SUEZ Recycling and Recovery UK Ltd

SUEZ Holloway Lane AD Facility, West Drayton, UB7 0AE

Bioaerosol Risk Assessment

784-B049022
2nd February 2024

PRESENTED TO

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EXECUTIVE SUMMARY

This report presents the findings of a bioaerosol risk assessment undertaken to support an Environmental Permit Application to operate an installation activity which involves the anaerobic digestion of separately collected food waste as a new operation at Holloway Lane, West Drayton, UB7 0AE.

The report comprises a bioaerosol dispersion modelling assessment undertaken in accordance with national and regulatory guidance for the assessment of risks. It appraises the potential for risks to human health at surrounding receptors.

A Bioaerosols Dispersion Modelling Assessment has been undertaken using AERMOD and representations of bioaerosols emissions from AD facility operations.

The predicted long-term and short-term bioaerosol concentrations at the receptor locations are all below the acceptable levels of 1000 and 500 cfu/m^3 for total bacteria and aspergillus for the protection of public health.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AD	Anaerobic Digestion
AERMOD	AERMOD is the state-of-the-science, steady-state Gaussian air dispersion model that is EPA-approved for most refined modelling scenarios. BREEZE AERMOD is an enhanced version of the EPA-approved AERMOD that provides modelers with the tools and functionality required to perform air quality analyses that help to address permitting, regulatory, and nuisance issues, perform academic research, and assist companies worldwide with capital planning
AL	Acceptable Level
CHP	Combined Heat and Power
CFU/m^3 / cfu/m^3	Total bacterial colony-forming units per cubic metre
DEFRA	Department for Environment Food & Rural Affairs
EA	Environment Agency
LEV	Local Extract Ventilation
LT	Long-term
NGR	The United Kingdom National Grid Reference
MWth	Thermal megawatt
NTF	The National Transfer Format (NTF) is a file format designed in 1988 specifically for the transfer of geospatial information
ODTS	Organic Dust Toxic Syndrome
OS	the UK Ordnance Survey
PC	Process Concentration
PEC	Predicted Environment Concentration
ST	Short-term
SUEZ	SUEZ Recycling and Recovery UK Ltd
µm	Micrometer
UK	The United Kingdom
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

This report presents the findings of a bioaerosol risk assessment undertaken to support an Environmental Permit Application to operate an installation activity which involves the anaerobic digestion of separately collected food waste as a new operation at Holloway Lane, West Drayton, UB7 0AE.

SUEZ Recycling and Recovery UK Ltd (SUEZ) are seeking to apply for an Environmental Permit to allow the operation of an Anaerobic Digestion (AD) facility. The process will generate biogas which will be processed by a Combined Heat and Power (CHP) engine to generate heat and electricity that would be used by the AD plant. Once the parasitic load has been met, any excess biogas will be processed by a gas upgrading plant to National Gas Grid criteria and injected into the gas grid via a gas main situated to the south of the site. Alternatively, excess biogas will be processed by the CHP engines to generate electricity that will be exported to the National Grid.

Section 11.4 of the EA's "Biological waste treatment: appropriate measures for permitted facilities (July 2023)" Guidance indicates that monitoring for bioaerosols is only required if the facility is within 250 m of a sensitive receptor.

The nearest 'highly sensitive' receptor is a residential property (Property off Harmondsworth Lane) which is located approximately 145 m southeast of the proposed AD facility. The closest sensitive receptor is a commercial property off Holloway Lane, located approximately 50 m northwest of the proposed AD facility. As such, bioaerosol monitoring is required in connection to the AD facility.

Pre-application discussions with the EA confirmed that a Bioaerosol Risk Assessment was necessary as even though there will be no outdoor storage of waste and all activities will be undertaken within an entirely enclosed process, the site is within 250 m of a sensitive receptor.

A Bioaerosol Risk Assessment has been undertaken in order to satisfy the EA's requirements.

1.1 SITE LOCATION

The Holloway Lane AD Site is located approximately 445m from West Drayton at Holloway Lane, Sipson, Middlesex, UB7 0AE and is centred at approximate National Grid Reference (NGR) TQ 06719 78035.

The location of the site and site environmental permit boundary are shown in **Figure 1-1**, the Holloway Lane site layout is shown in **Figure 1-2**, and the AD facility site layout plan is shown in **Figure 1-3**.

