Bioaerosols
Sampling Report

For the
Composting Facility
at

Lawrence Landfill
Haverfordwest

M9 sampling
During Active Processes
10th September 2026

Prepared for:

Mr Guy Lawrence

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Tel: 07831 152121

Site assessed:
Permit Ref:
EPR/LB3930AT

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Sampling date **10th September 2026**
Report date **27th October 2026**

SUMMARY BIOAEROSOLS MONITORING AT THE COMPOSTING SITE

S1. The External Windrow Composting Operations

The Lawrence Landfill Ltd. composting facilities are located at the site at Lawrence Landfill, Dredgemans Hill Johnston, Haverfordwest, Pembrokeshire, SA62 3NX.
The relatively small scale composting activities service Pembrokeshire County Council, and forms part of the earth and construction materials production at the site. The throughput is approximately 6000 t/year.

The site is located in a rural agricultural setting and is set within a former quarry. The land generally rises from south to north, except that the operational workings are within a deep 'bowl'; which affords visual screening and decreases the site's exposure to wind. The overall site entails areas of minerals workings, aggregates recycling and earthworks. The land surrounding the site is landscaped to provide woodland, pools lakes and areas of shrubland. The site is bounded to the east by the A4076 main road that runs north south, and the access entry point is from this at the north-eastern corner of the site. Beyond the site boundary, to the north, west and south is open grass farmland. To the east there is some housing along the main road and a cemetery. Further east are fields of solar panels. There are two dwellings within the overall site which are the homes of the directors. To the south-west of the site, (at the western end of Clay Lane) there is the recent development of a modern dwelling (230m distant from the composting site).

S2. Bioaerosols, composting and health effects

Bioaerosols are complex mixtures of airborne micro-organisms and their products, and are ubiquitous, particularly in rural environments. Composting relies on bacteria and fungi and so these are prevalent. Significant health effects may be attributable to prolonged and high concentrations of *Aspergillus fumigatus;* however, these can be minimised by temperature control, moisture and good management.

S3. Natural Resources Wales Requirements to Monitor Bioaerosols Emissions – M9 2018

The Environmental Permit (dated 2015) shows the requirement to monitor Bioaerosols in the air around the site in accordance with the AfOR Protocol for Sampling Bioaerosols that was current at that time. In 2018 a new methodology (**2018 - M9 Technical Guidance Note**) was published and became the official Statutory Guidance and primary reference document regarding the sampling of bioaerosols. It replaced the AfOR Protocol. It included guidance regarding the threshold levels of Total Viable Bacteria and *Aspergillus Fumigatus* bioaerosols that should not be exceeded in the air at specified distances, downwind of composting sites. It removes the requirement to monitor 'Gram-Negative' bioaerosols which was previously required at specified sites (where Animal By-Products were processed).

The 2018 - M9 Technical Guidance Note [Appendix 1] provides a standardised approach for the monitoring of the bioaerosols. It describes how Bioaerosols are to be sampled and measured using a number of different techniques. One of the techniques is the use of Andersen type samplers (impaction method) as used in this instance. It describes how sampling should be carried out upwind and downwind using a 'fan-shaped' array of samplers in the downwind direction from the site. [see Appendix 1 to this report].

S4. This Report

This report provides the results of air quality sampling carried out during the afternoon of **10th Sept 2026** in the area near to and around the composting facility: in particular in the Upwind and Downwind areas. The timing coincided with the **GREEN WASTE SHREDDING and FEEDSTOCK MOVEMENT** operations being undertaken and these activities continued throughout the sampling session. The wind was from the **West** and so was generally **blowing across the site and out to the East, towards the site entrance.**

S5. Results and Conclusions

The results of sampling suggest that under these conditions, there were variable but **LOW** levels of bioaerosols generated and released from the compost **GREEN WASTE SHREDDING** activity.

The **Maximum Median** Downwind Bioaerosol level of **Total Bacteria** was **131 cfu/m^3 and the Aspergillus Fumigatus** was **18 cfu/m^3** . The downwind Bioaerosols levels attributable to the compost site were therefore **only LOW** overall and **were less than 15%** of the NRW Guideline thresholds.

As the bioaerosols emission levels were < 15% of guidance thresholds it is safe to conclude that the composting activities pose minimal adverse risk to the health of persons in the nearby dwellings.

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MCIWM CEnv. Tel: 07785 352993

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This Report provides the results of a specific one-day session of sampling of bioaerosols at the Composting Facility. The report follows guidelines provided within the "M9 Monitoring Guidance" for monitoring bioaerosols. The results are compared to M9 Guideline values.

Reference to The M9 2018 Monitoring Guidance
The **M9 Monitoring Guidance** (Summary shown at Appendix 1.) is referred to throughout; and was used as the basis for the methodology employed during these sampling sessions because it is more rigorous and takes better account of variations with regard to wind direction changes during sampling.

Recogen Ltd. Environmental Quality Reporting – An Independent Assessor
For the purposes of quality assurance in undertaking this monitoring work, Recogen Ltd. is a recognised organisation with appropriately trained, qualified and experienced personnel; *independent* to the composting site operator. This monitoring work was undertaken by D J Baldwin, BSc (Hons) CEnv. MCIWM, Technical Director with Recogen Ltd. who has >40 years waste and environmental management experience. David is FACTS (fertiliser advice certification) qualified and has the Environmental Permit Operators Certificate and is WAMITAB Registered.

Recogen Ltd. is registered as a Quality Environmental Consultancy on the National Business Link Register and is a supplier of Technical Consultancy to DEFRA, The Waste and Resources Action Programme (WRAP) and to The Renewable Energy Association - Organic Recycling Group formerly known as 'The Composting Association'.

David has managed or contributed to many major projects on waste management for Government (**DEFRA, ETSU, DTI, WRAP, EA**) and The Waste Management Industry including Composting and Anaerobic Digestion processes, compost site design, product quality assurance (PAS100:2005, 2011 and 2018), PAS110, The Compost Quality Protocol, ISO9001, ISO14001, COSHH and H&S Risk Assessments.

The Laboratory used for provision and enumeration of the Collection Plates was: D&F Associates Limited, Shell Green House, Gorsey Lane, Widnes, Cheshire WA8 0YZ.

Box 1. Notes:
1. Culture media supplied by D and F Associates Laboratory (Widnes, Cheshire) is based on that specified in the M9 Guidance. The mediums used for the identification of bacteria and the *Aspergillus Fumigatus* type fungi species are in accordance with The Guidance.

2. D and F Associates Laboratory (Widnes, Cheshire) are UKAS accredited for many analyses and also runs its own internal Quality Management System. All media preparation and storage, whether for UKAS accredited analyses or otherwise, is carried-out in accordance with UKAS approved Standard Operating Procedures and fully recorded to appropriate standards.

3. D and F Associates Laboratory is on the approved list of Laboratories for the Environment Agency and is regularly called upon to undertake R&D work for the Environment Agency.

BIOAEROSOLS MONITORING - DEFINITIONS

Bioaerosols, composting and health effects

Bioaerosols are complex mixtures of airborne micro-organisms and their products, and are ubiquitous, particularly in rural environments. The most serious health problems appear to arise from *Aspergillus Fumigatus*, but there are other fungal spores and bacteria that cause problems. International studies have shown that there is a wide variability in individual susceptibility to bioaerosol exposure.

