term	Short Term
NO_2	Annual mean	99.79th percentile (%ile) 1-hour mean
NO_x	Annual mean *(Ecological Impacts)*	24-hour mean (Ecological Impacts)
SO_2	-	99.9%ile 15-minute mean
	-	99.73%ile 1-hour mean
	-	99.18%ile 24-hour mean
	Annual mean (*Ecological Impacts)*	-
CO	8-hour rolling mean	-
TVOC as Benzene	Annual mean	-
	24-hour mean	-
Nitrogen Deposition	Annual mean (Ecological Impacts)	-
Acid Deposition	Annual mean (Ecological Impacts)	-

Process Conditions

3.3.2 Process conditions for the modelled emission sources were obtained from the technical datasheets provided by JEDI UK Ltd or the manufacturer's data sheets. Reference should be made to Table 7 for the parameters for each emission stack.

Table 7: Process Stack Conditions

Parameter	Unit	A1[(a)]	A2[(b)]	A4[(c)]
Stack height	m	10.0	5.5	6.0
Stack diameter	m	0.30	0.25	0.08
Flue gas efflux velocity	m/s	35.5	6.27	30.12
Volumetric flow rate	m^3/s	2.51	0.30	545.00
Temperature	˚C	425	180	20
Moisture Content	%	11	11	11
Oxygen Content	%	9	9	9

[a] Data from MWM TCG 3016 V16.technical datasheet - Referenced @ 5% Oxygen, STP.
[b] Data from Viessmann VITOPLEX 200 Boiler
[c] Data provided by operator – BUU Off-gas Stack Emissions Datasheet

Stack Emissions

3.3.3 NO_x concentrations for source A1 were based on the maximum Emission Limit Values (ELVs) obtained from Annex II, of MCP regulations[7] . The remaining ELVs associated with sources A1, A2 and A4, with the exception of H_2S, were obtained from the EA's statutory guidance[8].

3.3.4 In the absence of available ELVs for H_2S emissions a concentration was calculated based on the maximum odour concentration referenced in the EA's statutory guidance[9].The calculation applies the odour detection threshold for H_2S (0.0047 ppm H_2S equivalent to 1 ou_E/m^3) to provide a worst case H_2S emissions concentration.

3.3.5 Further to this the BUU (source A4) will be fitted with activated carbon filtration which effectively removes the majority of H_2S and VOCs from the biogas. As such, the application of the ELVs stated in Table 8 is considered a robust approach.

3.3.6 Emission concentrations detailed in Table 8 are referenced at standard temperature (273K) and pressure (101.3kPa) and, in the case of source A1 as a dry gas at 5% oxygen, and source A2 as a dry gas at 3% O_2.

Table 8: Maximum Emission Concentrations

Pollutant	Emission Concentrations (Nmg/m^3)		
	A1	A2	A4
NO_x (as NO_2)	95[(a)]	500 ([b])	-
SO_2	-	350 [(b)]	-
CO	1,400*-	1,400 [(b)]	-
TVOC (as Benzene)	-	1,000 [(b)]	1,000[(b)]
NH_3	-	-	20.0[(c)]
H_2S	-	-	7.5[(d)]

a. MCPD: ELV for new for new engines and gas turbines burning natural gas.
b. SR2021 No 6: Maximum stated ELV for plant burning biogas: *including CO for CHP unit
c. SR2021 No 6: Maximum stated ELV for channelled emissions.
d. Based on the odour threshold for H_2S (0.0047) provided by the Health and Safety Executive[10] and odour ELV

[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32015L2193#ntc28-L_2015313EN.01001501-E0028 [Accessed 26/05/2023]
[8] SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, 5th July 2022.
[9] SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, 5th July 2022.
[10] https://www.hse.gov.uk/offshore/infosheets/is6-2009.htm [Accessed 06/08/2024]

3.3.7 The mass emissions rates shown in Table 9 was calculated to using flow conditions provided in Table 7 and maximum emission concentrations in Table 8.

Table 9 Emission Rates

Pollutant	Emission Rate (g/s)		
	A1	A2	
NO_x (as NO_2)	0.062	0.055	-
SO_2	-	0.039	-
CO	0.919	0.154	-
TVOC (as Benzene)	-	0.110	0.141
NH_3	-	-	0.003
H_2S	-	-	0.001

3.4 Time Varied Emissions

3.4.1 JEDI UK Ltd have confirmed that source A1 will operate for 8,500 hours, source A2 for 1,500 hours and source A4 for 8,760 hours. A factor of 0.171 based on the proportion of operating hours in the year was applied to the annual mean PCs associated with source A2. Sources A1 and A4 was modelled to reflect continuous operations throughout the year (8,760 hours).

3.4.2 Short term impacts were modelled with the boiler running continuously to consider peak hour contributions.

3.5 Terrain Data

3.5.1 Areas of complex terrain have potential to affect the dispersion of pollutants which vary dependent on the height and location of modelled emission sources. Ordnance Survey Landform Panorama terrain data was pre-processed within the ADMS-6 model and covers the Facility and surrounding receptor locations.

3.6 Building Effects

3.6.1 Buildings can influence the dispersion of pollutant and may lead to increases to ground level concentrations. A review of adjacent buildings was therefore undertaken and subsequently included within the model and are summarised in Table 10. Onsite building heights were provided by JEDI UK Ltd.