Figure 1-1. Site Location

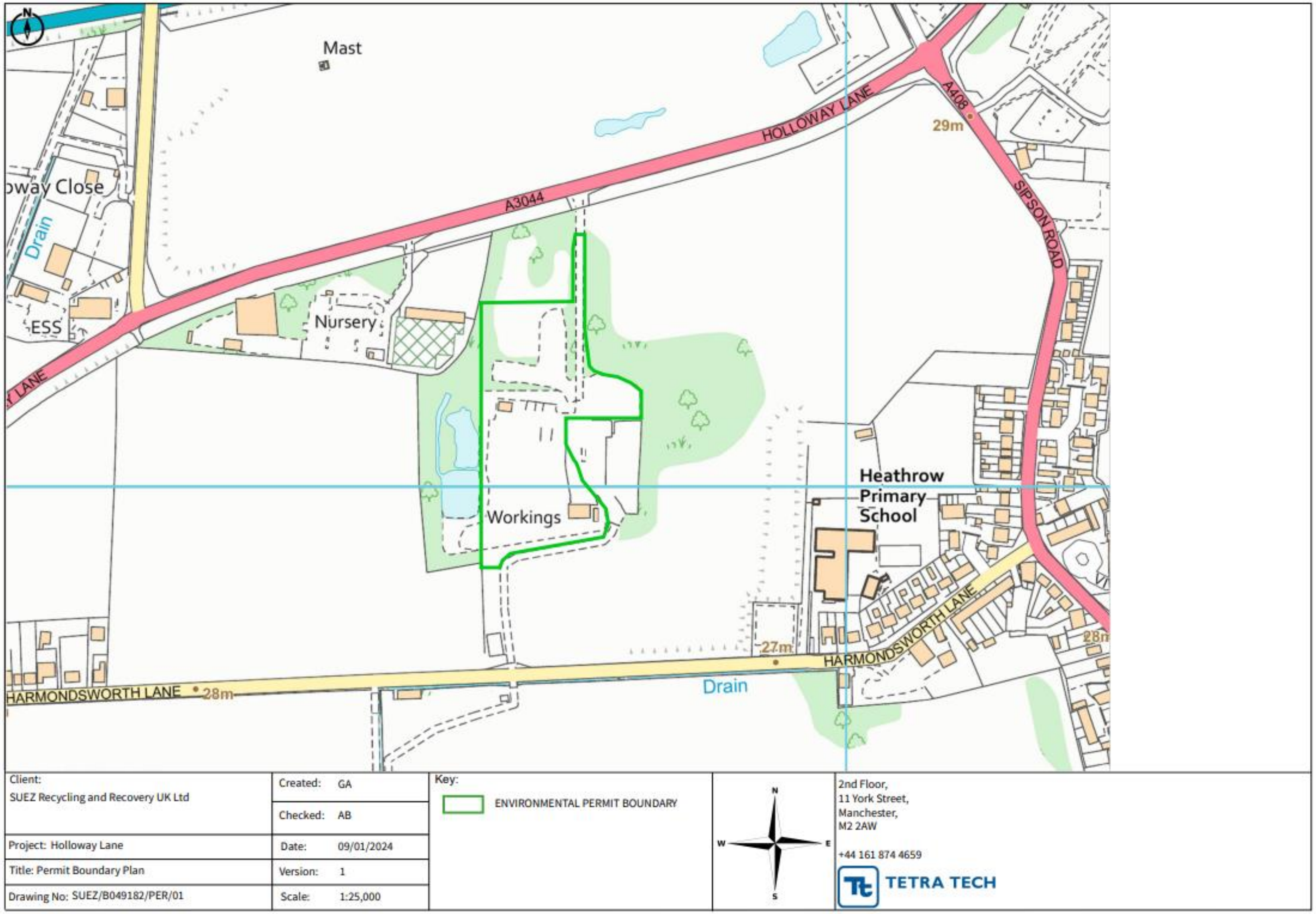
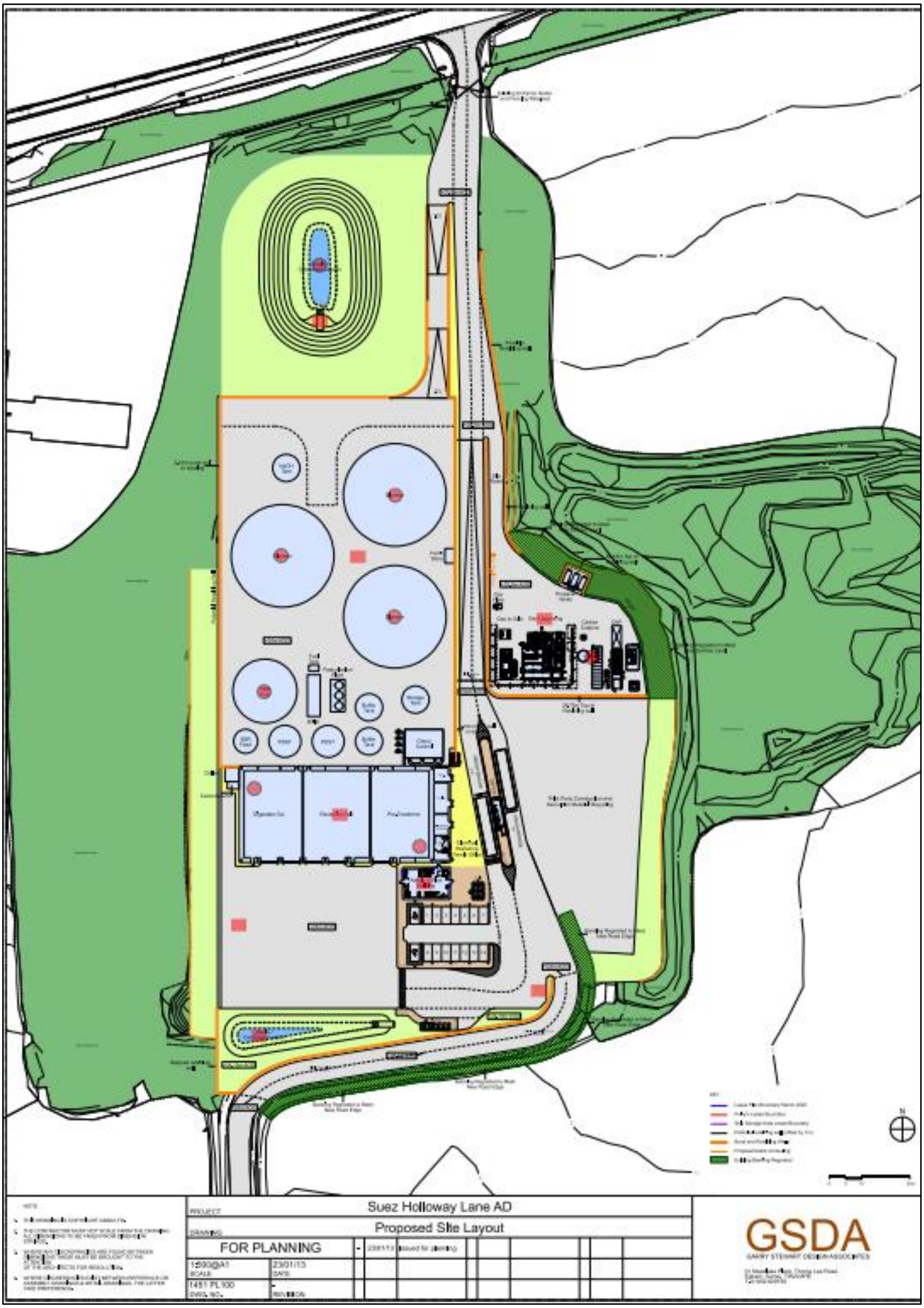


Figure 1-2. Holloway Lane Site Visualisation (after SUEZ)

Figure 1-3. Proposed AD Site Layout



1.2 OVERVIEW AND SCOPE OF ASSESSMENT

The operation of the facility may result in bioaerosol emissions from a number of activities with the potential impact on the existing sensitive receptors in the surrounding area. The bioaerosols may be released from the AD process building and biofilter system.

The principal objective is to investigate off-site bioaerosol concentrations at nearby sensitive receptors after the operation of a new AD Facility.

The assessment steps include the following:

1) Identification of bioaerosol emission sources;
2) Representations of the bioaerosol releases in the modelling; and
3) Predicting the potential additional health risk with the operations of the proposed new AD facility.

1.3 CONTEXT

The objective of this bioaerosol risk assessment is to determine whether off-site impacts from the proposed AD facility meet the required acceptable levels (AL) for the protection of human health.

The detailed modelling results have been presented in this report in terms of the emitted pollutant Process Contribution (PC) and Predicted Environmental concentration (PEC = PC+ Background concentration). AERMOD modelling was undertaken for the most representative meteorological dataset and the worst-case, highest predicted long-term and short-term PECs were compared to the appropriate acceptable levels.

1.4 REPORT STRUCTURE

Following this introductory section, the remainder of this report is structured as follows:

- Section 1.0: Introduction
- Section 2.0: Definition of Bioaerosols and Health Effects
- Section 3.0: Legislation and Best Practice Guidance
- Section 4.0: Bioaerosol Risk Assessment
- Section 5.0: Detailed Modelling Assessment Results
- Section 6.0: Conclusions

All technical Appendices are included at the end of this report for information.

2.0 DEFINITION OF BIOAEROSOLS AND HEALTH EFFECTS

2.1 BIOAEROSOLS

'Bioaerosol' is a broad term used to describe potentially biologically active matter including microorganisms and their constituent parts: bacteria, fungi, viruses, spores, moulds, rusts, protozoa, pollens, etc. and their degradation products and toxins etc. Bioaerosols are typically associated with organic materials and may be present as clumps, aggregates, or single cells, which may or may not be attached to particles of other material.

Bioaerosols occur naturally in the environment and concentrations vary widely. Bioaerosol sources include natural organic processes in grassland, agriculture and woodland, trades such as leather working, farming, food preparation, woodworking, and human activity in homes, offices, schools, hospitals, canteens as well as waste disposal.

Bioaerosols can be transported by air movements or by attachment to other objects (e.g. dirt attached to vehicle tyres or particulate carried in the wind). Transport by wind is most significant and therefore 'line of sight' with the absence of significant barriers is relevant for the assessment of pathways and identification of receptors. Winds >3.1m/s are more normally associated with lifting and transport of organic particulate. Barriers can create 'sheltered' areas enabling deposition of particles of small size. Barriers can also deflect wind away from the source to prevent release away from the receptor to prevent exposure.

Bioaerosols generated from mushroom growing generally contain the same microorganisms commonly encountered in 'normal' outdoor air. However, where they are released in large quantities, they have the potential to influence some aspects of public health.