Commercial scale composting activities tend to generate large amounts of bioaerosols; and these are likely to contain human allergens and pathogens. They have potential effects on respiratory health and may cause headaches, nausea and fatigue. There has been very little investigation into the effects of community exposure to bioaerosols from composting, but there is some limited data that suggest that living close to a composting facility may be associated with an increased risk of adverse health effects. 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.

Composting

Composting is the biological decomposition of biodegradable waste under conditions that are predominantly aerobic and that allow the development of thermophilic temperatures as a result of biologically produced heat. It may include associated waste storage and treatment operations carried out at the composting facility.

Operations

…likely to result in the uncontrolled release of high levels of bioaerosols
Include the shredding of waste and the turning of waste in the sanitisation, stabilisation and maturation stages of composting where these operations are not contained or are not subjected to exhaust ventilation and scrubbing/filtering.

Sensitive receptors (SR's)

'Sensitive receptors' refers to people likely to be within 250 metres 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. M9 Technical Guidance Box 5.1 provides the following:

> **Box 5.1: definition of nearest sensitive receptor for composting and anaerobic digestion for standard rules permits**
>
> 'Nearest sensitive receptor' means the nearest place to the permitted activities where people are likely to be for prolonged periods. This term would therefore apply to dwellings (including any associated gardens) and too many types of workplaces. We would not normally regard a place where people are likely to be present for less than 6 hours at one time as being a sensitive receptor. The term does not apply to those controlling the permitted facility, their staff when they are at work or to visitors to the facility, as their health is covered by Health and Safety at Work legislation, but would apply to dwellings occupied by the family of those controlling the anaerobic digestion facility.

Acceptable levels at the sensitive receptors

Refers to the concentrations of bioaerosols (as predicted or as derived from direct measurements) at the sensitive receptors that are attributable to the composting operations. EA Policy documents have determined that the acceptable (appropriate) levels (given as colony forming units per cubic metre of air) are:

Bioaerosol type	Threshold value	units
total bacteria	1000	cfu m^{-3}
Aspergillus Fumigatus	500	cfu m^{-3}

M9 Sampling and This Site

In 2018 the EA published M9 which provides guidance on more detailed standardised methods for the sampling of bioaerosols. Specifically, the guidance is in regard to point source emissions (stacks) and biofilter emissions, but also provides guidance for using a 'fan-shaped' downwind array for sampling stations.

When the Permit for this site was granted the prescribed sampling methodology was The AfOR Protocol for Sampling Bioaerosols. The permit also mentions gram-negative bacteria. The methods used for the sampling in this report embrace the **M9 methodology** that includes a downwind fan shaped array of samplers and takes account of the need for sampling at a distance downwind that equates to that to the Nearest Sensitive Receptor. The M9 methodology does not require Gram-negative bacteria sampling.
A summary of M9 is provided at **Appendix 1**.

1.0 SITE LOCATION (Lawrence Landfill - Composting Facility)

Lawrence Landfill Ltd
Dredgemans Hill
Johnston
Haverfordwest
Pembrokeshire
SA62 3NX . **OS Grid ref.** SM 93482 12647

Figure 1: Lawrence Landfill - Composting Facility Location Map (red squares ■ are Nearest Receptors)

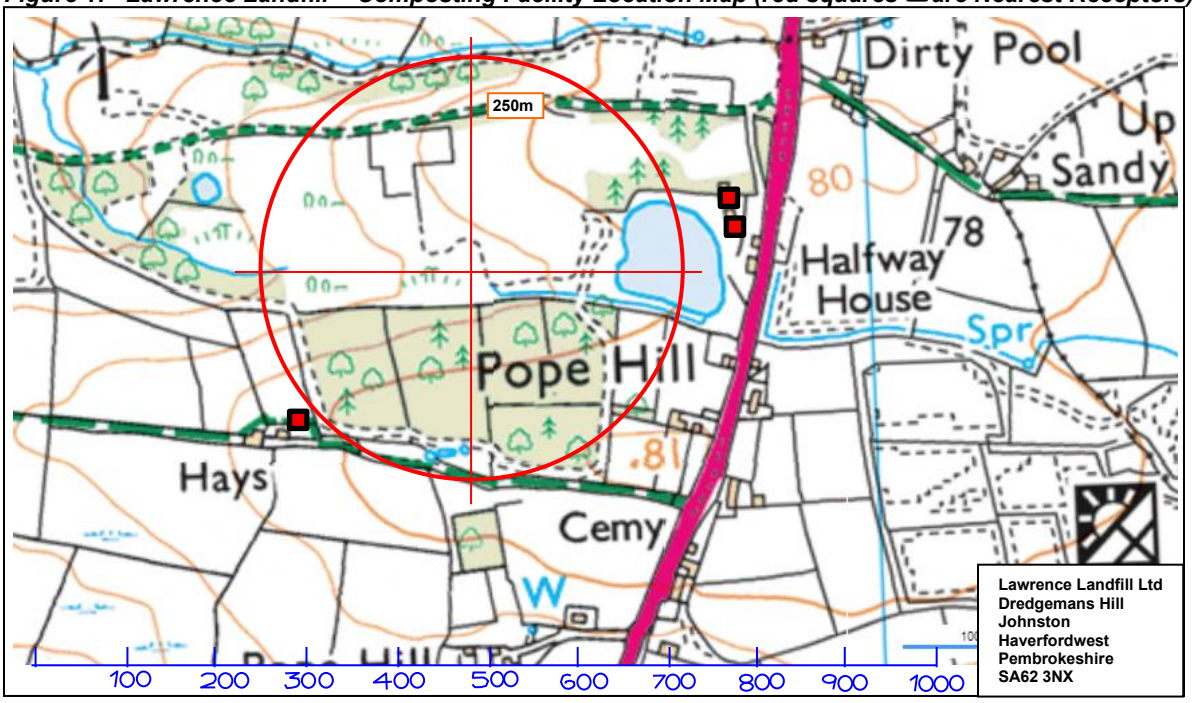
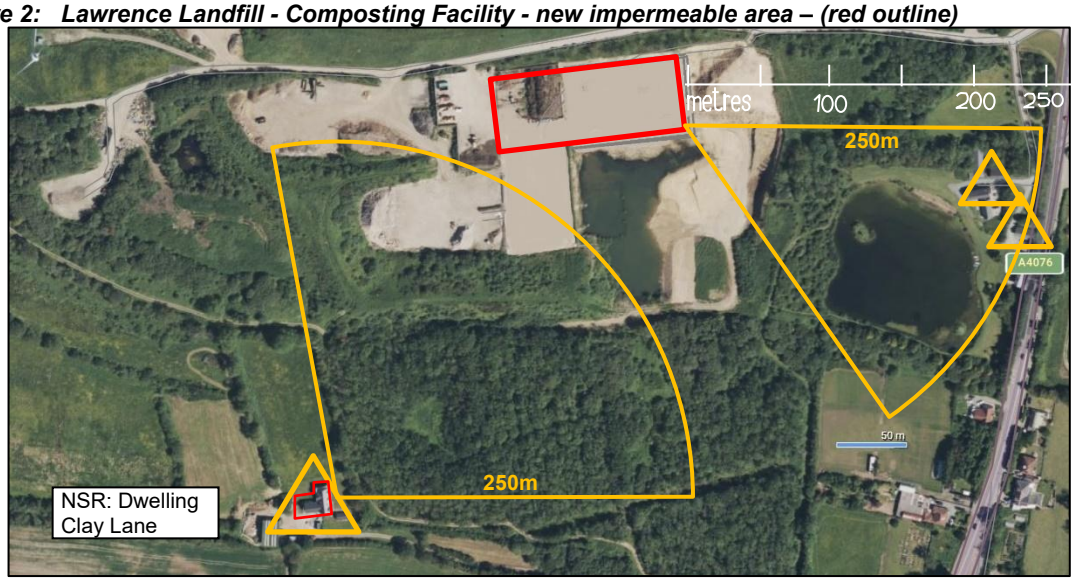


Figure 2: Lawrence Landfill - Composting Facility - new impermeable area – (red outline)



2.0 INTERPRETATION OF THE NRW/EA's BIOAEROSOL POLICY

2.1 Composting and Bioaerosols

Composting processes rely on biological activity, notably the utilisation of bacteria and fungi in order to bio-degrade the volatile material and convert it to more stable forms of humic substance. The process relies on mechanical treatment in the preparation and handling of the material, as well as specialist facilities for controlling the processes involved.