Table 10: Building Geometries

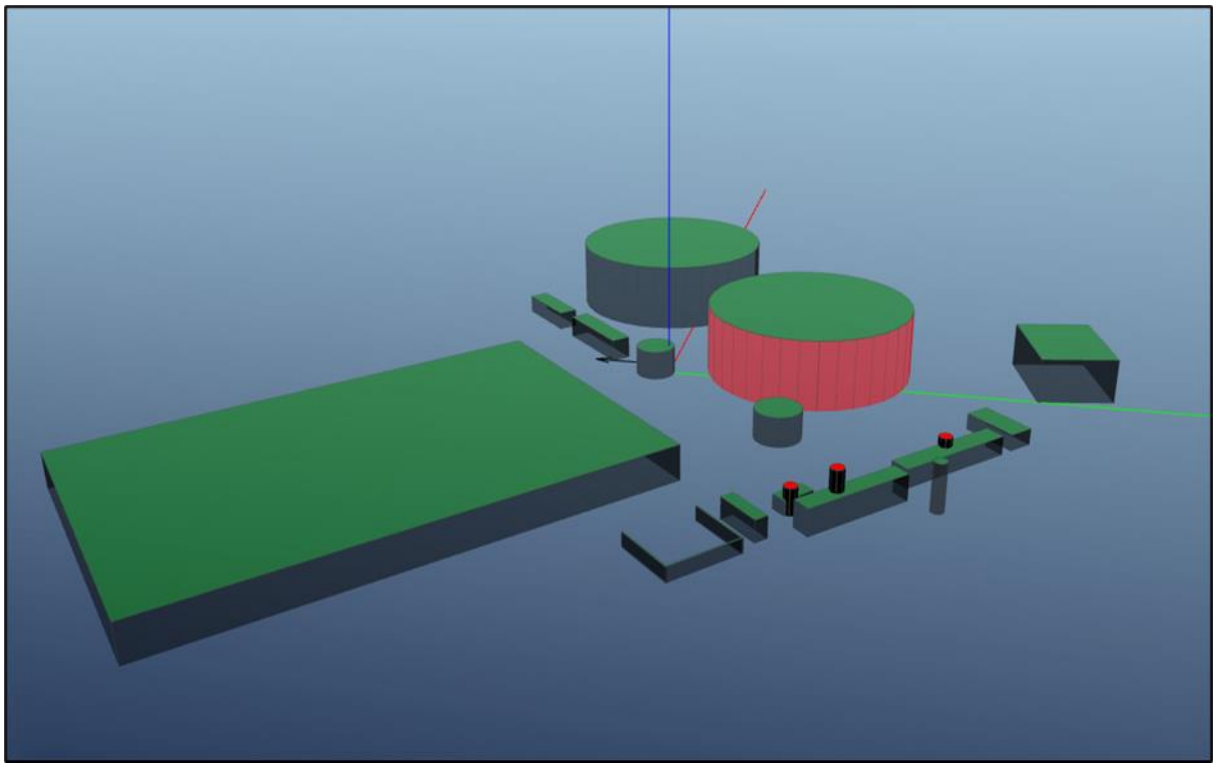
Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
1	TNV Digester	371956.8	127418.7	16.0	35.5	Circular	N/A
2	Post Digester	371924.4	127387.5	16.0	35.5	Circular	N/A
3	Feed Hopper 1	371940.0	127439.2	4.2	11.9	3.3	224.4
4	Feed Hopper 2	371927.5	127426.4	5.0	3.4	14.9	134.4
5	Silage Clamps	371868.1	127443.8	7.5	75.7	49.2	130.3
6	Liquid Tanks 1	371917.7	127413.6	6.5	6.6	Circular	N/A
7	Liquid Tanks 2	371896.2	127389.6	6.5	7.6	Circular	N/A
8	Site Office	371927.0	127344.0	10.0	12.6	16.4	169.6
9	Grid Entry Units	371903.2	127355.9	3.5	9.1	4.1	226.0
10	Biogas Upgrader	371891.3	127363.7	4.0	3.3	19.5	225.4

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
11	CHP Unit	371874.5	127376.8	5.5	3.0	17.9	225.7
12	Boiler Unit	371874.8	127384.9	3.0	2.5	5.3	222.2
13	Pasteurisation Units	371867.6	127390.7	4.5	2.2	7.5	134.3
14	Flare	371877.7	127365.3	3.0	2.0	Circular	N/A
15	Digestate Bunker Wall	371856.3	127401.8	3.0	0.2	10.2	133.8
16	Digestate Bunker Wall	371864.9	127393.6	3.0	0.2	10.2	133.8
17	Digestate Bunker Wall	371857.2	127394.1	3.0	0.3	12.0	223.8

3.6.2 Reference should be made to Figure 2 for a graphical representation of the modelled building layout and ADMS-6 model inputs. A three-dimensional representation of the modelled building layout is provided below.

3.6.3 A three-dimensional representation of the modelled building layout is provided below.

Figure 3: 3D Model Layout

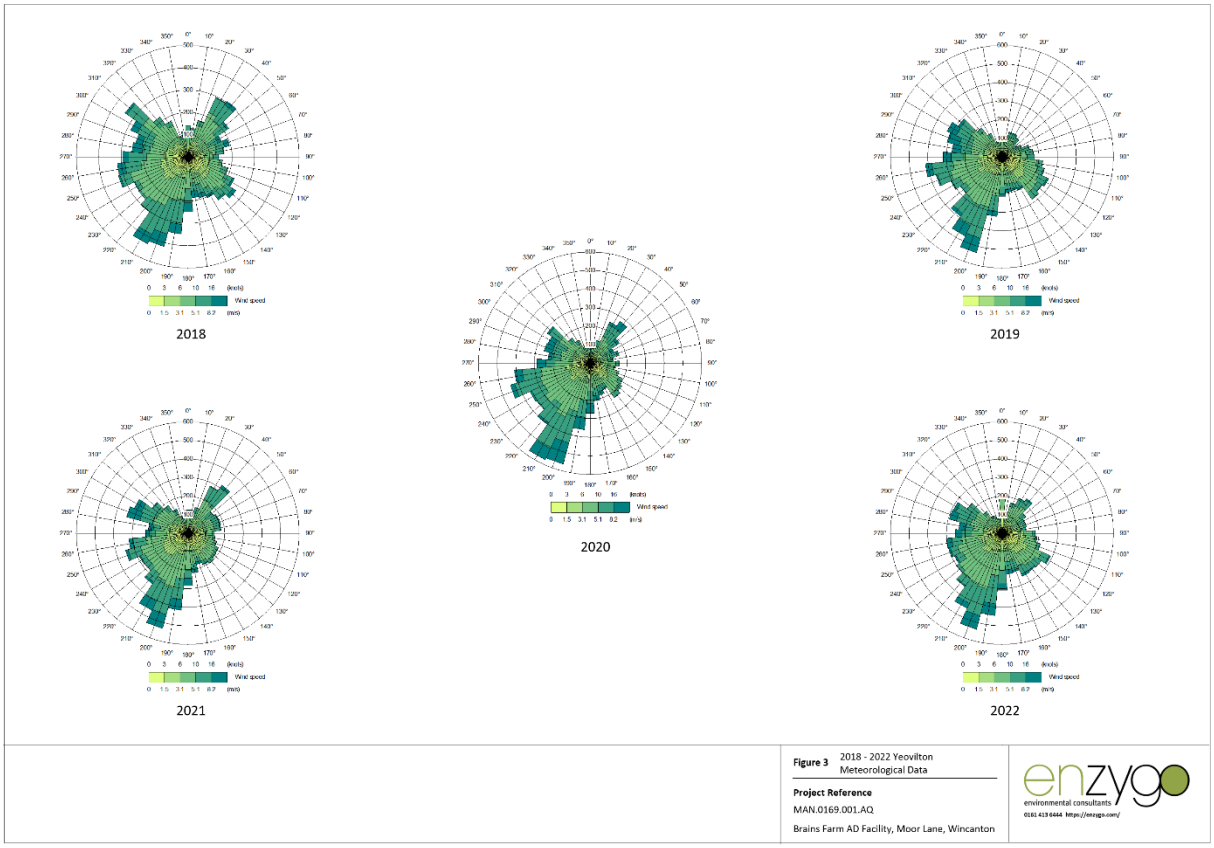


3.7 Meteorological Data

3.7.1 Hourly sequential data used in this assessment was obtain from Yeovilton meteorological station, located 17 km southwest of the Facility. Both sites are located within similar rural contexts and share comparable topographies. The choice of this parameter therefore provides a suitable representative of metrological conditions across the modelled domain.

3.7.2 Maximum emissions across the five years of meteorological data (2018 - 2022) was utilised to ensure a worse case assessment. All meteorological data was provided by ADM Ltd. Figure 4 shows the meteorological wind roses.