Whilst occurring everywhere, microorganisms are fragile and die rapidly on exposure, though individual particles may travel over several kilometres. However, with a combination of dispersion, particulate drop out and loss of viability, bioaerosol concentrations rapidly reduce with distance from the source. Studies indicate that bioaerosol from open window composting is usually reduced to background levels within 200m of the source (often within 100m). The Environment Agency's position is more cautious, with guidance in '*Composting and potential health effects from bioaerosols: out interim guidance for permit applicants',* Position Statement 031, Version 1.0, 1st November 2010, stating that:

> *"The consensus from various studies is that bioaerosols from composting activities decline rapidly within the first 100 metres from a site and generally decline to background levels within 250m".*

Enclosed systems are recognised as providing better control of bioaerosol releases. Compost disturbance is reduced, minimising the generation of bioaerosol and improved control of temperature and conditions eliminate pathogenic micro-organisms.

2.2 HEALTH EFFECTS

Bioaerosols are generally less than 10μm in size and can penetrate deep into the lungs; causing respiratory and gastro-intestinal symptoms such as inflammation, coughs, fever and exacerbation of respiratory diseases. Endotoxins cause symptoms from eye irritation and dermatitis or in extreme cases resemble those of influenza, such as shivering, an increase in body temperature, dry cough, and muscle and joint pains. Relevant to composting are infections caused by *Aspergillus fumigatus*. Invasive aspergillosis is a severe infection, which may be fatal and is a concern with ‘at risk’ and ‘immunosuppressed’ patients (*Guidance on the evaluation of bioaerosol risk assessment for composting facilities*, Cranfield University, Published by the Environment Agency, 2009).

Organic Dust Toxic Syndrome (ODTS) is an acute disease, which results in symptoms resembling those of influenza, such as shivering, an increase in body temperature, dry cough, and muscle and joint pains (Rylander, 1997). Particularly relevant to waste management facilities are infections caused by *Aspergillus fumigatus*. Invasive aspergillosis is a particularly severe infection, which may be fatal and is primarily a concern with at risk and immuno-suppressed patients (*Guidance on the evaluation of bioaerosol risk assessment for composting facilities*, Cranfield University, Published by the Environment Agency, 2009).

One of the current knowledge gaps for bioaerosols is their dose-response relationships. We currently cannot state with any certainty that a given concentration will result in a particular health impact. This is because of the number of bioaerosols as well as the complexities associated with human responses to different micro-organisms (*Guidance on the evaluation of bioaerosol risk assessment for composting facilities*, Cranfield University, Published by the Environment Agency, 2009).

3.0 LEGISLATION AND BEST PRACTICE GUIDANCE

Section 11.4 of the EA's "Biological waste treatment: appropriate measures for permitted facilities" Guidance, published 21 September 2022 and updated 6 July 2023 states:

"3. If your facility is within 250 metres of a sensitive receptor, you must:

- *write and implement a site specific bioaerosol risk assessment; and*
- *monitor bioaerosols to make sure that the control methods you have stated are effective."*

The nearest 'highly sensitive' residential receptor is the property at 46 Harmondsworth Lane, which is located approximately 145 m southeast of the proposed AD facility. The closest sensitive receptor is a commercial property off Holloway Lane, located approximately 50 m northwest of the proposed AD facility. As such, a Bioaerosol Risk Assessment has been undertaken to assess the potential impact on bioaerosols associated with the proposal.

The site-specific bioaerosol risk assessments provide operators with the basis for identifying operational controls on site and allow them to target controls where exposures to significant hazards are of greatest concern. Furthermore, they should reassure the regulator and local communities that facilities are being operated safely and responsibly without undue risks to operational staff, to public health or to the environment.

The EA's Position Statement of "composting and potential health effects from bioaerosols: our interim guidance for permit applicants" (1st November 2010) provides the definitions of the receptors and acceptable levels at the receptors.

Receptors

The term 'receptor' refers to people likely to be within 250 m of the composting operation for prolonged or frequent periods. This term would therefore apply to dwellings (including any associated gardens) and to workplaces where workers would frequently be present. It does not apply to the operators of composting facilities or their staff while carrying out the composting operation as their health is covered by Health and Safety legislation.

Acceptable Levels at the Receptors

This refers to the concentrations of bioaerosols (as predicted or as derived from direct measurements) at the receptors which are attributable to the composting operations. The acceptable levels are 1000 and 500 cfu/m^3 for total bacteria and *Aspergillus* respectively (*Guidance on the evaluation of bioaerosol risk assessment for composting facilities*, Cranfield University, Published by the Environment Agency, 2009).

4.0 BIOAEROSOL RISK ASSESSMENT

4.1 IDENTIFICATION OF BIOAEROSOL EMISSION SOURCES

The operation of the facility may result in bioaerosol emissions from a number of activities. The following potential sources were identified as potential bioaerosol emission sources:

(1) Bioaerosol emissions from odour control stack emission; and
(2) Fugitive emissions from the AD Process Building.

4.1.1 Bioaerosol Emissions from Odour Control System

It is proposed that an odour control system will be installed at the site. The odour control system will consist of biofilters, activated carbon bed filters, and pre-bed dust filtration to treat the odorous air that are extracted from the processing buildings and the local extraction sources. The proposed odour control system will reduce the odour emissions and will reduce the bioaerosol emissions as well.

The Ventilation rate requirements (air to be treated) from Building Extraction and Local / Source Extraction are detailed as below:

Building Extraction:

(1) Pre-treatment Building. Ventilation rate at 3 Air changes / hour is 20,300 m^3/hr;
(2) Reception Hall / Building. Ventilation rate at 3 Air changes / hour is 32,500 m^3/hr; and,
(3) Digestate Out Building. Ventilation rate at 3 Air changes / hour is 29,800 m^3/hr.

Total Building Extraction Rate required: 82,600 m^3/hr.

Local / Source Extraction:

(1) Hydrolysis Buffer Tanks. Maximum Feed Rate 200 m^3/hr;
(2) Pasteurisation Plant. Maximum Feed Rate 200 m^3/hr;
(3) Pre-Treatment units and associated Local Extract Ventilation (LEV) equipment - estimated 4200 m^3/hr; and,
(4) Digestate Dewatering unit and associated LEV equipment - estimates 500 m^3/hr.

Total Local / Source Extraction Rate required: 5,100 m^3/h.

It is proposed that odour control is utilising a Biofilter for the Local / Source Extraction, before discharging into the main Extract duct, and utilising an Activated Carbon deep-bed filter for the Main building Extract.

4.1.2 Bioaerosol Emissions from AD Process Building Doors

All putrescible waste for the AD facility will be unloaded and pre-treated from within an enclosed building. This building benefits from a fast-acting door and will be kept closed when not in use (i.e. arrival or departure of vehicles). In addition, pedestrian doors are also closed when not in direct use. This will minimise the potential for any bioaerosols generated on site to impact receptors beyond the site boundary.

The AD facility will operate 24 hours a day and 7 days a week, vehicle movements will be restricted to 07:00 – 19:00 Monday – Sunday.

Although it is considered that the stated control mechanisms will provide effective reductions in bioaerosol concentrations, it is recognised that there is the potential for the release of residual bioaerosols when the trucks/lorries entering or leaving the building. As such, emissions have been evaluated further as part of the dispersion modelling assessment.

4.2 BIOAEROSOL EMISSION RATES

4.2.1 Bioaerosol Emission Rates for Odour Control System

The bioaerosol emission rates from the odour control system have been derived from the article titled 'Impact of Bed Material Type and Waste Gas Origin', by Katarzyna Affek et al, 2021 (https://www.mdpi.com/2073-4433/12/12/1574). The paper discussed the biofilters were applied to treat waste gases at different industrial sites including a mechanical–biological treatment plant of municipal solid waste, a wastewater treatment plant, and a food industry plant. Two types of materials were used as beds in the biofilters as follows:

- Stump wood chips and pine bark; and,
- Stump wood chips, pine bark and compost from green waste.