It is recognised that when any agitation of organic material occurs, especially turning, screening or shredding, elevated numbers of micro-organisms may be released into the air. Once released into the air they can remain airborne for long periods and form a 'bioaerosol' – an aerosol of biological particles.

2.2 Bioaerosols Risk

Bioaerosols are small particles of biologically active material that may be carried independently in the air or otherwise may become attached to other particles of dust or moisture. Consequently, the minute particles may be inhalable and also respirable (deposited in the air sacs of the lungs where gases are exchanged). Some of the small particles (<3-5microns) in bioaerosols have the potential to be harmful to human health and can cause pathogenic or allergenic reactions. Human physiology and therefore susceptibility is receptor-dependent and so the EA have advised arbitrary values as reference levels for risk.

2.3 Environment Agency Policy and Approach to Bioaerosols.

The Environment Agency (The EA) and National Resources Wales (NRW) has recently reviewed, updated and re-published (2018) its 'Policy' in regard to bioaerosols. This builds upon the 2009 policy in regard to the use of 250metres as a distance from a composting activity, within which there was deemed greater risk. T**he policy** highlighted ***the need to maintain bioaerosols at appropriate levels at any dwelling or workplace.***

'appropriate levels' may be….

i) those before the start of the composting process or
ii) bioaerosols levels no greater than
1,000 colony forming units (cfu) m^{-3} total bacteria,
500 cfu m^{-3} Aspergillus Fumigatus and

Reference to ***appropriate levels*** takes into account background levels specific to that locality. Background levels are highly variable and may range from 1- 1,000 cfu/m^3 or more.

In 2018 the **M9 Technical Guidance** note [see Appendix 1] was produced to provide a standardised approach for monitoring bioaerosols. It is applicable to facilities that have both ambient and point source emissions. It has been developed to replace the AfOR 2009 Standardised Protocol for use with Environmental Permits from 2018. It does not require the monitoring of gram-negative bacteria.

M9 describes how Bioaerosols can be sampled and measured using a number of different techniques. One of the techniques is the use of Andersen type samplers (impaction method) as used in this instance. It describes how sampling should be carried out upwind of the site and places more focus on gathering data that relates to the levels likely to be found at the 'Nearest Sensitive Receptor'. A summary of M9 is provided at Appendix 1. This was used to inform the methodology for the sampling of bioaerosols around this site.

2.4 Applying the Environment Agency Bioaerosols Policy to the Composting Site.

There is a dwelling (western end of Clay Lane) that is now beyond 250m of the Composting Facility. For the purpose of this monitoring a distance of 250m has been used. The Director's houses are to the east of the site and the active area is now closer to those properties. Directors being full time employees of the composting company, are not regarded as 'sensitive receptors'.

To avoid issues with entering the woodland; and to work within the limits set by the lake, the sampling stations were established at 200m from the centre of activity (shredding).

3.0 COMPOSTING SITE - SENSITIVE RECEPTORS

Site Situation with Regard to Sensitive Receptors

The composting site is accommodated in a rural area and is separated from the nearest sensitive receptor by a distance of greater than 250m. The nearest sensitive receptors (dwellings being the Director's own properties) are now at a distance of less than 250m away. For the most time of the year with the prevailing wind south westerly, the nearest third party dwelling is UPWIND of the site. [Refer - Bioaerosol Risk Assessment wind-rose data].

4.0 COMPOSTING SITE - BIOAEROSOL SAMPLING STATIONS

4.1 Location of sampling Stations

Sampling stations locations are shown at Figure 3. **Four** locations were used to provide data in accordance with 'Upwind'; and the 'Fan-Array' of 'Downwind' at distances equal to that to the Clay Lane dwelling.

Figure 3: Fan Array (blue sector) of Sampling Station Locations –Lawrence Landfill Composting Facility.