Figure 4: Meteorological Wind Roses



Roughness Length

3.7.3 The specific roughness length (z_0) values specified with the ADMS-6 model is summarised in Table 11.

Table 11 Utilised Roughness Length

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

Monin-Obukhov Length

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

Table 12 Utilised Monin-Obukhov Lengths

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

Surface Albedo and Priestley-Taylor Parameter

3.7.5 The surface albedo and Priestley-Taylor parameters used in the assessment were the model default values of 0.23 and 1 respectively.

3.8 NO_x to NO_2 Conversion

3.8.1 Ground level NOx concentrations were predicted through dispersion modelling. NO_2 concentrations reported in the results section assume conversion from NO_x to NO_2, based upon EA guidance[4] detailed below:

- 35% for short-term average concentrations; and
- 70% for long-term average concentrations.

3.9 15-minute Sulphur Dioxide Concentration Predictions

3.9.1 Throughout the assessment, 15-minute mean SO_2 concentrations have been calculated using the following correction factor based upon empirical relationships with the 99.9th percentile of 1-hour means, as described in EA guidance:

99.9th percentile of 15-minute means = 1.34 x 99.9th percentile of 1-hour means

4.0 Baseline and Sensitive Receptors

4.1 Human Receptors

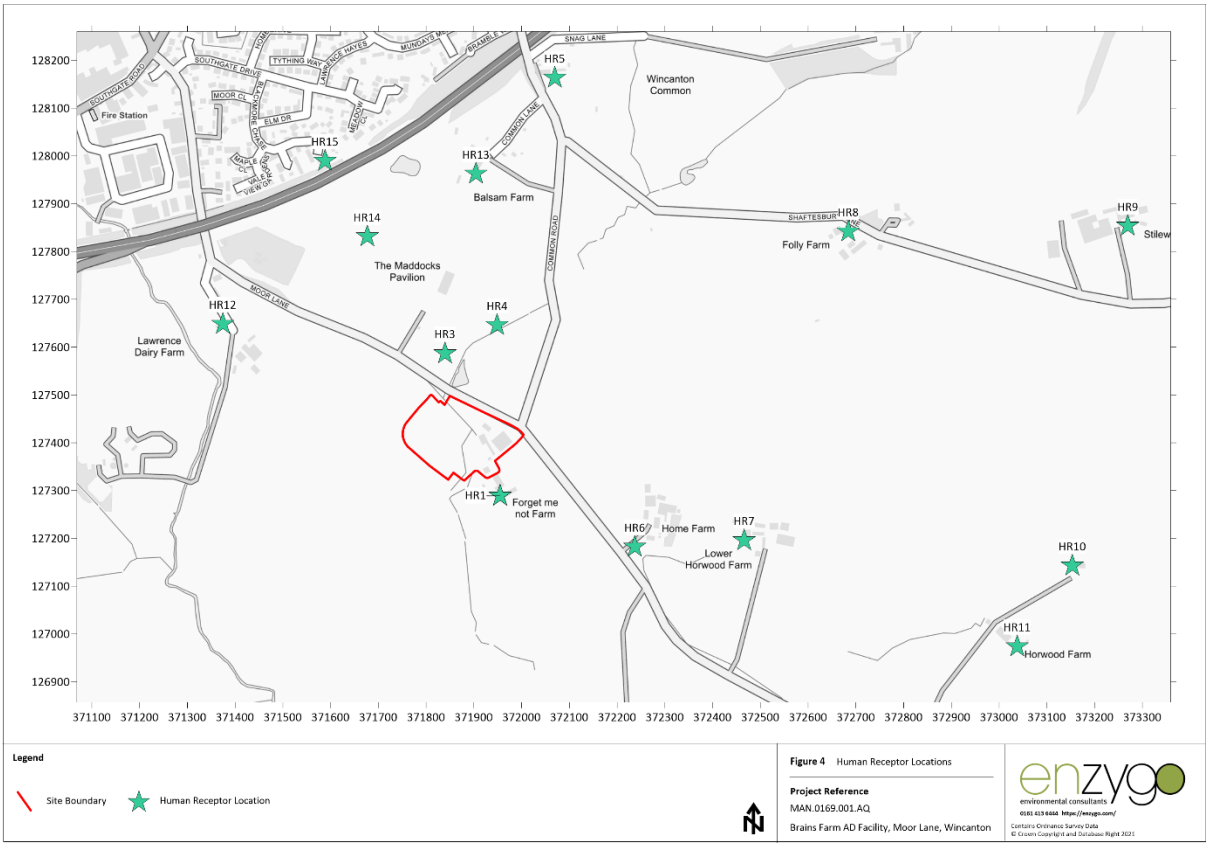
4.1.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. A desk-top study was undertaken in order to identify sensitive receptor locations which require a detailed assessment. Identified receptors were modelled at the minimum height of relevant exposure. The modelled receptors are summarised in Table 13.

Table 13: Sensitive Human Receptors

Receptor		Use	NGR (m)		Distance from Centre of Site (m)	Height (m)
			X	Y		
HR1	Forget Me Not Farm	Residential	371955.0	127289.0	137	1.5
HR2	Wincanton Sports Ground	Recreational	371839.5	127587.0	137	1.5
HR3	Wincanton Sports Ground	Recreational	371948.9	127645.9	189	1.5
HR4	Vine House, Common Road	Residential	372069.5	128163.2	254	1.5
HR5	Home Farm	Residential	372237.1	127182.1	785	1.5
HR6	Lower Horwood Farm	Residential	372466.1	127196.0	421	1.5
HR7	Folly Farm	Residential	372684.1	127842.0	623	1.5
HR8	Stileaway Farm	Residential	373269.7	127853.3	919	1.5
HR9	Higher Horwood Farm	Residential	373153.4	127142.7	1,463	1.5
HR10	Higher Horwood Farm Cottage	Residential	373037.8	126974.0	1,302	1.5
HR11	Lawerence Dairy Farm	Residential	371374.1	127648.4	1,236	1.5
HR12	Balsalm Farm	Residential	371904.4	127962.3	561	1.5
HR13	Allotments, Moor Lane	Residential	371676.7	127831.2	561	1.5
HR14	40 Blackmore Chase	Residential	371588.3	127989.5	474	1.5

4.1.2 Figure 5 presents the modelled receptor locations.

Figure 5: Modelled Sensitive Human Receptor Locations



Human Receptor Baseline

4.1.3 A desktop study was undertaken to define the baseline air quality within the vicinity of the Facility. The baseline year will correspond with either the current year or the most recent year that monitoring data is available. 2022 predicted background concentrations are summarised in Table 14.