The maximum bacteria concentrations in the treated gas for all biofilters at different industrial sites range 4,000 to 11,000 CFU/m^3, with an average of 7,200 CFU/m^3. The maximum bacteria concentration of 11,000 CFU/m^3 for the biofilter treated air has been used to produce a worst-case assessment. In addition, an assumption of the bacteria concentration of 11,000 CFU/m^3 for the main building extraction air after an activated Carbon deep-bed filter treatment has been made for the assessment. Therefore, the air volumes and bacteria concentrations for the odour control system are summarised as follows:

(1) Total Building Extraction volume of 82,600 m^3/hr with bacterial concentration of 11,000 CFU/m^3; and,
(2) Total Local / Source Extraction volume of 5,100 m^3/h with bacterial concentration of 11,000 CFU/m^3.

4.2.2 Fugitive Bioaerosol Emission Rates from AD Process Building Doors

A line source has been used for representing the bioaerosol release from the opening AD process building door. An emission rate of 10^5 CFU/m/s has been used and which is derived from the emission data in the final report titled 'Defra Project WR 1121 Bioaerosols and odour emissions from composting facilities' (20 August 2013).

The fast acting door will only be open to accommodate access for the lorry entering or leaving the building. When considering lorry movements it is reasonable to assume that the shutter could potentially be open for a maximum of 5 minutes in any 1 hour.

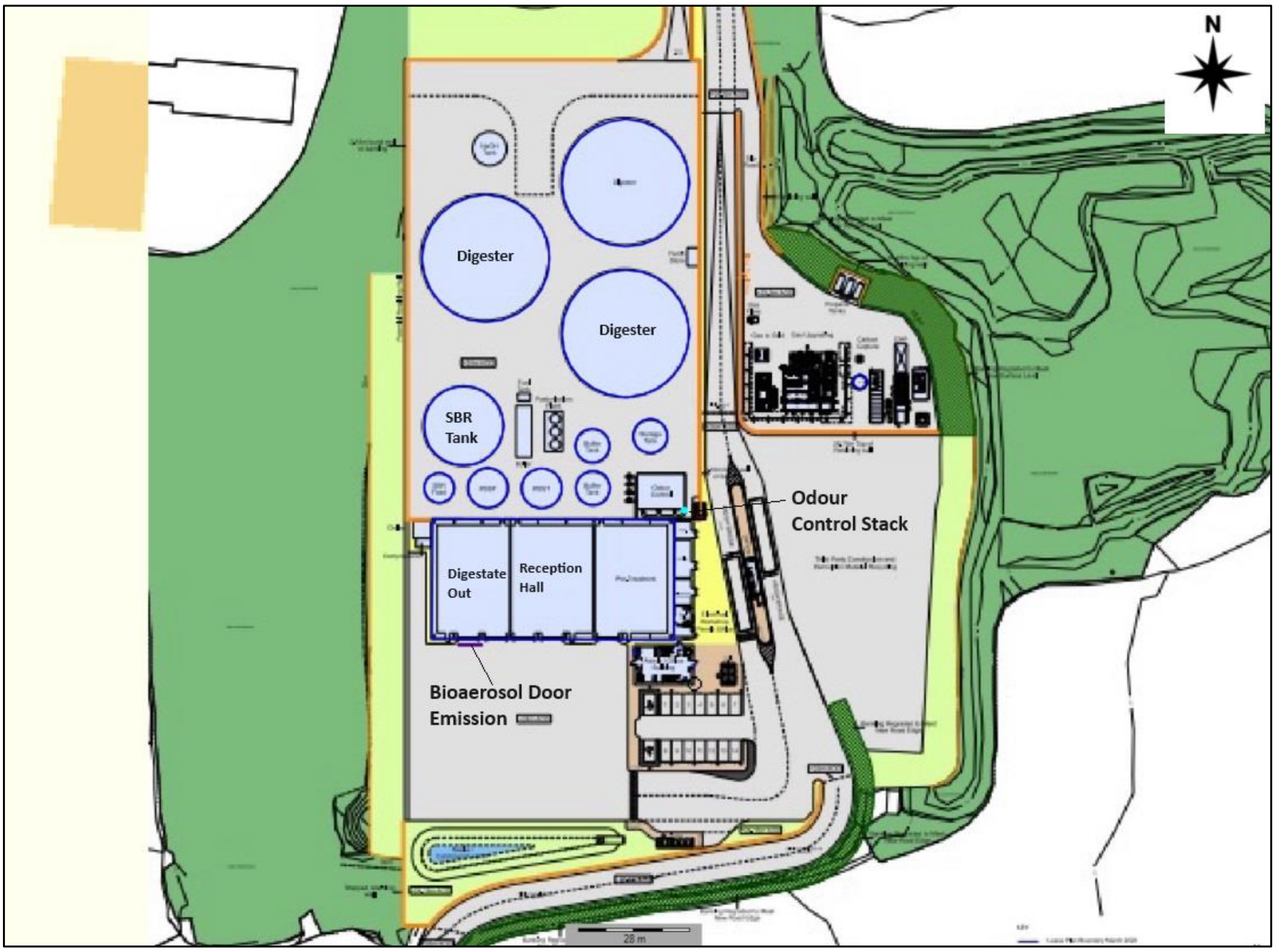
4.3 REPRESENTATIONS OF THE BIOAEROSOL RELEASES IN THE MODELLING

The bacteria emissions used within AERMOD and the odour control system stack parameters are presented in **Table 4-1**. The locations of the modelled emission sources are illustrated in **Figure 4-1**.

Table 4-1. Bacteria Emissions for the Assessment and Stack Parameters

Parameter	Emission Rate	Unit
Odour Control System Stack – Modelled as a Point Source		
Total Gas Volume	82,600 m^3/hr of building extraction rate + 5100 m^3/hr = 87,700 m^3/hr	m^3/hr
Bacteria Concentrations	11,000	CFU/m^3
Stack Gas Temperature	25	°C
Bacteria Emission Rate	2,012,228	CFU/s
Stack diameter	1.3	m
Stack velocity	17.29	m/s
Stack Height	18.3 m above Ground Level	m
Fugitive Bioaerosol Emissions from AD Process Building Door – Modelled as a Line Source		
Line Source length	6	m
Line Source Bacteria Emission Rate	10^5	CFU/m/s
Release Height	6 m above Ground Level	m