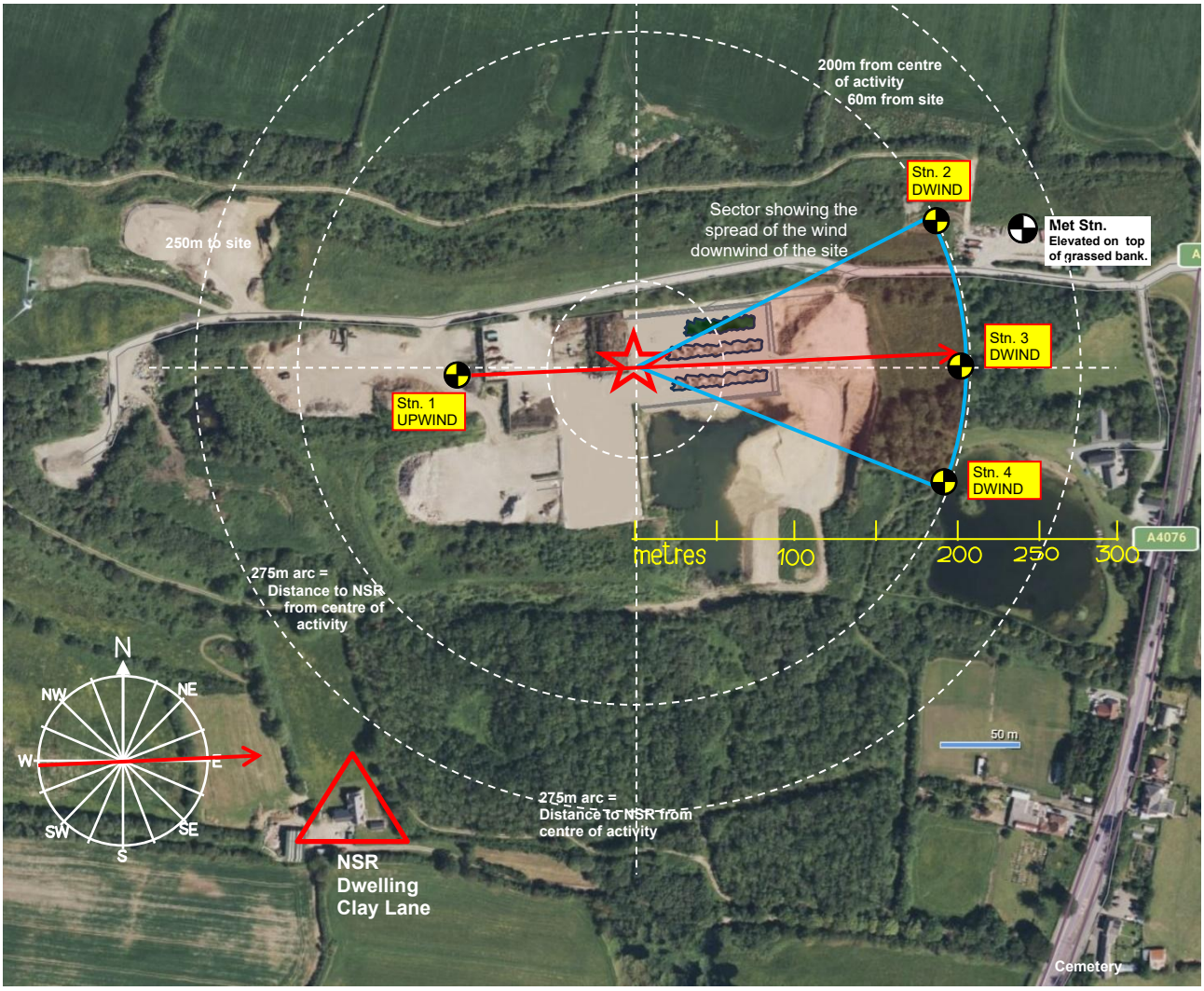


Table 1. Key to Sampling Stations SA62 3NX *Centre of active processes during monitoring –*

Station 1	SM 93431 12641	Upwind for all sessions	50m W of Site	100m and W from centre of activity
Station 2	SM 93750 12717	Downwind left of centre	100m ENE of Site	200m and ENE of centre of activity
Station 3	SM 93764 12634	Downwind as centre	100m E of Site	200m and E of centre of activity
Station 4	SM 93743 12570	Downwind right of centre	100m ENE of Site	200m and ESE of centre of activity

As can be seen, the station locations were arranged to relate to the **Westerly** wind i.e. **blowing toward the East.** The left station 2 and right station 4 were arranged either side of the centreline of the wind at the outset and as the wind direction was steady, it was deemed unnecessary to rearrange these as the sessions progressed. Station 1 (the upwind) was located at the edge of the concrete pad to the W of the composting area. Stations 2, 3 and 4 were necessarily positioned to the East of the site within clear areas, either on the edge of the site tracks or else in a clearing by the lake.

4.2 Activities Ongoing at the Site during Sampling

The sampling was undertaken during a period of **GREEN WASTE SHREDDING** activity, to determine the level of bioaerosols during a period when materials handling and processing (loading shovel operation, and raw material movement/shredding) activities were being undertaken.

5.0 BIOAEROSOL TYPES

Types of bioaerosol were sampled and enumerated

Description	**Total Bacteria**	**Aspergillus Fumigatus**
Enumerated as	**cfu/plate**	**cfu/plate**
Interpreted as	**cfu/m^3**	**cfu/m^3**

These types relate to the EA guidance given earlier (Section 2.3 on page 3). Note: Gram Negative Bacteria formerly required for Animal By-Product material treatment facilities; are, under M9 Guidance NOT required to be sampled.

6.0 BIOAEROSOL SAMPLING PROCEDURE

6.1 Standardised sampling Procedure

The methodology was based on the M9 Guidance 'Environmental Monitoring of Bioaerosols at Regulated Facilities' published 2018 V2 by The Environment Agency. (Refer to Appendix 1).

6.2 Sampling Equipment and Method

6.2.1 Samplers

Samplers comprised the 3 part 'Andersen' type sampler design, with base, sampling hole manifold and collection funnel. Air stagnation baffles were fitted during sampling. Using extendable tripods, the samplers were set at 2m during each session of sampling.

6.2.2 Positive Displacement Suction Pumps

The air suction diaphragm pumps, were Charles Austen Pumps, twin headed parallel pumps operating off 12v DC Motors. The Pumps were pre-calibrated to provide a uniform air-flow rate with the target flow of 28.3 litres/minute (+/- 2%) (0.57 l/min). Measured flow-rates are shown in the results for each sampler. These were recorded as 28 l/min.

6.3 Sample Collection media and Enumeration

The collection media and laboratory-based incubation and enumeration was undertaken by 'D & F Associates Ltd of Widnes' a UKAS accredited laboratory. (See Box1 at page ii)

6.4 Weather Monitoring Equipment

Weather during the sampling was monitored using a portable weather station mounted on a 2m pole at the site, with temperature, humidity, wind direction and wind-speed monitoring. See section 7.

6.5 Sampler Locations

The sampling station locations were selected to provide the data in accordance with the M9 Guidance. Station locations are described at 4.1 Table 1 and shown at figure 3.

The fan array of the station locations was maintained as it was set out, because the wind remained steady. The stations were located in accessible positions, enabling useful time to set them up for each session. A small, time offset was used to provide time to work at each station.

6.6 Sample Chain of Custody

The sampling plates and exposed samples were kept in sealed polythene bags within a 12 volt powered refrigerator during the sampling sessions and during transport and short term storage. The samples were delivered refrigerated to the laboratory within 24 hours of the sampling having been undertaken and placed into a refrigerator prior to processing.

Delivery to the lab	Same day as sampling.	The lab operates a secure reception protocol that enables the samples to be delivered directly into a refrigerator at any time of the day or evening
Sample analysis	Incubation of the samples was started immediately after receipt/ registration at the laboratory.	Samples are put into incubation within a few hours of reception.
How stored.	Samples are retained in a 12volt powered portable refrigerator during sampling progression and transport to the laboratory	Storage of the plates and after they have been exposed is undertaken using the mobile fridge where they are held at ~5°C temperature as defined in laboratory procedures.

6.7 Sampling Periods

Sampling was replicated in four Sessions. In each, the **18 minute** Upwind sampling was started a few minutes before, and ended a few minutes after the **6 minute** downwind sampling periods. A 2 minute stagger in downwind sampling was used to provide time for the Technician to move from station to station.

7.0 MET DATA DURING SAMPLING

The following data was recorded by the Kestrel 4500 portable Met Station, mounted on a tripod and mast at approx. 2.0m height above ground level. It was located on a mound, at the edge of the carpark area to the North-east of the site. The Kestrel 4500 comprises a wind vane, vane type anemometer, temperature and humidity sensors and has a built-in data-logger. The data logging interval was set at 1 minute.

The data is presented at Table 3 in accordance with the M9 Guidance and is based on the raw data gathered during the overall period of sampling at the site. The raw data is shown at Appendix 2.