Table 14: Predicted Long Term Background Pollutant Concentrations

Receptor	Predicted Background Concentration (µg/m³)						
	NO_x	NO_2	SO_2	CO	TVOC	NH_3	H_2S
HR1	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR2	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR3	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR4	6.18	4.95	186.00	2.38	0.14	2.32	1.49
HR5	4.69	3.79	182.00	2.30	0.14	2.32	1.49
HR6	4.69	3.79	182.00	2.30	0.14	2.32	1.49
HR7	4.69	3.79	182.00	2.30	0.14	2.32	1.49
HR8	4.39	3.55	181.00	2.09	0.13	2.32	1.49
HR9	4.39	3.55	181.00	2.09	0.13	2.32	1.49
HR10	4.20	3.40	176.00	2.00	0.11	2.32	1.49
HR11	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR12	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR13	6.08	4.86	183.00	2.59	0.14	2.32	1.49
HR14	6.08	4.86	183.00	2.59	0.14	2.32	1.49

4.1.4 Background concentrations of NO_x and NO_2, were obtained from DEFRA website[11] for 2022, with CO, SO_2 and benzene predictions obtained from the 2001 base maps. These are the most reliable and recent predictions available and are therefore considered to provide a reasonable representation of background concentrations in the vicinity of the site.

4.1.5 Background data for H_2S was obtained via a literature review which indicated background concentrations typically range between 0.11 ppb and 0.33 ppb, although concentrations in urban areas can be as high as 1 ppb[12]. A background concentration of 1.49 µg/m^3 (1 ppb) was therefore utilised in the absence of data from DEFRA prediction or monitored sources. Background NH_3 concentrations were obtained from the rural background analyser located at Castle Cary (UKA00328)[13].

4.1.6 To provide a conservative assessment the maximum background concentrations across the study area was applied to all receptor locations as set out in Table 15

Table 15: Maximum Long Term Background Pollutant Concentrations

Receptor	Predicted Background Concentration (µg/m³)						
	NO_x	NO_2	SO_2	CO	TVOC	NH_3	H_2S
All Locations	6.18	4.95	186.00	2.59	0.14	2.32	1.49

Short term Background Concentrations

4.1.7 It was assumed that the short-term background concentration of a substance is twice its long-term concentrations provided in Table 14 as suggested within EA risk assessment for your environmental permit guidance[4].

4.2 Ecological Sensitive Receptors

4.2.1 The EA guidance 'Air emissions risk assessment for your environmental permit'[4] states:

"Note that conservation sites need only be considered where they fall within set distances of the activity:

- *Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or RAMSAR sites within 10km of the installation; and*
- *Site of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Site (LWS) and Ancient Woodlands (AW) within 2km of the location."*

4.2.2 A desk top study was undertaken using the Multi-Agency Geographic Information for the Countryside (MAGIC)[14] to identify statutory and locally designated sites within the distances stated above. The study confirmed no SPAs, SACs or RAMSAR sites within 10 km and no LNRs, NNRs or SSSIs with 2km of the Facility.

4.2.3 The EAs nature and heritage conservation screening assessment did identify one Local Wildlife Site (LWS) within 2 km of the proposed Facility. The Common Lane LWS is located approximately 1,635 m south of the site as detailed in Table 16.

[11] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

[12] Environmental Toxicology of Hydrogen Sulphide, Nitric Oxide, Samantha L. Malone et al, 2017

[13] https://uk-air.defra.gov.uk/networks/site-info?uka_id=UKA00328&provider=

[14] https://magic.defra.gov.uk/MagicMap.aspx

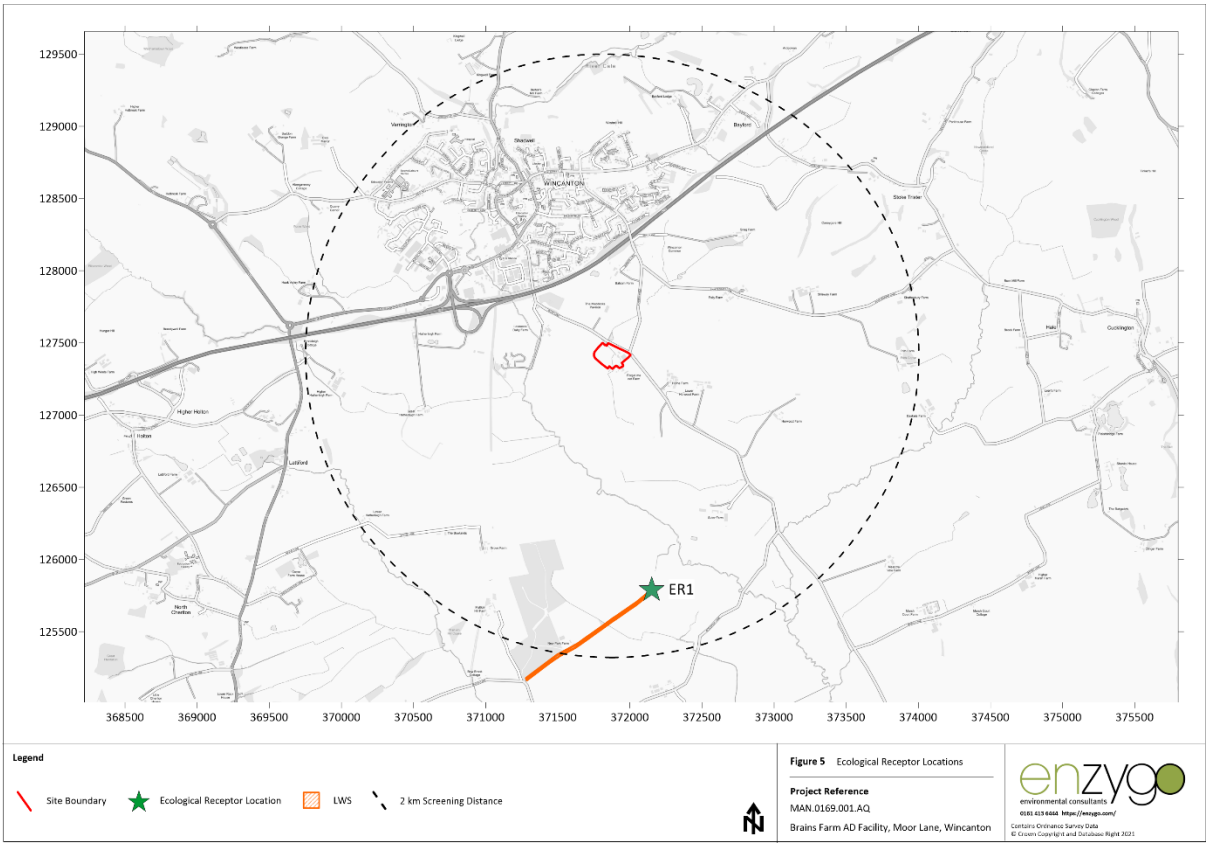
Table 16: Ecological Sensitive Receptors

ID	Ecological Receptor	NGR		Closest Distance to Facility (m)
		X	Y	
ER1	Common Lane LWS	372152.2	125790.3	1,635

4.2.4 The LWS is a green lane with species-rich flora and good hedge system with semi-mature oak standards. A review of Living England Habitat Map provided by MAGIC confirmed the presence of acid, calcareous and neutral grasslands at the LWS site.