Figure 4-1. Modelled Bioaerosol Emission Sources



4.4 SENSITIVE RECEPTORS

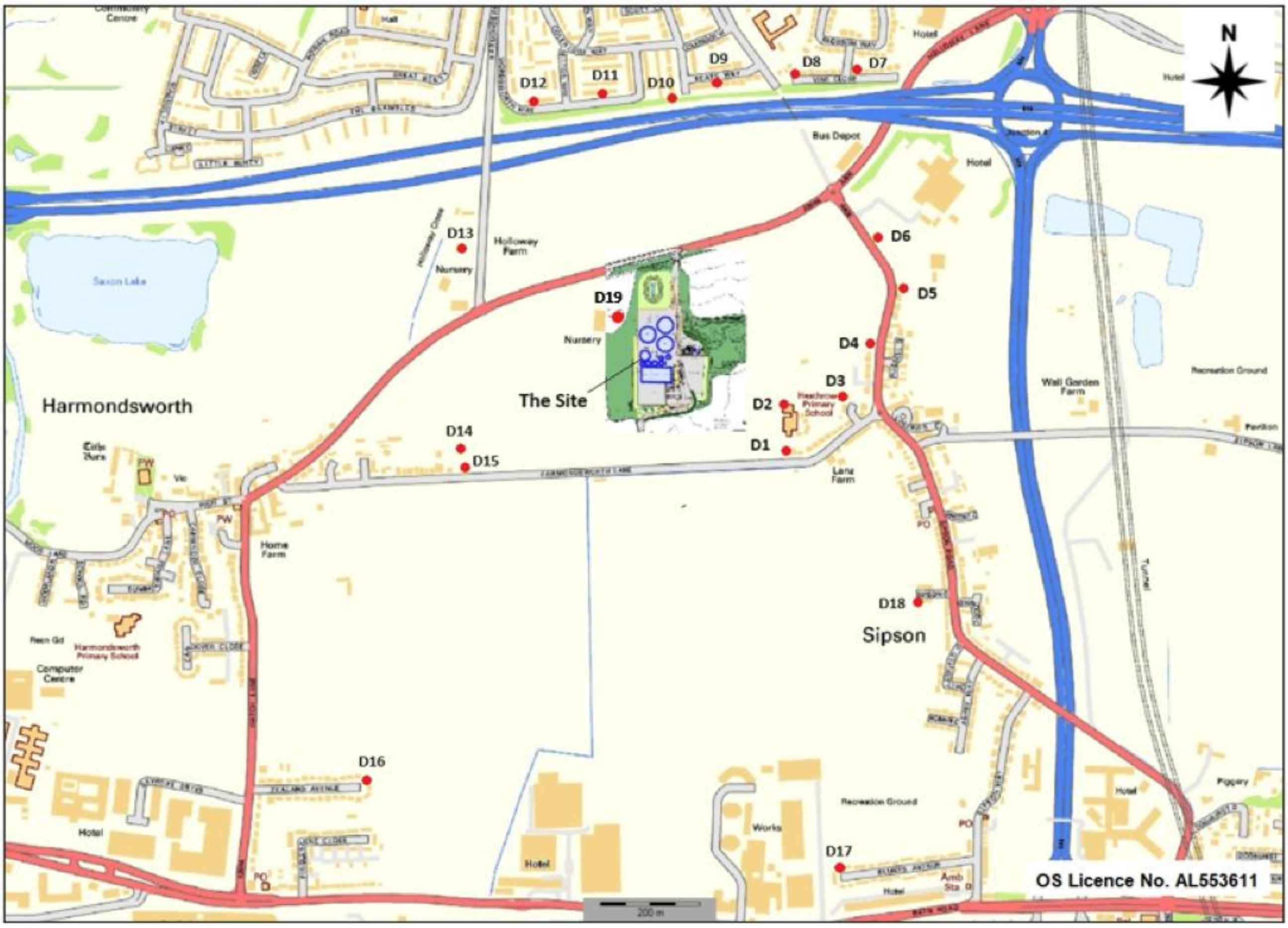
The discrete sensitive receptors identified for the purposes of this air quality assessment are contained in **Table 4-2** and shown in **Figure 4-2**. The assessment has also been undertaken to determine the potential impacts on those selected receptors.

It should be noted that these do not represent an exhaustive list of all receptors within the vicinity of the Site, rather worst-case representative locations within and adjacent to the site.

Table 4-2. Modelled Sensitive Human Receptors

Receptor ID	Receptor Name	UK NGR (m)	
		X	Y
D1	46 Harmondsworth Lane	506982	177865
D2	Heathrow Primary School	506976	177956
D3	18 Wykeham Close	507091	177977
D4	356 Sipson Road	507147	178084
D5	241 Sipson Road	507210	178191
D6	239 Sipson Road	507159	178294
D7	15 Vine Close	507119	178629
D8	2 Vine Close	506998	178625
D9	88 Keats Way	506842	178607
D10	74 Keats Way	506751	178581
D11	231 Wordsworth Way	506610	178585
D12	177 Wordsworth Way	506478	178570
D13	Holloway Farm	506327	178275
D14	62a Harmondsworth Lane	506327	177867
D15	62 Harmondsworth Lane	506337	177828
D16	21 Zealand Ave	506136	177203
D17	64 Blunts Ave	507090	177027
D18	30 Sipson Close	507251	177563
D19	Ansell Garden Centre	506647	178118

Figure 4-2. Location of Sensitive Human Receptors

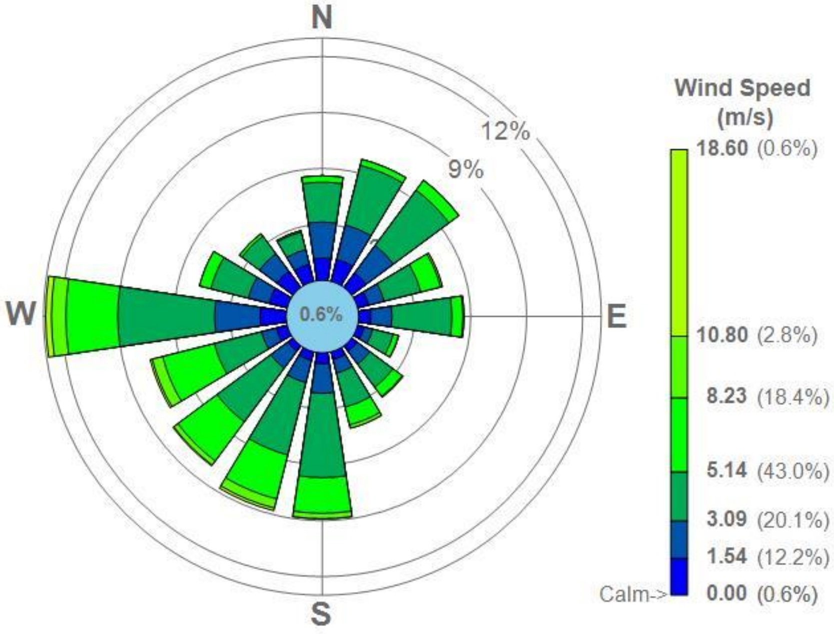


4.5 METEOROLOGICAL DATA

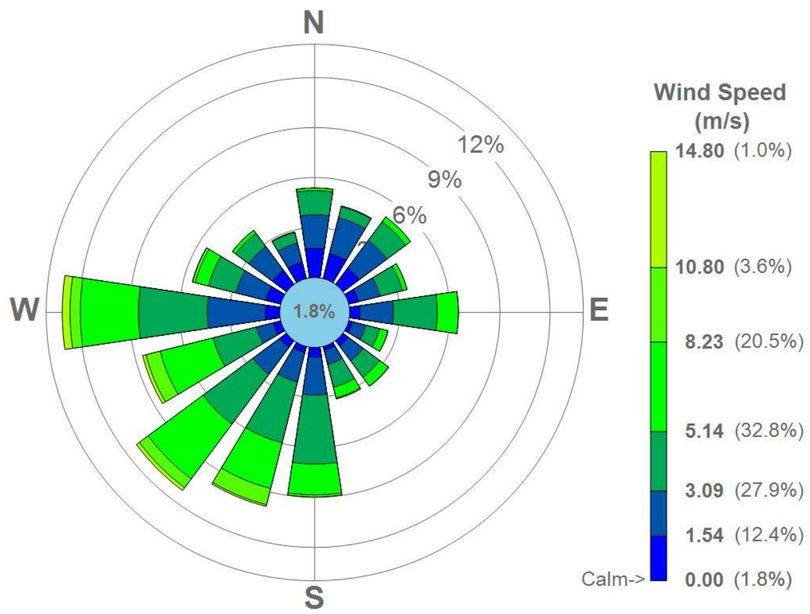
The 5-year meteorological data (2018 – 2022 inclusive) used in the assessment is derived from Heathrow Airport weather station, which is considered representative of conditions within the vicinity of the site, with all the complete parameters necessary for the AERMOD model. Reference should be made to **Figure 4-3** for an illustration of the prevalent wind conditions at the Heathrow Airport weather station.