Table 2: Meteorological Conditions Lawrence Landfill – 10th September 2026

Meteorological Conditions											
Site:		**Lawrence Landfill, Pembroke**			**Site Operator:**			**Lawrence Landfill Ltd.**			
Sampling Date:		***10th September 2026***			**Monitoring Contractor:**			**Recogen Ltd.**			
Sample Ref Nos.		**Location**	**Bearing of Samplers** from centre of Active Area ° to N	**Mean Wind Direction** wind blows TO during sampling period ° to N	**Difference in bearing** of samplers and mean direction wind blows TO ° to N	**Wind Speed** as sampling **ms^{-1}** @ 2m | @10m		**Mean Air Temp** as sampling **°C**	**Mean Air RH** Mean **RH%**	**Prevailing Weather Pressure** Cloud Cover 1/8 ths mbar (okta)	
L	1A Upwind T & F	Upwind Stn. 1	267	**85**	**182**	3.6	5.0	14.0	71	1007	7/8
L	1B Left T & F	Downwind Stn. 2	62		-22.7						
L	1C Centre T & F	Downwind Stn. 3	87		2						
L	1D Right T & F	Downwind Stn. 4	112		27						
L	2A Upwind T & F	Upwind Stn. 1	267	**88**	**179**	3.5	4.8	14.6	69	1007	7/8
L	2B Left T & F	Downwind Stn. 2	62		-25.9						
L	2C Centre T & F	Downwind Stn. 3	87		-1						
L	2D Right T & F	Downwind Stn. 4	112		24						
L	3A Upwind T & F	Upwind Stn. 1	267	**88**	**179**	3.5	4.8	15.0	66	1007	6/8
L	3B Left T & F	Downwind Stn. 2	62		-26.0						
L	3C Centre T & F	Downwind Stn. 3	87		-1						
L	3D Right T & F	Downwind Stn. 4	112		24						
L	4A Upwind T & F	Upwind Stn. 1	267	**87**	**180**	3.7	5.1	14.7	67	1007	6/8
L	4B Left T & F	Downwind Stn. 2	62		-25.4						
L	4C Centre T & F	Downwind Stn. 3	87		0						
L	4D Right T & F	Downwind Stn. 4	112		25						

The sampling sessions were started at 09:45 and the temperature was 14.0 rising to 14.7° C through the session. There was a fresh gusting wind from the **West** of 3.6 to 3.7m/sec. The air humidity was moderately high at 71% falling to 67% RH. There was no rain during the sampling period although generally, the sky was overcast with cloud cover as 85% clearing to 70% a little later

8.0 SUMMARY OF THE BIOAEROSOL SAMPLING RESULTS

The full raw results are shown in Appendix 3. These show the counts per plate and the calculation of the concentrations for each bioaerosol, based on the sampling time and airflow in the samplers.

The Data are presented in Tables 3 and 4 in accordance with the M9 Guidance. Table 3 shows the Results for **Total Viable Bacteria** and Table 4 shows the results for the **Aspergillus Fumigatus** Samples.

The tables reveal the **MEDIAN** of the **UPWIND** and the **DOWNWIND** sampling results. The **MAXIMUM MEDIAN** value is derived from the session medians. The sampling of TVC and AF was done concurrently.

Table 3: Sampling Results – TOTAL BACTERIA - Lawrence Landfill – 10th September 2026

Site:	**Lawrence Landfill, Pembroke**			Type of materials on site			Composted Green Waste		
Sampling Date:		***10th September 2026***		Estimated material on site			1000 tonnes		
Site Operator:		**Lawrence Landfill**		Type of Activity			Green Waste Composting		
Monitoring Contractor:		**Recogen Ltd** of Shrewsbury.		Activities affecting bioaerosols release			Green Waste Sorting and Shredding of feedstock. Vehicle movements.		
				Bioaerosol Type:			**TOTAL BACTERIA**		
Sample Ref Nos. Station Location ref. **All Sample Refs: 'T' (Total Viable Bacteria)**		**Station Location** bearing from centre of activity ° from N	**Distance** from centre of activity metres	**Difference in bearing** between sampler location and mean direction that wind blows TO	**Sampling Period** Start Time.	End Time	**Concentration of bioaerosols** **Total Viable Bacteria cfu/m³**	**Mean** of **UPWIND** Samples **Total Bacteria cfu/m³**	**Median** of **DOWNWIND** Samples **Total Bacteria cfu/m³**
L1 AT	UW Stn. 1	267	100	182	09:50	10:08	**34**	34	
L1 BT	DW Stn. 2	62	200	23	09:53	09:59	**107**		
L1 CT	DW Stn. 3	87	200	-2	09:54	10:00	**196**		131
L1 DT	DW Stn. 4	112	200	-27	09:55	10:01	**131**		
L2 AT	UW Stn. 1	267	100	179	10:21	10:39	**24**	24	
L2 BT	DW Stn. 2	62	200	26	10:24	10:30	**107**		
L2 CT	DW Stn. 3	87	200	1	10:25	10:31	**488**		107
L2 DT	DW Stn. 4	112	200	-24	10:26	10:32	**65**		
L3 AT	UW Stn. 1	267	100	179	10:51	11:09	**8**	8	
L3 BT	DW Stn. 2	62	200	26	10:54	11:00	**155**		
L3 CT	DW Stn. 3	87	200	1	10:55	11:01	**119**		119
L3 DT	DW Stn. 4	112	200	-24	10:56	11:02	**42**		
L4 AT	UW Stn. 1	267	100	180	11:22	11:40	**16**	16	
L4 BT	DW Stn. 2	62	200	25	11:25	11:31	**452**		
L4 CT	DW Stn. 3	87	200	0	11:26	11:32	**71**		71
L4 DT	DW Stn. 4	112	200	-25	11:27	11:33	**30**		
				UPWIND /DOWNWIND MEDIAN VALUES				**20**	**113**
				MAX MEDIAN UPWIND & DOWNWIND VALUE				**34**	**131**

Commentary to assist interpretation

1. The wind during the sessions was steady from the **West** arriving from the direction north of the 'Clay Lane' 3rd party NSR, the woodland and over the composting site, then blowing out to the East towards the Directors houses.

2. The **UPWIND Total Bacteria** bioaerosol levels were **VERY LOW**, (mean value **20 cfu/m³**) most likely due to the damp topography and cool wet weather preceding the sampling.

3. The **DOWNWIND** sample values showed evidence of bioaerosols emissions and varied depending on the location within the 'fan-array' and the time of the session. These values were variable, likely due to the fresh wind, but remained **LOW**. The **MEDIAN DOWNWIND** Total Bacteria was **LOW** at **113 cfu/m³** and the **MAXIMUM MEDIAN** was **131 cfu/m³**.

Table 4: Sampling Results – ASPERGILLUS FUMIGATUS - Lawrence Landfill – 10th September 2026

Site:	**Lawrence Landfill, Pembroke**			Type of materials on site			Composted Green Waste		
Sampling Date:		***10th September 2026***		Estimated material on site			1000 tonnes		
Site Operator:		**Lawrence Landfill**		Type of Activity			Open Windrow Composting		
Monitoring Contractor:		**Recogen Ltd** of Shrewsbury.		Activities affecting bioaerosols release			Green Waste Sorting and Shredding of feedstock. Vehicle movements.		
				Bioaerosol Type:			**ASPERGILLUS FUMIGATUS**		
Sample Ref Nos. Station Location ref. **All Sample Refs: 'F' (Asp. Fumigatus)**		**Station Location** bearing from centre of site ° from N	**Distance** from centre of activity metres	**Difference in bearing** between sampler location and mean direction that wind blows TO	**Sampling Period** Start Time.	End Time.	Concentration of bioaerosols **Aspergillus Fumigatus cfu/m³**	Mean of **UPWIND** Samples **Aspergillus Fumigatus cfu/m³**	Median of **DOWNWIND** Samples **Aspergillus Fumigatus cfu/m³**
L1 AF	UW Stn. 1	267	100	182	09:50	10:08	0	0	
L1 BF	DW Stn. 2	62	200	23	09:53	09:59	6		
L1 CF	DW Stn. 3	87	200	-2	09:54	10:00	18		6
L1 DF	DW Stn. 4	112	200	-27	09:55	10:01	6		
L2 AF	UW Stn. 1	267	100	179	10:21	10:39	0	0	
L2 BF	DW Stn. 2	62	200	26	10:24	10:30	36		
L2 CF	DW Stn. 3	87	200	1	10:25	10:31	18		18
L2 DF	DW Stn. 4	112	200	-24	10:26	10:32	0		
L3 AF	UW Stn. 1	267	100	179	10:51	11:09	0	0	
L3 BF	DW Stn. 2	62	200	26	10:54	11:00	6		
L3 CF	DW Stn. 3	87	200	1	10:55	11:01	0		0
L3 DF	DW Stn. 4	112	200	-24	10:56	11:02	0		
L4 AF	UW Stn. 1	267	100	180	11:22	11:40	0	0	
L4 BF	DW Stn. 2	62	200	25	11:25	11:31	6		
L4 CF	DW Stn. 3	87	200	0	11:26	11:32	0		0
L4 DF	DW Stn. 4	112	200	-25	11:27	11:33	0		
				UPWIND /DOWNWIND MEDIAN AF VALUES				**0**	**3**
				MAX MEDIAN UP & DOWNWIND 'AF' VALUE				**0**	**18**