4.2.5 The location of the Common Lane LWS is displayed in Figure 6.

Figure 6: Modelled Sensitive Ecological Receptor Locations



Ecological Receptor Baseline

4.2.6 CLDs are designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS website was undertaken to identify suitable habitat descriptions and associated CLDs. For the receptors with multiple habitats, the most sensitive habitat has been taken for both nitrogen and acid deposition. The CLDs for nitrogen deposition are presented in Table 17.

Table 17: Nitrogen Critical Load

ID	Designation	Nitrogen Class	Nitrogen Critical Load (kgN/ha/yr)	
			Min	Max
ER1	Common Lane LWS	Calcareous Grassland	5	10

4.2.7 Table 18 shows the relevant critical loads for acid deposition.

Table 18: Acid Critical Load

ID	Designation	Acidity Class	Critical Load (ke/ha/yr)		
			CLminN	CLmaxN	CLmaxS
ER1	Common Lane LWS	Acid Grassland	0.438	4.548	4.110

*APIS database accessed 06/08/2024

4.2.8 Background deposition rates and concentrations were downloaded from the APIS website and are summarised in Table 19 and represent the maximum predicted concentrations at each designation.

Table 19: Background Deposition Rates

ID	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)		Background Concentration ug/m_3		
		N	S	NO_x	SO_2	NH_3
ER1	17.75	1.27	0.11	5.74	0.62	2.16

*APIS database accessed 06/08/2024

Deposition Rates

4.2.9 Deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06[15]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used are presented within Table 20.

Table 20 Conversion Factors to Determine Dry Deposition Flux

Pollutant	Grassland Deposition Velocity (m/s)	Forest Deposition Velocity (m/s)	Conversion Factor (µg/m^2/s to kg/ha/yr)	Conversion Factor (µg/m^2/s to keq/ha/yr)
NO_2	0.0015	0.003	96	6.84
SO_2	0.012	0.024	157.7	9.84
NH_3	0.020	0.030	260	18.50

4.2.10 Predicted ground level pollutant concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The standard conversion factors are shown in Table 21.

Table 21 Conversion Factors to Units of Equivalents

Species	Conversion Factors from kg/ha/yr to keq/ha/yr
N	0.07143
S	0.06250
NH_3	0.07143

4.2.11 The proportion of the EQS consisting of the PC and PEC were then calculated.

4.3 Assessment Criteria and Significance of Impacts

EA Guidance Criteria

4.3.1 Guidance for assessing the significance of emissions impacts from point sources are also given in the EA's guidance[4]. Predicted pollutant concentrations are summarised in the following formats:

[15] AQTAG 06: Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air, EA, 2014

- Process contribution (PC) - Predicted pollutant concentration as a result of emissions from the site only; and
- Predicted environmental concentration (PEC) - Total predicted pollutant concentration as a result of emissions from the site and existing baseline levels.

Initial Screening Stage

4.3.2 The significance of predicted impact was assessed in accordance with EA criteria and through consideration of likely effects as a result of the proposals. The EA guidance states that process contributions can be considered insignificant if:

- the short-term PC is less than 10% of the short-term environmental standard; and
- the long-term PC is less than 1% of the long-term environmental standard.

4.3.3 If both criteria are met predicted impacts can be considered insignificant and no further analysis is required. It is critical to note that exceedances of the 1% or 10% insignificance criteria does not by itself correspond to significant risk or adverse harm.

Second Screening Stage

4.3.4 If the above criteria are not met, then a second stage of screening is required to determine the impact of the PEC:

- The short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration; and
- The long-term PEC is less than 70% of the long-term environmental standards.

4.3.5 If both criteria are met during the second stage of screening, then predicted impacts can be considered insignificant. Should these criteria be exceeded then the PEC should be checked against the EQS.

Ecological Screening

4.3.6 If emissions that affect LWS meet both of the following criteria, they can be considered insignificant:

- The short-term PC is less than 100% of the short-term environmental standard; and
- The long-term PC is less than 100% of the long-term environmental standard.

4.3.7 In addition, the EA guidance also states that the APIS critical load function tool should be used to determine whether there is an exceedance of deposition of nutrient nitrogen or acidity, as the standard of exceedance is site-specific.

4.3.8 It is again critical to note that exceedances of the above insignificance criteria do not directly correspond to significant risk or adverse harm.

4.4 Modelling Uncertainties

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

- Model uncertainty - due to model limitations;

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

4.4.2 The analysis of maximum emissions across the five years of meteorological data (2018 - 2022) provides sensitivity analysis which sufficiently accounts for variations in modelled predictions from year to year. Additionally, worse case assumptions regarding the application of emission rates within the model also minimise podetial uncertainties..

4.4.3 The application of maximum ELV concentrations as well as the concurrent and continuous operation of all pollutant sources minimises potential uncertainties. As such, a sufficient degree of confidence can be placed in the results .

4.4.4 It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

4.5 Assumptions

4.5.1 The following assumptions were made during the dispersion modelling:

- Concurrent operation for emission sources A1, A2 and A4;
- All combustion sources assumed at 100% loading;
- Maximum permitted emission concentrations were applied to all sources;
- Emission concentrations associated with A1 rebased on maximum ELVs stated in the MCPD regulations;
- Emission concentrations associated with A2 and A4 are based on maximum ELV provided by the EAs statutory guidance - *SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, 17th May 2022*[8]. The application of such ELV is likely to provide an overestimation of actual conditions;
- H_2S emission concentrations are based on the maximum odour concentration referenced in the EAs statutory guidance[8] in context of the human odour threshold for H_2S. Mass emission rates were calculated using stack parameters provided by JEDI UK Ltd;
- In accordance with the EA guidance it was assumed that the entire TVOC emissions consisted of C_6H_6 benzene given that the proportions of individual species are unknown. However, It is anticipated that benzene emissions would represent a much smaller proportion of the total TVOC content;
- It is understood that the flare, vents and PRVs will only operate during emergency scenarios, either a result of system failure or abnormal gas production. Given the reduced operating schedule, impacts are considered insignificant and have not been assessed; and
- Following a review of the Somerset Council Planning Portal and EA's Public Register no significant proposed or recently consented industrial, livestock or agricultural activities are located with 3 km of the Facility. Therefore, potential in combination effects have been screened out of the assessment. Furthermore, it is considered the background concentrations and levels used in the assessment account for PC from local activities.

4.6 Dispersion Modelling Report Requirements

4.6.1 Table 22 provides the checklist of dispersion modelling report requirements.

Table 22 Dispersion Modelling Report Requirements

Item	Location within Report
Location map	Figure 1
List of pollutants modelled and relevant guidelines	Table 2, Table 3 and Table 4
Details of modelled scenarios	Section 3.3d
Details of relevant ambient concentrations used	Table 14 and Table 19
Model description and justification	Section 3.2
Special model treatments used	Section 3.3 to 3.12
Table of emission parameters used	Table 8
Details of modelled domain and receptors	Section 4.0 and Figure 5 and Figure 6
Details of meteorological data used	Section 3.7
Details of terrain treatment	Section 3.5
Details of building treatment	Section 3.6 and Table 10

5.0 Results

5.1 Introduction

5.1.1 Dispersion modelling was undertaken with the inputs described in Section 3.0.

5.1.2 Predicted pollutant concentrations were predicted separately for 5 assessment years and the maximum concentration reported for each pollutant. Impact significance was determined using the EA's guidance[5]. Impacts upon receptor locations relate to the operation of onsite combustion process associated with emission sources A1 and A2 and channelled emission associated with source A4.