Figure 4-3. Heathrow Airport Meteorological Station Windrose

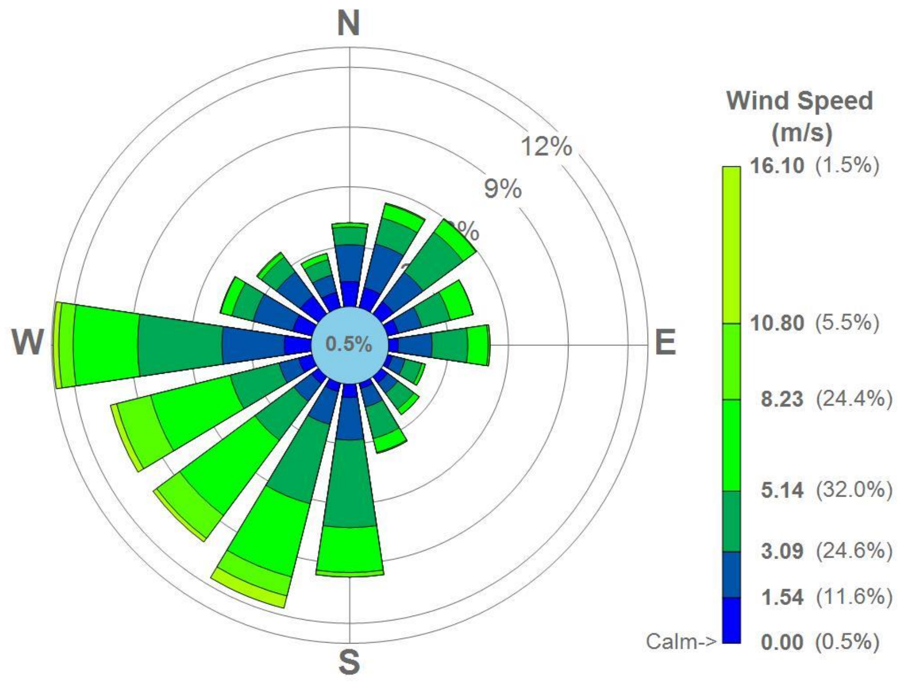
2018 Windrose



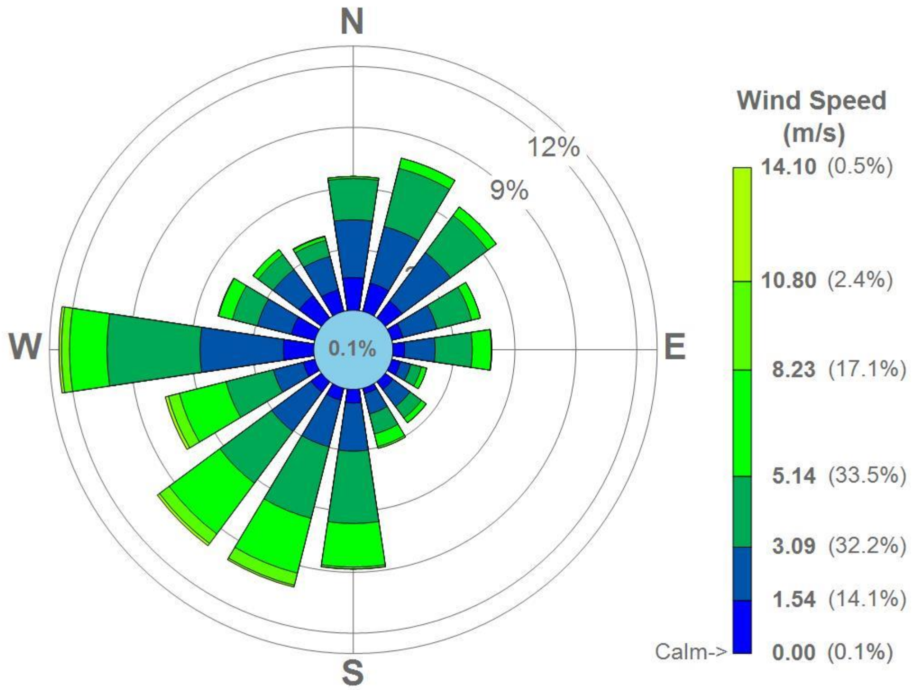
2019 Windrose



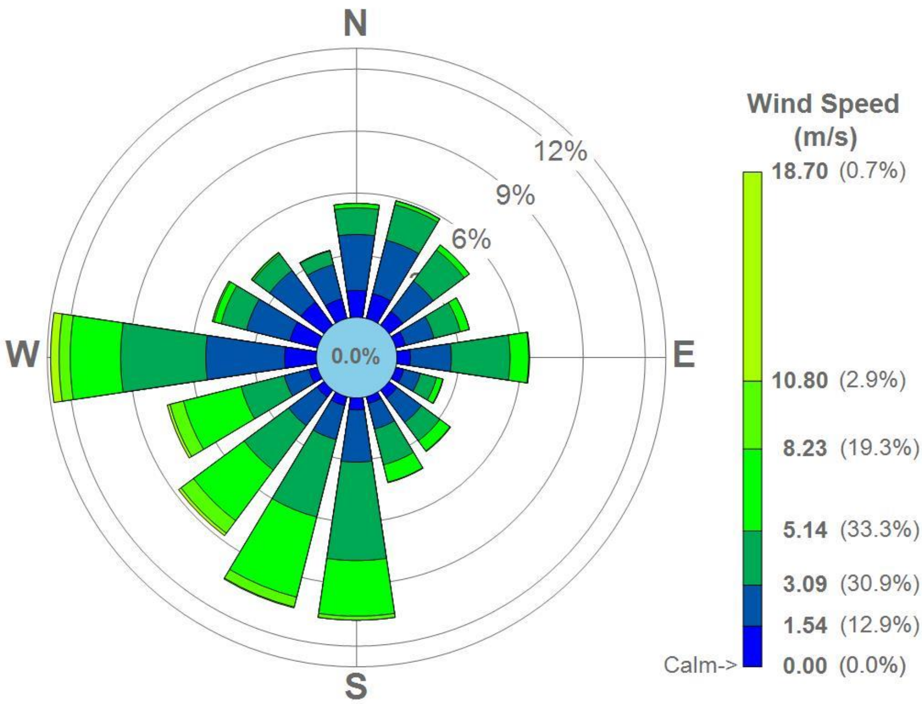
2020 Windrose



2021 Windrose



2022 Windrose



4.6 SURFACE CHARACTERISTICS

The land uses surrounding the Site are mostly described as farmlands, open fields and residential properties. A surface roughness value of 0.5 (the value for open suburbia areas) has been used in the modelling for a worst-case assessment.