Commentary to assist interpretation

1. The wind during the sessions was steady from the **West** arriving from the direction north of the 'Clay Lane' 3rd party NSR, the woodland and over the composting site, then blowing out to the East towards the Directors houses.

2. The **MEDIAN UPWIND** value for Aspergillus Fumigatus was **NIL cfu/m³** (**MAXIMUM also NIL cfu/m³**).

3. The Median **DOWNWIND** Aspergillus Fumigatus sample value was **EXTREMELY LOW** (**3 cfu/m³**). **The MAXIMUM MEDIAN VALUE (derived from all values) was also 18 cfu/m³**. These levels suggest that there was **NEGLIGIBLE** contribution of the Aspergillus Fumigatus type bioaerosols due to the composting site activities.

4. Aspergillus Fumigatus (fungi) are very often present where material is undergoing composting, however, background levels of these bioaerosols within rural areas may typically be 0 - 50 cfu/m³.

9.0 DISCUSSION OF RESULTS

9.1 Summary – Site Conditions and Activity During Sampling

During the sampling there was traffic moving around the overall site; with lorries delivering fresh green waste material and lorries hauling aggregates from the site. The feedstock green waste was being shredded to form a new windrow. Table 5 provides a results summary.

9.2 Summary - Bioaerosol levels

Table 5 – Summary of results Lawrence Landfill Composting Facility - 10th September 2026

		Total Bacteria			Asp. Fumigatus	
	Activities	**Median UW**	**Median DW**		**Mean UW**	**Median DW**
		cfu/m^3	cfu/m^3		cfu/m^3	cfu/m^3
Session 1	Green Waste Shredding & Movement	**34**	**131**		**0**	**6**
Session 2	Green Waste Shredding & Movement	**24**	**107**		**0**	**18**
Session 3	Green Waste Shredding & Movement	**8**	**119**		**0**	**0**
Session 4	Green Waste Shredding & Movement	**16**	**71**		**0**	**0**
Overall	Median Upwind & Downwind	**20**	**113**		**0**	**3**
Maximum Median Upwind and Downwind		**34**	**131**		**0**	**18**
Downwind contribution from the site			**97**			**18**

* Maximum Median Values are used to compare to Permit Values. Downwind contribution from site is taken as DW value minus the Upwind Value.

10.0 CONCLUSIONS-BIOAEROSOL SAMPLING

10.1 General Conclusions

The following may be concluded from the air quality results sampled **10th September 2026**:

1. The results show **VERY LOW** levels of Total Bacteria (**20 cfu/m^3**) and NIL Aspergillus Fumigatus (AF) (**0 cfu/m^3**) in the samples taken **UPWIND** of the site.

2. The results of the samples taken **DOWNWIND** of the site show variable but **LOW** levels of Total Bacteria and **NEGLIGIBLE** levels of Aspergillus Fumigatus (AF). These indicate that the Green Waste Shredding activity, was contributing **only LOW** levels of bioaerosols into the air leaving the site.

3. The **MEDIAN DOWNWIND** Total Bacteria was **LOW** at **113 cfu/m^3** and the **MAXIMUM MEDIAN** was only **131 cfu/m^3**. The variability was likely due to the various lifting, movement, releasing actions during the disturbance of the feedstock.

4. The Aspergillus Fumigatus **MEDIAN DOWNWIND** was **3 cfu/m^3** and the **MAXIMUM MEDIAN VALUE was 18 cfu/m^3**.

5. The bioaerosol contributions were **Total Bacteria 97 cfu/m^3** and **A. Fumigatus 18 cfu/m^3**.

10.2 Overall Conclusion

The results of sampling suggest that under these conditions, there were variable but **LOW** levels of bioaerosols generated and released from the compost **GREEN WASTE SHREDDING** activity.

The **Maximum Median** Downwind Bioaerosol level of **Total Bacteria** was **131 cfu/m^3 and the Aspergillus Fumigatus** was **18 cfu/m^3** . The downwind Bioaerosols levels attributable to the compost site were therefore **only LOW** overall and **were less than 15%** of the NRW Guideline thresholds.

As the bioaerosols emission levels were < 15% of guidance thresholds it is safe to conclude that the composting activities pose minimal adverse risk to the health of persons in the nearby dwellings.

APPENDIX 1. The M9 2018 Technical Guidance Note (Monitoring)

Technical Guidance Note (Monitoring)

M9
Environmental monitoring of bioaerosols at regulated facilities

Environment Agency January 2018 Version 2

Sampling bioaerosols
Bioaerosols can be measured using a number of different techniques. This technical note describes the following techniques for sampling bioaerosols:

Impaction
The impaction method uses a single stage Andersen sampler, loaded with a Petri dish of appropriate media. This method uses inertial forces to collect microorganisms in the air. Air is drawn through the perforated holes in the sampling head at a constant rate, using a vacuum pump. The velocity of the air is determined by the diameter of the holes in the sampling head. When the air hits the collection surface it is forced to change direction. The inertia of the microorganisms prevents them from changing direction, which causes them to become impacted onto the Petri dish media. When a sufficient volume of air has been collected, the Petri dish is removed and incubated, without further treatment.

5.2 Sample location strategy
The principle of this specification is to compare the concentrations in air unaffected by the activities of the facility (that is the background air sampled upwind of the plant) with the concentration of bioaerosols in air downwind of the plant. This comparison enables an assessment of the plant related contribution over a specified area to be made. The difference between the upwind and downwind concentration caused by bioaerosol emissions from the site is known as the process contribution. It uses sampling locations that form a fan like shape, which helps to ensure that variable wind directions are taken account of during the sampling period.

5.2.2 Sample locations upwind of the site
Sampling should be carried out upwind of the site. Upwind data should provide information on the concentration of specified bioaerosols that are present in the air blowing onto the operational area of the site. This should reflect either the background concentration at that time, or the effects of neighbouring operations, such as agricultural activities.

Upwind data indicates the concentration of bioaerosols that would be present, irrespective of whether the facility was there or not. The sample location of the upwind concentration measurement should be measured at a distance of 50m from the centre of the active operational area.