5.2 Human Receptors

Annual Mean NO_2

Table 23 Predicted Annual Mean NO_2 Concentrations

ID	Predicted Concentration (µg/m^3)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
HR1	0.31	5.26	0.8	13.1
HR2	0.18	5.13	0.5	12.8
HR3	0.22	5.17	0.6	12.9
HR4	0.04	4.99	0.1	12.5
HR5	0.07	5.02	0.2	12.5
HR6	0.04	4.99	0.1	12.5
HR7	0.03	4.98	0.1	12.4
HR8	0.01	4.96	0.0	12.4
HR9	0.02	4.97	0.0	12.4
HR10	0.01	4.96	0.0	12.4
HR11	0.04	4.99	0.1	12.5
HR12	0.05	5.00	0.1	12.5
HR13	0.05	5.00	0.1	12.5
HR14	0.03	4.98	0.1	12.5

Predicted concentrations assessed against the relevant annual mean EQS of 40 µg/m³.

1-hour Mean NO_2

Table 24 Predicted 1-Hour Mean NO_2 Concentrations

ID	Predicted Concentration (µg/m^3)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR1	5.9	15.8	3.0	3.1
HR2	4.2	14.1	2.1	2.2
HR3	3.6	13.5	1.8	1.9
HR4	1.2	11.1	0.6	0.7
HR5	1.7	11.6	0.9	0.9
HR6	1.3	11.2	0.7	0.7
HR7	1.1	11.0	0.5	0.6
HR8	0.6	10.5	0.3	0.3

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR9	0.6	10.5	0.3	0.3
HR10	0.6	10.5	0.3	0.3
HR11	1.8	11.7	0.9	0.9
HR12	1.6	11.5	0.8	0.9
HR13	1.9	11.8	0.9	1.0
HR14	1.4	11.3	0.7	0.7

Predicted concentrations were assessed against the relevant 99.79%ile 1-hour mean EQS of 200 µg/m³
a: PC proportion of the EQS minus twice the long-term background.

5.2.1 As presented in Table 23 and Table 24, PC proportions of the annual and 1-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for this pollutant.

5.2.2 Based on these predictions no unacceptable adverse impacts are associated with NO_2 emissions.

24-Hour Mean (99.18%ile) SO_2

Table 25 Predicted 24-Hour SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR1	7.9	13.1	6.4	6.6
HR2	4.7	9.9	3.8	3.9
HR3	4.5	9.7	3.6	3.7
HR4	1.1	6.3	0.9	0.9
HR5	1.9	7.1	1.5	1.6
HR6	1.6	6.8	1.3	1.4
HR7	1.0	6.2	0.8	0.9
HR8	0.5	5.6	0.4	0.4
HR9	0.6	5.8	0.5	0.5
HR10	0.7	5.9	0.6	0.6
HR11	2.2	7.3	1.7	1.8
HR12	1.5	6.7	1.2	1.3
HR13	2.5	7.6	2.0	2.1
HR14	1.7	6.9	1.3	1.4

Predicted concentrations assessed against the 24-hour mean EQS of 125 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

1-Hour Mean (99.73%ile) SO_2

Table 26 Predicted 1-Hour SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR1	8.9	14.1	2.5	2.6
HR2	6.4	11.6	1.8	1.9

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR3	5.6	10.8	1.6	1.6
HR4	1.9	7.1	0.5	0.5
HR5	2.5	7.7	0.7	0.7
HR6	2.0	7.2	0.6	0.6
HR7	1.5	6.7	0.4	0.4
HR8	0.9	6.0	0.2	0.2
HR9	0.8	6.0	0.2	0.2
HR10	0.9	6.1	0.3	0.3
HR11	2.7	7.9	0.8	0.8
HR12	2.4	7.6	0.7	0.7
HR13	2.8	8.0	0.8	0.8
HR14	2.1	7.2	0.6	0.6

Predicted concentrations assessed the 1-hour mean EQS of 350 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

15-Minute Mean (99.90%ile) SO_2

Table 27 Predicted 15-minute SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR1	12.5	17.7	4.7	4.8
HR2	9.9	15.1	3.7	3.8
HR3	8.6	13.8	3.2	3.3
HR4	2.7	7.9	1.0	1.0
HR5	4.2	9.3	1.6	1.6
HR6	3.3	8.4	1.2	1.2
HR7	2.3	7.5	0.9	0.9
HR8	1.2	6.4	0.5	0.5
HR9	1.2	6.4	0.5	0.5
HR10	1.5	6.7	0.6	0.6
HR11	4.1	9.3	1.5	1.6
HR12	3.9	9.1	1.5	1.5
HR13	4.5	9.6	1.7	1.7
HR14	3.3	8.5	1.2	1.3

Predicted concentrations assessed against the 15-minute mean EQS of 266 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

5.2.3 As presented in Table 25, Table 26 and Table 27, PC proportions of the 24-hour, 1-hour and 15 minute mean EQS are less than 10% at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria.

5.2.4 Considering the above no unacceptable adverse impacts are associated with SO_2 emissions.

8-hour Rolling Mean CO

5.2.5 Predicted 8-hour rolling mean CO concentrations are summarised in Table 28.

Table 28 Predicted 8-Hour Rolling Mean CO Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR1	89.7	461.7	0.9	0.9
HR2	53.7	425.7	0.5	0.6
HR3	42.4	414.4	0.4	0.4
HR4	10.8	382.8	0.1	0.1
HR5	22.0	394.0	0.2	0.2
HR6	13.2	385.2	0.1	0.1
HR7	12.2	384.2	0.1	0.1
HR8	7.4	379.4	0.1	0.1
HR9	6.2	378.2	0.1	0.1
HR10	5.8	377.8	0.1	0.1
HR11	18.7	390.7	0.2	0.2
HR12	13.1	385.1	0.1	0.1
HR13	18.6	390.6	0.2	0.2
HR14	12.7	384.7	0.1	0.1

Concentrations assessed against 8-hour rolling mean EQS of 10,000 µg/m³.
a: PEC proportion of the EQS minus twice the long-term background

5.2.6 As presented in Table 28, the PC proportion of the 8-hour rolling mean EQS is less than 10% at all receptors locations. Impacts can be screened out as insignificant based on the initial EA screening criteria.