4.7 BUILDINGS IN THE MODELLING ASSESSMENT

Buildings nearby or immediately adjacent to the stacks could potentially cause building downwash effects on emission sources and have therefore been modelled. The locations and dimensions of the buildings used in the model are given in **Table 4-3** and illustrated in **Figure 4-4.**

Table 4-3. Locations and Heights of Buildings Used in the Model

ID	Name	UK NGR (m)		Modelled Building Height (m)	Note
		506689	178036		
1	Main Process Building	506689	178036	16.0	-
2	Storage Tank	506743	178056	11	Radius = 4.3 m
3	Buffer Tank1	506729	178054	16.64	Radius = 4.3 m
4	Buffer Tank2	506729	178043	16.64	Radius = 4.3 m
5	PDST Tank1	506716	178043	10.28	Radius = 5.0 m
6	PDST Tank2	506703	178043	10.28	Radius = 5.0 m
7	SBR Feed Tank	506690	178043	8.37	Radius = 3.8 m
8	SBR Tank	506697	178059	10.77	Radius = 110 m
9	Digester 1	506737	178082	15.3	Radius = 16 m
10	Digester 2	506737	178120	15.3	Radius = 16 m
11	Digester 3	506702	178101	15.3	Radius = 16 m
12	Carbon Capture Unit	506796	178070	15.9	Radius = 1.74 m

Figure 4-4. Locations of Modelled Buildings

4.8 TREATMENT OF TERRAIN

The presence of steep terrain can influence the dispersion of emissions and the resulting pollutant concentrations. USEPA guidance indicates that terrain effects should be considered if the gradient exceeds 1:10. A digital terrain file in the UK Ordnance Survey (OS) Landranger format (.NTF) has been used in the assessment.

4.9 MODELLING UNCERTAINTY

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

- Model uncertainty - due to model limitations;
- Data uncertainty - including emissions estimates, background estimates and meteorology; and,
- Variability - randomness of measurements used.

However, potential uncertainties in model results have been minimised as far as practicable and worst-case inputs considered in order to provide a robust assessment. This included the following:

- Choice of model - AERMOD is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Facility operating parameters - Operational parameters were provided for the facility;
- Emission rates - Emissions were based on 24-hour operation, this is likely to overestimate impacts as periods of shut down have not been considered;
- Background concentrations - Background pollutant concentrations were obtained from a number of recognised sources in order to consider baseline levels in the vicinity of the site, as detailed within the main report text; and,
- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered where necessary in order to ensure a robust assessment of potential pollutant concentrations.

5.0 DETAILED MODELLING ASSESSMENT RESULTS

The detailed atmospheric dispersion modelling of process emissions was undertaken using the input parameters detailed in Section 4.

All predicted concentrations have been compared to the relevant environmental assessment criteria, as detailed in Section 3.

5.1 LONG-TERM (LT) MODELLING

As there are no long term statutory Environmental Assessment Levels or Environmental Quality Standards for long term releases of bioaerosols, only an acceptable level, we have used the acceptable levels as outlined within the EA’s own guidance documents and compared long term releases to these acceptable levels.

5.1.1 Total Bacteria (LT)

The long-term emissions of total bacteria at identified receptors from the sources considered were assessed for all 5 years of meteorological data. The maximum PCs of total bacteria at the receptor are presented in **Table 5-1**. From the meteorological dataset, the year resulting in maximum long-term total bacteria concentration at sensitive residential receptor location was identified as 2020. Therefore, the 2020 results have been used to compare the acceptable levels.

Table 5-1. The Long-Term Process Concentrations of Total Bacteria

ID	Name	Long-Term Process Contribution (PC) cfu/m^3				
		2018 Met Data	2019 Met Data	2020 Met Data	2021 Met Data	2022 Met Data
D1	46 Harmondsworth Lane	1.99	2.06	1.79	1.98	2.21
D2	Heathrow Primary School	2.76	2.75	2.36	2.26	2.77
D3	18 Wykeham Close	2.44	2.53	2.11	2.09	2.37
D4	356 Sipson Road	2.92	2.84	2.99	2.48	2.53
D5	241 Sipson Road	2.55	2.69	3.16	2.47	2.37
D6	239 Sipson Road	2.54	3.05	3.11	2.67	2.54
D7	15 Vine Close	1.95	2.33	2.41	2.30	2.23
D8	2 Vine Close	2.05	2.44	2.67	2.50	2.47
D9	88 Keats Way	1.99	2.25	2.38	2.35	2.48
D10	74 Keats Way	2.21	2.20	2.27	2.13	2.47
D11	231 Wordsworth Way	1.56	1.34	1.68	1.48	1.81
D12	177 Wordsworth Way	1.35	1.16	1.24	1.06	1.38
D13	Holloway Farm	0.71	0.71	0.56	0.49	0.67
D14	62a Hamondsworth Lane	1.89	1.74	1.97	1.99	1.78
D15	62 Hamondsworth Lane	2.27	1.83	2.16	2.41	1.97
D16	21 Zealand Ave	0.97	0.76	0.79	1.00	0.76
D17	64 Blunts Ave	0.34	0.40	0.34	0.47	0.37
D18	30 Sipson Close	0.65	0.67	0.62	0.71	0.77
D19	Ansell Garden Centre	2.87	2.65	2.29	2.19	3.18

There is no bioaerosol background information background available at the Site.

An ambient bioaerosol background value, however, has been used in the assessment and which is derived from a bioaerosol concentration sampling data at a composting facility in Leicestershire. The sampled composing site is situated in a rural setting. A total of 15 bioaerosol samples at the upwind locations to the composting site has been analysed and the those sampled concentrations can be used to represent background levels. The sampled bioaerosol concentrations range from less than 167 cfu/m^3 to 389 cfu/m^3, with an average of 261 cfu/m^3. A background bioaerosol concentration value of 389 cfu/m^3 has been used.

In addition, a sampled background 'fungi as aspergillus' concentration value of 167 cfu/m^3 has been used in the assessment.

The total bacteria concentrations (PC + background concentration) using 2020 met data (the year resulting in maximum long-term PC concentration), are presented in **Table 5-2**.

Table 5-2. The Maximum Long-Term (Annual Mean) PEC of Total Bacteria

ID	Name	Long-Term Process Contribution (PC) cfu/m^3		
		Process Contrib'tn (PC)	Background[(a)]	PEC[(a)] (PC +Background)
D1	46 Harmondsworth Lane	1.79	389	390.79
D2	Heathrow Primary School	2.36	389	391.36
D3	18 Wykeham Close	2.11	389	391.11
D4	356 Sipson Road	2.99	389	391.99
D5	241 Sipson Road	3.16	389	392.16
D6	239 Sipson Road	3.11	389	392.11
D7	15 Vine Close	2.41	389	391.41
D8	2 Vine Close	2.67	389	391.67
D9	88 Keats Way	2.38	389	391.38
D10	74 Keats Way	2.27	389	391.27
D11	231 Wordsworth Way	1.68	389	390.68
D12	177 Wordsworth Way	1.24	389	390.24
D13	Holloway Farm	0.56	389	389.56
D14	62a Hamondsworth Lane	1.97	389	390.97
D15	62 Hamondsworth Lane	2.16	389	391.16
D16	21 Zealand Ave	0.79	389	389.79
D17	64 Blunts Ave	0.34	389	389.34
D18	30 Sipson Close	0.62	389	389.62
D19	Ansell Garden Centre	2.29	389	391.29

From **Table 5-2**, it can be seen that the predicted long term total bacteria concentrations at any of the modelled receptors are all below the acceptable level of 1000 cfu/m^3.

5.1.2 Fungi as Aspergillus (LT)

For fungi as aspergillus concentrations, the ratios of the measured fungi concentration to the measured mesophilic bacteria at a composting facility in Leicestershire have been calculated and the ratio has been identified as 26/100.

The fungi as aspergillus concentrations (PC + background concentration) using 2020 met data (the year resulting in maximum long-term PC concentration), are presented in **Table 5-3**.