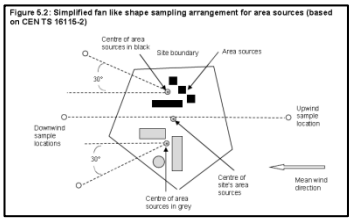


Figure 5.2: Simplified fan like shape sampling arrangement for area sources (based on CEN TS 16115-2)

5.2.3 Sample locations downwind of the site
Sampling should be carried out downwind of the site, using a fan like shape arrangement to detect the position of the plume. The orientation of the measurement area is determined by the prevailing mean wind direction.

This approach is used to ensure that measurements are made in the emission plume, during the sampling campaign. If there are any buildings, installations or structures between the downwind location(s) and the centre of the active operational area, then sampling should be carried out *upwind of that structure or installation, at a distance greater than twice its height*.

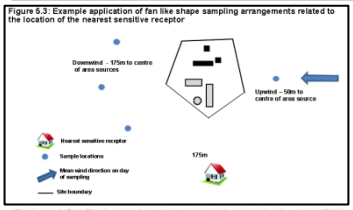


Figure 5.3: Example application of fan like shape sampling arrangements related to the location of the nearest sensitive receptor

Figure 5.1 shows this approach applied to a facility with a single point source. Topography or vegetation may restrict the line of sight required to locate sample traverses. This may make it difficult to determine the angle for locating the sample points. The restriction should be noted in the sample strategy and final monitoring report. For area sources, the orientation of the fan like shape sampling arrangement is selected by determining the centre point of the sources in the site.

Photograph 5.1: Single stage impaction sampler (Andersen) set up in the field



Each impaction sampler should be mounted onto a tripod, or other suitable structure, so that the top of the inlet cone is held **between 1.5 and 1.8m above the ground**. Each single stage impaction sampler fitted with a cone should be fitted with a **hemi-cylindrical baffle** extending in height at least 15 centimetres (cm) above the top of the inlet of the cone, to ensure stagnation point sampling.

5.6.2 Sampling procedure
A single Petri dish (with the lid removed) should be loaded into each sampler immediately prior to use, in accordance with the manufacturer's instructions. Once loaded, the sampler should be kept upright, to prevent the Petri dish from dislodging. A single sample of *Aspergillus fumigatus* (1 Petri dish containing selective medium) should be collected at each of the specified locations using a single stage impaction sampler. The same procedure should be repeated for mesophilic bacteria using Petri dishes containing selective medium specific for the culturing of mesophilic bacteria.

APPENDIX 2. WEATHER DATA DURING SAMPLING

Meteorological data was recorded by the Kestrel 4500 mounted on a 2.0m mast. It comprises a wind vane, type anemometer, temperature and humidity sensors. The logging interval was 1 minute. See table A2.

Table A2: Meteorological Data Lawrence Landfill - 10th September 2026

Time	Wind	Wind	Wind	Temp	RH	BP		Time	Wind	Wind	Wind	Temp	RH	BP
	Bearing	Direction	Speed m/s	°C	%	mb			Bearing	Direction	Speed m/s	°C	%	mb
09:49:00	272	W	3.7	14	70	1007		10:47:00	271	W	2.4	15	69	1007
09:50:00	273	W	3.6	14	71	1007		10:48:00	261	W	3.7	15	68	1007
09:51:00	264	W	4.8	14	71	1007		10:49:00	266	W	3.9	15	68	1007
09:52:00	263	W	3.4	14	71	1007		10:50:00	263	W	3.0	15	67	1007
09:53:00	269	W	4.3	14	72	1007		10:51:00	252	WSW	3.2	15	67	1007
09:54:00	272	W	4.4	14	72	1007		10:52:00	263	W	4.0	15	66	1007
09:55:00	270	W	4.6	14	72	1007		10:53:00	257	WSW	4.1	15	65	1007
09:56:00	256	WSW	3.4	14	71	1007		10:54:00	258	WSW	2.6	15	66	1007
09:57:00	252	WSW	4.0	14	71	1007		10:55:00	282	WNW	2.3	15	66	1007
09:58:00	271	W	3.1	14	71	1007		10:56:00	273	W	2.8	15	66	1007
09:59:00	261	W	3.8	14	70	1007		10:57:00	264	W	3.7	15	65	1007
10:00:00	269	W	4.7	14	71	1007		10:58:00	272	W	2.4	15	65	1007
10:01:00	264	W	4.2	14	70	1007		10:59:00	277	W	3.4	15	65	1007
10:02:00	279	W	3.9	14	70	1007		11:00:00	280	W	1.8	15	65	1007
10:03:00	264	W	2.2	14	70	1007		11:01:00	257	WSW	3.1	15	65	1007
10:04:00	265	W	2.9	14	70	1007		11:02:00	273	W	3.5	15	64	1007
10:05:00	262	W	2.7	14	70	1007		11:03:00	272	W	4.0	15	65	1007
10:06:00	263	W	2.4	14	70	1007		11:04:00	277	W	4.5	15	65	1007
10:07:00	254	WSW	3.6	14	70	1007		11:05:00	259	W	3.5	15	66	1007
10:08:00	265	W	2.8	14	70	1007		11:06:00	271	W	3.9	15	67	1007
10:09:00	252	WSW	3.6	14	70	1007		11:07:00	270	W	4.2	15	67	1007
10:10:00	263	W	4.7	14	70	1007		11:08:00	263	W	4.6	15	67	1007
10:11:00	264	W	4.9	14	70	1007		11:09:00	269	W	4.5	15	67	1007
10:12:00	251	WSW	3.5	14	70	1007		11:10:00	269	W	4.9	15	66	1007
10:13:00	278	W	3.5	14	70	1007		11:11:00	272	W	4.8	15	66	1007
10:14:00	264	W	2.5	14	70	1007		11:12:00	264	W	3.2	15	67	1007
10:15:00	264	W	3.7	14	70	1007		11:13:00	251	WSW	2.8	15	67	1007
10:16:00	289	WNW	3.4	14	69	1007		11:14:00	275	W	3.0	15	67	1007
10:17:00	283	WNW	3.5	14	69	1007		11:15:00	263	W	3.6	15	67	1007
10:18:00	258	WSW	3.3	14	69	1007		11:16:00	264	W	3.6	15	67	1007
10:19:00	268	W	3.9	14	69	1007		11:17:00	267	W	3.0	15	67	1007
10:20:00	267	W	3.2	14	70	1007		11:18:00	257	WSW	3.7	15	67	1007
10:21:00	264	W	3.0	14	69	1007		11:19:00	255	WSW	3.5	15	66	1007
10:22:00	272	W	3.0	15	69	1007		11:20:00	267	W	2.8	15	67	1007
10:23:00	273	W	2.9	15	70	1007		11:21:00	266	W	3.5	15	67	1007
10:24:00	272	W	2.7	15	69	1007		11:22:00	270	W	4.4	15	67	1007
10:25:00	263	W	4.8	15	69	1007		11:23:00	278	W	4.3	15	67	1007
10:26:00	268	W	3.2	15	68	1007		11:24:00	279	W	4.2	15	67	1007
10:27:00	259	W	3.6	15	69	1007		11:25:00	263	W	3.1	15	67	1007
10:28:00	265	W	3.1	15	69	1007		11:26:00	279	W	4.4	15	67	1007
10:29:00	263	W	3.5	15	69	1007		11:27:00	274	W	4.3	15	67	1007
10:30:00	258	WSW	2.9	15	69	1007		11:28:00	270	W	4.1	15	68	1007
10:31:00	262	W	3.0	15	68	1007		11:29:00	271	W	3.5	15	68	1007
10:32:00	262	W	2.3	15	69	1007		11:30:00	263	W	4.2	15	67	1007
10:33:00	273	W	3.8	15	69	1007		11:31:00	275	W	4.5	15	67	1007
10:34:00	275	W	4.5	15	69	1007		11:32:00	267	W	3.5	15	67	1007
10:35:00	277	W	3.8	14	69	1007		11:33:00	266	W	3.1	15	68	1007
10:36:00	264	W	3.0	14	69	1007		11:34:00	266	W	2.7	15	67	1007
10:37:00	272	W	4.2	15	69	1007		11:35:00	262	W	2.7	15	68	1007
10:38:00	270	W	3.4	15	68	1007		11:36:00	261	W	2.8	15	68	1007
10:39:00	271	W	4.9	14	68	1007		11:37:00	253	WSW	4.0	15	68	1007
10:40:00	274	W	4.8	15	68	1007		11:38:00	259	W	3.7	15	68	1007
10:41:00	257	WSW	4.3	15	67	1007		11:39:00	260	W	3.8	15	67	1007
10:42:00	267	W	3.7	15	67	1007		11:40:00	261	W	3.9	15	68	1007
10:43:00	269	W	4.4	15	67	1007		11:41:00	277	W	3.9	15	68	1007
10:44:00	273	W	3.3	15	68	1007		11:42:00	258	WSW	3.0	15	68	1007
10:45:00	262	W	5.0	15	68	1007		11:43:00	275	W	2.3	15	67	1007
10:46:00	269	W	3.9	15	68	1007		11:44:00	278	W	3.8	13	67	1007