5.2.7 Based on these predictions no unacceptable adverse impacts are associated with CO emissions.

Annual Mean TVOC (as Benzene)

Table 29 Predicted Annual Mean Benzene Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
HR1	2.8	3.0	**56.3**	59.0
HR2	1.1	1.3	**22.7**	25.4
HR3	1.0	1.2	**20.5**	23.3
HR4	0.2	0.3	**3.4**	6.2
HR5	0.4	0.6	**9.0**	11.8
HR6	0.3	0.4	**5.5**	8.3
HR7	0.1	0.2	**2.0**	4.8
HR8	0.0	0.2	0.9	3.7
HR9	0.1	0.2	**1.9**	4.6
HR10	0.1	0.2	**1.7**	4.5
HR11	0.3	0.5	**6.9**	9.7
HR12	0.2	0.4	**4.7**	7.5
HR13	0.3	0.5	**6.6**	9.3
HR14	0.2	0.3	**4.0**	6.8

Predicted concentrations were assessed against annual mean EQS of 5 µg/m³.

24-hour Mean TVOC (as Benzene)

Table 30 Predicted 24-Hour Mean Benzene Concentrations

ID	Predicted Concentration (µg/m^3)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
HR1	34.6	***34.8***	**115.2**	**116.3**
HR2	15.3	15.5	**50.9**	**51.4**
HR3	12.6	12.9	**42.1**	**42.5**
HR4	2.3	2.5	7.5	7.6
HR5	5.8	6.1	**19.5**	19.6
HR6	4.0	4.3	**13.3**	13.4
HR7	1.5	1.8	5.1	5.2
HR8	0.7	1.0	2.3	2.3
HR9	1.4	1.7	4.7	4.7
HR10	1.5	1.8	4.9	5.0
HR11	5.0	5.2	**16.5**	16.7
HR12	3.1	3.3	**10.2**	10.3
HR13	5.1	5.3	**16.9**	17.0
HR14	3.2	3.5	**10.7**	10.8

Predicted concentrations were assessed against 24-hour mean EQS of 30 µg/m^3.

a: PEC proportion of the EQS minus twice the long-term background

5.2.8 As presented in Table 29, PC proportions of the annual mean EQS are greater than 1% at thirteen receptor locations. Impacts at these locations cannot initially be screened out as insignificant. Annual mean PEC proportions at all locations are predicted to be well below 70% of the EQS at all receptor locations and all annual mean impacts can be screened as insignificant based on EA criteria.

5.2.9 As presented in Table 30, PC proportions of the 24-hour mean EQS are greater than 10% at nine receptor locations. Impacts at these locations cannot initially be screened out as insignificant. 24-hour mean PC proportions are greater than 20% of the EQS minus twice the long-term background concentration at three locations (HR1 - HR3) and impacts cannot be screened out as insignificant. PECs at these receptor locations all exceed the 24-hour mean EQS.

5.2.10 While impacts upon 24-hour mean concentrations cannot be screened as insignificant using the EA guidance, professional judgment has been applied to determine the significance of impacts. As detailed in Section 4.5 the composition of TVOCs is unknown and was assumed to consist entirely of benzene in line with the EA's permitting guidance[4]

5.2.11 It should also be noted that the BUU will be fitted with abatement systems including a single 5m^3 activated carbon filter to remove TVOC's from the biogas. As confirmed by JEDI UK Ltd actual emissions of non-methane VOCs associated the BUU are in fact less than 1% of the total composition, which are predominantly made up of carbon dioxide (CO_2) emission.

5.2.12 The composition of emissions associated with the BUU is presented in Table 31.

Table 31 BUU Emissions Profile

Pollutant	Proportion (%)
Methane (CH_4)	0.61
Carbon Dioxide (CO_2)	98.9

Pollutant	Proportion (%)
Nitrogen (N_2)	0.01
O_2	0.26
H_2O	0.14

5.2.13 As such VOC emissions consist almost entirely of methane and non-methane VOC (NMVOC) emissions (e.g. benzene) will be negligible. The assumption that all BUU emitted VOCs consist entirely of benzene and the application of maximum ELVs is evidently a significant overestimation when reviewed against the emission profile presented in Table 31

5.2.14 Therefore, impacts presented in Table 29 and Table 30 are considered a significant overestimation which would not represent actual NMVOC content which is expected to be less than 0.1% of the TVOC emissions. As such, based on the robust assumptions no unacceptable adverse impacts are associated with VOC emissions.

Annual Mean NH_3

Table 32 Predicted Annual Mean NH_3 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
HR1	0.1	2.4	<0.1	1.3
HR2	0.1	2.4	<0.1	1.7
HR3	<0.1	2.3	<0.1	1.7
HR4	<0.1	2.3	<0.1	1.7
HR5	<0.1	2.3	<0.1	1.7
HR6	<0.1	2.3	<0.1	1.7
HR7	<0.1	2.3	<0.1	1.7
HR8	<0.1	2.3	<0.1	1.7
HR9	<0.1	2.3	<0.1	1.7
HR10	<0.1	2.3	<0.1	1.7
HR11	<0.1	2.3	<0.1	1.7
HR12	<0.1	2.3	<0.1	1.7
HR13	<0.1	2.3	<0.1	1.7
HR14	<0.1	2.3	<0.1	1.7

Predicted concentrations assessed against the relevant annual mean EQS of 180 µg/m³.

24-hour Mean NH_3

Table 33 Predicted 1-Hour Mean NH_3 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR1	1.6	6.2	<0.1	<0.1
HR2	1.2	5.9	<0.1	<0.1
HR3	0.9	5.6	<0.1	<0.1
HR4	0.2	4.8	<0.1	<0.1
HR5	0.6	5.2	<0.1	<0.1
HR6	0.4	5.1	<0.1	<0.1
HR7	0.1	4.8	<0.1	<0.1

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR8	0.1	4.7	<0.1	<0.1
HR9	0.1	4.7	<0.1	<0.1
HR10	0.1	4.8	<0.1	<0.1
HR11	0.3	5.0	<0.1	<0.1
HR12	0.3	5.0	<0.1	<0.1
HR13	0.4	5.0	<0.1	<0.1
HR14	0.3	4.9	<0.1	<0.1

Predicted concentrations were assessed against the relevant 1-hour mean EQS of 2500 µg/m³
a: PC proportion of the EQS minus twice the long-term background.

5.2.15 As presented in Table 23 and Table 24, PC proportions of the annual and 1-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria.

5.2.16 Based on these predictions no unacceptable adverse impacts are associated with NH_3 emissions.

Annual Mean H_2S

Table 34 Predicted Annual Mean H_2S Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
HR1	<0.1	1.5	<0.1	1.1
HR2	<0.1	1.5	<0.1	1.1
HR3	<0.1	1.5	<0.1	1.1
HR4	<0.1	1.5	<0.1	1.1
HR5	<0.1	1.5	<0.1	1.1
HR6	<0.1	1.5	<0.1	1.1
HR7	<0.1	1.5	<0.1	1.1
HR8	<0.1	1.5	<0.1	1.1
HR9	<0.1	1.5	<0.1	1.1
HR10	<0.1	1.5	<0.1	1.1
HR11	<0.1	1.5	<0.1	1.1
HR12	<0.1	1.5	<0.1	1.1
HR13	<0.1	1.5	<0.1	1.1
HR14	<0.1	1.5	<0.1	1.1

Predicted concentrations assessed against the relevant annual mean EQS of 140 µg/m³.