Table 5-3. The Long-Term (Annual Mean) PEC of Fungi as Aspergillus

ID	Name	Long-Term Process Contribution (PC) cfu/m^3		
		Process Contrib'tn (PC)	Background[(a)]	PEC[(a)] (PC +Background)
D1	46 Harmondsworth Lane	0.46	167	167.46
D2	Heathrow Primary School	0.61	167	167.61
D3	18 Wykeham Close	0.55	167	167.55
D4	356 Sipson Road	0.78	167	167.78
D5	241 Sipson Road	0.82	167	167.82
D6	239 Sipson Road	0.81	167	167.81
D7	15 Vine Close	0.63	167	167.63
D8	2 Vine Close	0.69	167	167.69
D9	88 Keats Way	0.62	167	167.62
D10	74 Keats Way	0.59	167	167.59
D11	231 Wordsworth Way	0.44	167	167.44
D12	177 Wordsworth Way	0.32	167	167.32
D13	Holloway Farm	0.15	167	167.15
D14	62a Hamondsworth Lane	0.51	167	167.51
D15	62 Hamondsworth Lane	0.56	167	167.56
D16	21 Zealand Ave	0.21	167	167.21
D17	64 Blunts Ave	0.09	167	167.09
D18	30 Sipson Close	0.16	167	167.16
D19	Ansell Garden Centre	0.60	167	167.60

From **Table 5-3**, it can be seen that the predicted long-term fungi as aspergillus concentrations at any of the modelled receptors are all below the acceptable level of 500 cfu/m^3.

5.2 SHORT-TERM (ST) MODELLING

5.2.1 Total Bacteria (ST)

The short-term (1-Hour Mean) emissions of total bacteria at identified receptors from the sources considered were assessed for all 5 years of meteorological data. The maximum PCs of total bacteria at the receptor are presented in **Table 5-4**. From the meteorological dataset, the year resulting in maximum short-term total bacteria concentration at sensitive residential receptor location was identified as 2022. Therefore, the 2022 results have been used to compare the acceptable levels.

Table 5-4. The Short-Term Process Concentrations of Total Bacteria

ID	Name	Short-Term Process Contribution (PC) cfu/m^3				
		2018 Met Data	2019 Met Data	2020 Met Data	2021 Met Data	2022 Met Data
D1	46 Harmondsworth Lane	76.51	74.00	100.51	69.02	76.51
D2	Heathrow Primary School	114.71	87.81	95.38	95.35	114.71
D3	18 Wykeham Close	107.71	105.74	70.58	75.94	107.71
D4	356 Sipson Road	51.29	53.73	52.37	61.44	51.29
D5	241 Sipson Road	114.44	110.94	120.21	99.33	114.44
D6	239 Sipson Road	111.48	110.50	101.64	112.79	111.48
D7	15 Vine Close	100.51	89.03	100.49	90.30	100.51
D8	2 Vine Close	105.16	106.82	110.51	115.37	105.16
D9	88 Keats Way	126.91	123.52	117.17	126.88	126.91
D10	74 Keats Way	126.45	124.50	112.38	112.09	126.45
D11	231 Wordsworth Way	122.32	129.39	127.30	127.74	122.32
D12	177 Wordsworth Way	133.68	127.53	128.65	131.00	133.68
D13	Holloway Farm	44.39	49.80	54.27	51.24	44.39
D14	62a Hamondsworth Lane	138.90	156.47	157.43	134.96	138.90
D15	62 Hamondsworth Lane	149.29	125.22	133.47	126.58	149.29
D16	21 Zealand Ave	69.12	73.60	70.22	66.57	69.12
D17	64 Blunts Ave	58.90	63.06	54.87	70.65	58.90
D18	30 Sipson Close	84.34	90.03	81.63	91.02	84.34
D19	Ansell Garden Centre	137.88	117.11	147.69	127.82	123.03

The short-term total bacteria concentrations (PC + background concentration) using 2022 met data (the year resulting in maximum short-term PC concentration), are presented in **Table 5-5**.

Table 5-5. The Short-Term (1-Hour Mean) PEC of Total Bacteria

ID	Name	Short-Term Process Contribution (PC) cfu/m^3		
		Process Contrib'tn (PC)	Background[(a)]	PEC[(a)] (PC +Background)
D1	46 Harmondsworth Lane	76.81	389	465.81
D2	Heathrow Primary School	109.01	389	498.01
D3	18 Wykeham Close	73.65	389	462.65
D4	356 Sipson Road	51.11	389	440.11
D5	241 Sipson Road	95.26	389	484.26
D6	239 Sipson Road	106.04	389	495.04
D7	15 Vine Close	89.52	389	478.52
D8	2 Vine Close	111.62	389	500.62
D9	88 Keats Way	116.00	389	505.00
D10	74 Keats Way	125.48	389	514.48
D11	231 Wordsworth Way	124.07	389	513.07
D12	177 Wordsworth Way	124.40	389	513.40
D13	Holloway Farm	40.38	389	429.38
D14	62a Hamondsworth Lane	162.37	389	551.37
D15	62 Hamondsworth Lane	152.78	389	541.78
D16	21 Zealand Ave	78.52	389	467.52
D17	64 Blunts Ave	65.11	389	454.11
D18	30 Sipson Close	98.56	389	487.56
D19	Ansell Garden Centre	123.03	389	512.03

From **Table 5-5**, it can be seen that the predicted short-term total bacteria concentrations at any of the modelled receptors are all below the acceptable level of 1000 cfu/m^3.

5.2.2 Fungi as Aspergillus (ST)

The short-term concentrations (PC + background concentration) of fungi as aspergillus using 2022 met data (the year resulting in maximum short-term PC concentration), are presented in **Table 5-6**.

Table 5-6. The Short-Term (Annual Mean) PEC of Fungi as Aspergillus

ID	Name	Short-Term Process Contribution (PC) cfu/m³		
		Process Contrib'tn (PC)	Background[(a)]	PEC[(a)] (PC +Background)
D1	46 Harmondsworth Lane	19.97	167	186.97
D2	Heathrow Primary School	28.34	167	195.34
D3	18 Wykeham Close	19.15	167	186.15
D4	356 Sipson Road	13.29	167	180.29
D5	241 Sipson Road	24.77	167	191.77
D6	239 Sipson Road	27.57	167	194.57
D7	15 Vine Close	23.28	167	190.28
D8	2 Vine Close	29.02	167	196.02
D9	88 Keats Way	30.16	167	197.16
D10	74 Keats Way	32.62	167	199.62
D11	231 Wordsworth Way	32.26	167	199.26
D12	177 Wordsworth Way	32.34	167	199.34
D13	Holloway Farm	10.50	167	177.50
D14	62a Hamondsworth Lane	42.22	167	209.22
D15	62 Hamondsworth Lane	39.72	167	206.72
D16	21 Zealand Ave	20.41	167	187.41
D17	64 Blunts Ave	16.93	167	183.93
D18	30 Sipson Close	25.62	167	192.62
D19	Ansell Garden Centre	31.99	167	198.99

From **Table 5-6**, it can be seen that the predicted short-term fungi as aspergillus concentrations at any of the modelled receptors are all below the acceptable level of 500 cfu/m^3.

6.0 CONCLUSIONS

Tetra Tech have undertaken a bioaerosol risk assessment to assess the potential bioaerosol emission impacts in support of an application to vary the environmental permit to allow the operation of a new Anaerobic Digestion (AD) Facility at Holloway Lane, Holloway Lane, West Drayton, UB7 0AE .

The report comprises a bioaerosol dispersion modelling assessment undertaken in accordance with national and regulatory guidance for the assessment of risks. It appraises the potential for risks to human health at surrounding receptors.

Bioaerosols dispersion modelling assessment has been undertaken using AERMOD and representations of bioaerosols emissions from the operations of AD process facility.

The predicted long-term and short-term bioaerosol concentrations at the receptor locations are all below the acceptable levels of 1000 and 500 cfu/m^3 for total bacteria and Aspergillus respectively for the protection of public health.

APPENDIX A - REPORT TERMS & CONDITIONS

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