APPENDIX 3. Bioaerosols Sampling Record and Results

Results Table A3.1: Session 1: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler location	Sampler station number	Sampler code	Pump Code	Pump Flowrate litres/min	Start time	End Time	Sample time. min.	PLATE COUNT cfu**	Total Bacteria cfu m^{-3}	Aspergillus Fumigatus cfu m^{-3}
L1 A	TVC	UPWIND A	**1**	YA	P1	28	9:50	10:08	18.00	**17**	34	
L1 B	TVC	DOWNWIND B	**2**	YB	P2	28	9:53	9:59	6.00	**18**	107	
L1 C	TVC	DOWNWIND C	**3**	RA	P3	28	9:54	10:00	6.00	**33**	196	
L1 D	TVC	DOWNWIND D	**4**	RB	P4	28	9:55	10:01	6.00	**22**	131	
L1 A	AF	UPWIND A	**1**	BA	Q1	28	9:50	10:08	18.00	**0**		0
L1 B	AF	DOWNWIND B	**2**	BB	Q2	28	9:53	9:59	6.00	**1**		6
L1 C	AF	DOWNWIND C	**3**	GA	Q3	28	9:54	10:00	6.00	**3**		18
L1 D	AF	DOWNWIND D	**4**	GB	Q4	28	9:55	10:01	6.00	**1**		6

*TVC=Total Viable (Bacteria) Count. AF=Aspergillus Fumigatus. **cfu = colony forming units

Results Table A3.2: Session 2: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler location	Sampler station number	Sampler code	Pump Code	Pump Flowrate litres/min	Start time	End Time	Sample time. min.	PLATE COUNT cfu**	Total Bacteria cfu m^{-3}	Aspergillus Fumigatus cfu m^{-3}
L2 A	TVC	UPWIND A	**1**	YA	P1	28	10:21	10:39	18.00	**12**	24	
L2 B	TVC	DOWNWIND B	**2**	YB	P2	28	10:24	10:30	6.00	**18**	107	
L2 C	TVC	DOWNWIND C	**3**	RA	P3	28	10:25	10:31	6.00	**82**	488	
L2 D	TVC	DOWNWIND D	**4**	RB	P4	28	10:26	10:32	6.00	**11**	65	
L2 A	AF	UPWIND A	**1**	BA	Q1	28	10:21	10:39	18.00	**0**		0
L2 B	AF	DOWNWIND B	**2**	BB	Q2	28	10:24	10:30	6.00	**6**		36
L2 C	AF	DOWNWIND C	**3**	GA	Q3	28	10:25	10:31	6.00	**3**		18
L2 D	AF	DOWNWIND D	**4**	GB	Q4	28	10:26	10:32	6.00	**0**		0

*TVC=Total Viable (Bacteria) Count. AF=Aspergillus Fumigatus. **cfu = colony forming units

Results Table A3.3: Session 3: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler location	Sampler station number	Sampler code	Pump Code	Pump Flowrate litres/min	Start time	End Time	Sample time. min.	PLATE COUNT cfu**	Total Bacteria cfu m^{-3}	Aspergillus Fumigatus cfu m^{-3}
L3 A	TVC	UPWIND A	**1**	YA	P1	28	10:51	11:09	18.00	**4**	8	
L3 B	TVC	DOWNWIND B	**2**	YB	P2	28	10:54	11:00	6.00	**26**	155	
L3 C	TVC	DOWNWIND C	**3**	RA	P3	28	10:55	11:01	6.00	**20**	119	
L3 D	TVC	DOWNWIND D	**4**	RB	P4	28	10:56	11:02	6.00	**7**	42	
L3 A	AF	UPWIND A	**1**	BA	Q1	28	10:51	11:09	18.00	**0**		0
L3 B	AF	DOWNWIND B	**2**	BB	Q2	28	10:54	11:00	6.00	**1**		6
L3 C	AF	DOWNWIND C	**3**	GA	Q3	28	10:55	11:01	6.00	**0**		0
L3 D	AF	DOWNWIND D	**4**	GB	Q4	28	10:56	11:02	6.00	**0**		0

*TVC=Total Viable (Bacteria) Count. AF=Aspergillus Fumigatus. **cfu = colony forming units

Results Table A3.4: Session 3: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler location	Sampler station number	Sampler code	Pump Code	Pump Flowrate litres/min	Start time	End Time	Sample time. min.	PLATE COUNT cfu**	Total Bacteria cfu m^{-3}	Aspergillus Fumigatus cfu m^{-3}
L4 A	TVC	UPWIND A	**1**	YA	P1	28	11:22	11:40	18.00	**8**	16	
L4 B	TVC	DOWNWIND B	**2**	YB	P2	28	11:25	11:31	6.00	**76**	452	
L4 C	TVC	DOWNWIND C	**3**	RA	P3	28	11:26	11:32	6.00	**12**	71	
L4 D	TVC	DOWNWIND D	**4**	RB	P4	28	11:27	11:33	6.00	**5**	30	
L4 A	AF	UPWIND A	**1**	BA	Q1	28	11:22	11:40	18.00	**0**		0
L4 B	AF	DOWNWIND B	**2**	BB	Q2	28	11:25	11:31	6.00	**1**		6
L4 C	AF	DOWNWIND C	**3**	GA	Q3	28	11:26	11:32	6.00	**0**		0
L4 D	AF	DOWNWIND D	**4**	GB	Q4	28	11:27	11:33	6.00	**0**		0

*TVC=Total Viable (Bacteria) Count. AF=Aspergillus Fumigatus. **cfu = colony forming units

Results Table A3.5: CONTROL PLATES

Control Type	Total Bacteria Cfu/Plate (T)		Aspergillus Fumigatus Cfu/Plate (F)
Passive Un-exposed Control	**LT1 =0, LT2 =0**		**LF1 =0, LF2 =0**