24-hour Mean H_2S

Table 35 Predicted 24-Hour Mean H_2S Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR1	<0.1	3.2	<0.1	0.1
HR2	<0.1	3.1	<0.1	0.1
HR3	<0.1	3.0	<0.1	0.0

ID	Predicted Concentration (µg/m^3)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
HR4	<0.1	3.0	<0.1	0.0
HR5	<0.1	3.0	<0.1	0.0
HR6	<0.1	3.0	<0.1	0.0
HR7	<0.1	3.0	<0.1	0.0
HR8	<0.1	3.0	<0.1	0.0
HR9	<0.1	3.0	<0.1	0.0
HR10	<0.1	3.0	<0.1	0.0
HR11	<0.1	3.0	<0.1	0.0
HR12	<0.1	3.0	<0.1	0.0
HR13	<0.1	3.0	<0.1	0.0
HR14	<0.1	3.0	<0.1	0.0

Predicted concentrations were assessed against the relevant 24-hour mean EQS of 150 µg/m^3

a: PC proportion of the EQS minus twice the long-term background.

5.2.17 As presented in Table 23 and Table 24, PC proportions of the annual and 24-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria.

5.2.18 Based on these predictions no unacceptable adverse impacts are associated with H_2S emissions.

5.3 Ecological Receptors

Annual Mean NO_x

Table 36 Predicted Annual Mean NO_x Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1	0.01	5.75	0.02	19.16

Predicted concentrations assessed against the relevant CLV: 30 µg/m³.

24-hour Mean NO_x

Table 37 Predicted 24-Hour Mean NO_x Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1	0.33	11.81	0.44	15.75

Predicted concentrations assessed against the relevant CLV: 75 µg/m³.

5.3.1 As presented in Table 36 and Table 37, PC proportions of the annual and 24-hour EQS are less than 100%. Impacts at the LWS can be screened out as insignificant based on the initial EA screening criteria.

5.3.2 Based on these predictions no unacceptable adverse ecological impacts are associated with NO_x emissions.

Annual Mean SO_2

Table 38 Predicted Annual Mean SO_2 Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1	0.001	0.62	0.01	6.21

Predicted concentrations assessed against the CL of 10 µg/m³

5.3.3 As presented in Table 38, PC proportions of the annual mean EQS are below 100% at all receptor locations and can be screened as insignificant based on the initial EA screening criteria.

5.3.4 Based on these predictions no adverse ecological impacts are associated with SO_2 emissions.

Annual Mean NH_3

Table 39 Predicted Annual Mean NH_3 Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1	0.001	2.16	0.08	**216.08**

Predicted concentrations assessed against the CL of 1 µg/m³

5.3.5 As presented in Table 38, PC proportions of the annual mean EQS are below 100% at all receptor locations and can be screened as insignificant based on the initial EA screening criteria. Whilst EQS is exceeded this due to existing background concentrations.

5.3.6 Based on these predictions no adverse ecological impacts are associated with NH_3 emissions.

Nitrogen Deposition

5.3.7 Predicted annual mean nitrogen deposition rates are summarised in Table 40.

Table 40 Predicted Annual Mean Nitrogen Deposition Rates

Receptor	Predicted Deposition Rate (kgN/ha/yr)		Proportion of EQS (%)			
			Low EQS		High EQS	
	PC	PEC	PC	PEC	PC	PEC
ER1	0.01	17.76	0.11	**355.11**	0.05	**177.55**

5.3.8 As presented in Table 40, the PC proportions of the low and high EQS are below 100% at the LWS. Whilst the PEC exceeds the CLD this due to existing background depositions.

5.3.9 Based on these predictions it is considered that no unacceptable adverse ecological impacts are associated with annual mean N deposition.

Acid Deposition

Table 41 Predicted Annual Mean Acid Deposition Rates

ID	Predicted Deposition Rate (keq/ha/yr)			% of Critical Load Function	
	S	N	Total	PC	PEC
E1	0.00017	0.00038	0.00055	0.13	**315.20**

5.3.10 As presented in Table 41, the PC proportion of the EQS are below 100% at the LWS and impacts can be screened as insignificant based on the initial EA screening criteria. Again, whilst the PEC exceeds the CLD this due to existing background depositions

5.3.11 Based on these predictions it is considered that no unacceptable adverse ecological impacts are associated with annual mean acid deposition.

6.0 Conclusions

6.1.1 Dispersion modelling was undertaken using the ADMS 6 modelling software. Impacts at human and ecological sensitive receptors were predicted with results compared against industry significance criteria provided by the EA.

6.1.2 Impacts were based on the Facility emitting the maximum permitted pollutant concentrations, as well the use of the maximum predicted concentrations over 5 assessment years. As such, predicted concentrations are likely to be an overestimation of actual impacts.

6.1.3 Dispersion modelling of onsite combustion processes was undertaken using ADMS 6. Impacts at sensitive receptors were quantified and the results compared with the relevant EQSs and significance criteria provided by the EA. Predicted Impacts were based on operating procedures at the proposed Facility.

6.1.4 Operational impacts on human health were considered to be not significant. Where pollutants could not be screened out based on their PC being less than 1% (for long-term impacts) or 10% (for short-term impacts) of the EQS, the total PEC has been shown to be below the EQS at all modelled locations within the assessment extents.

6.1.5 On that basis, impacts on pollutant concentrations at all human locations were considered not significant.

6.1.6 NO_x, SO_2 and NH_3 PC proportions at ecological receptors were screened as insignificant. The CLDs for nitrogen and acid deposition were exceeded as a baseline condition at all designations however the PC proportions from the Facility were below 1% and could be screened out as insignificant using the EA criteria. Therefore, impacts at ecological designations as a result of the facility are acceptable.

6.1.7 Based on the predictions and the use of conservative assumptions, such as worse case emission limit values and meteorological conditions over a 5-year period, it is considered that the overall air quality impacts of the Facility would be insignificant.

6.1.8 In terms of air quality, the proposal is therefore considered acceptable for permitting purposes.

7.0 Abbreviations

%ile	Percentile
AAD	Ambient Air Directive
AD	Anaerobic Digestion
ADM	Atmospheric Dispersion Modelling
ADMS	Atmosphere Dispersion Modelling Software
APIS	Air Pollution Information System
AQA	Air Quality Assessment
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
AQTAG	Air Quality Technical Advisory. Group.
AW	Ancient Woodland
BAT	Best Available Techniques
BUU	Biogas Upgrading Unit
C_6H_6	Benzene
CERC	Cambridge Environmental Research Consultants
CHP	Combined Heat and Power
CLD	Critical Load
CLV	Critical Level
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Levels
ELV	Emission Limit Value
EP	Environmental Permit
EQS	Environmental Quality Standard
H_2S	Hydrogen Sulphide
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
N	Nitrogen
NGR	National Grid Reference
NH_3	Ammonia
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
O_2	Oxygen
PC	Process Contribution
PEC	Predicted Environmental Concentration
PRV	Pressure Release Valve
S	Sulphur
SAC	Special Area of Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Importance
TVOC	Total Volatile Organic Compounds
z_0	Roughness Length
%ile	Percentile