Bioaerosol Sampling Report

FCC Environment Ltd

Llanddulas Composting Facility

3rd December 2025

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Approval Sheet

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Site:	Llanddulas Composting facility Abergele Road Llanddulas Conwy LL22 8HP
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Foreword

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Enitial cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outside the agreed scope of works.

This report is issued solely to the Client. Enitial does not accept any responsibility to any third parties to whom this report may be circulated, in part or in full, and any such parties rely on the contents at their own risk.

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1.0 Scope of Work

Enitial was tasked with providing Bioaerosol monitoring for FCC at their Llanddulas facility near Conway in North Wales.

Due to the potential health risks posed by the facility to nearby receptors, the testing was conducted to assess the amount of airborne bioaerosols being generated by the site that is released into the local environment. The monitoring is to ensure that this exposure is below the industry standard threshold set by the Environmental Agency.

The work was carried out on 3rd of December 2025. This document is a presentation of the resulting data.

2.0 Background

The bioaerosol monitoring was specifically undertaken to enumerate the quantity of micro-organisms that can be cultured from representative samples of ambient air, collected at pre-determined monitoring points in the locality of the site.

The monitoring was undertaken in accordance with Environment Agency Technical Guidance Note (Monitoring) M9 – Environmental monitoring of bioaerosols at regulated facilities – July 2018.

Pre-prepared agar sample plates for *Aspergillus fumigatus,* mesophilic micro-organisms (bacteria) were directly impacted with ambient air using an Andersen sampler at the four selected sampling locations.

In the UK, there are currently no statutory limits for ambient concentrations of bioaerosols. However, the Environment Agency's former Technical Guidance Note M17 provided guideline levels for assessing acceptable levels of bioaerosol concentrations at sensitive receptors:

- Total bacteria: 1000 cfu/m^3
- Aspergillus fumigatus: 500 cfu/m^3

Although M17 was withdrawn in October 2024 and replaced by new guidance which does not specify acceptable concentration levels. Therefore, until updated guidance is issued, the M17 guideline values continue to be used.

3.0 Methodology

3.1 Sampling Locations

The sampling locations were determined to achieve:

- One sampling location directly upwind of the centre of the composting facility.
- One location directly downwind of the composting facility.
- Two downwind locations aiming to achieve 30 degrees out from the line between the centre of the composting facility and the primary downwind location positioned to provide a fan-shaped arrangement to detect the position of the flume.

3.2 Agar Plates

The types of Agar used were:

Mesophilic micro-organisms: (Total Viable Count [TVC]) – Half Strength Nutrient Agar (also known as 93's – white in colour)

Aspergillus Fumigatus / Total Fungi: (colony-forming unit [cfu]) – Malt Extract Agar (also known as 94's – light yellow in colour)

The impacted agar plates were subsequently delivered to a specialist laboratory within 24 hours via a cool box with ice packs where they were cultured and enumerated.

3.3 Equipment

3.3.1 List of Equipment

The equipment used is as follows:

- Continuous operation mobile weather station (wind speed, direction, temperature, humidity) and tripod
- Digital stopwatch
- GPS device
- 4 x single-stage Andersen samplers
- 4 x tripods
- 4 x hemicylindrical baffles
- 4 x stoppers for Andersen samplers
- 4 x fully charged vacuum pumps (individual capacity of at least 35l per min) and connecting tubing
- Rotameter to fit vacuum pump

- Agar plates – variety dependent on required test
- 2 x sealable airtight sterile plastic containers
- Cool box with ice packs for transport
- 70% v/v aqueous solution / wipes of ethanol or industrial methylated spirits cleaning solution or other suitable disinfectants

3.3.2 Cleaning of Equipment

All parts of the sampling equipment that were in contact with the samples, work surfaces or storage containers were cleaned with a 70% aqueous solution or wipes of ethanol or methylated spirits, or other suitable disinfectants prior to use. Equipment was completely dried, through air drying before the sampling exercise was commenced.

On completion of cleaning the Andersen single-stage samplers, a stopper was placed in the cone entrance to stop any contamination occurring before the sampling event.

3.3.3 Setup and Operation

- The pumps were Pre-run for a specified time at the required flow rate of 28.3l/min (±2%). This pump test was undertaken once before the start of the monitoring exercise.
- The Andersen single-stage samplers were mounted on to the tripods securely at a height of 1.5-1.8m above ground and the baffles were fitted on the tripod to form a rear shield when aligned to the desired sampling direction.
- The vacuum pump was connected to the rotameter using an appropriate length and diameter of the tubing. Using the rotameter, the flow rate was adjusted to ensure it is running at a constant flow of 28.3l/min (±2%) for each pump.
- On completion of the pump test, the tubing from the dry gas flow meters was disconnected from the rotameter then connected to the inlet on the corresponding Andersen single-stage sampler.
- Fresh sample plates were installed in turn by removing the lid and being placed within the Andersen single-stage sampler
- The stoppers in the inlet of the Andersen single-stage samplers were removed.
- When the Andersen single-stage samplers were fitted with plates the vacuum pumps were activated and the start time recorded on the stopwatch. All pumps were switched on/off at the same time or at a maximum interval of up to 10% of the total run time.
- When the sample duration was completed the pumps were stopped and the finish time recorded.
- The plates were carefully removed ensuring that no contact was made with the exposed agar surface,
- The dish cover was replaced on to the plate and secured with masking tape.

- Each plate was placed into an individual plastic bag and sealed.
- The plates were stored in an upright, protective, and cooled container and transported to the laboratory within 24 hours.
- Control blank samples were taken at the site. The steps stated above were adhered to however the sample pump was not switched on. One of each sample media was inserted within the Andersen single-stage samplers, left in for the same period of sampling time, then packaged.
- Field blank samples were taken. The sample media were placed in re-sealable packaging without being opened.

3.3.4 Laboratory

The impacted agar plates were subsequently delivered to a specialist laboratory via a cool box with an ice pack. The analysis took place within 24 hours from sample collection.

The agar samples were then cultured and counted by a specialist laboratory for both Aspergillus fumigatus and mesophilic micro-organisms. The count result provides a quantification of the potential health risks posed by the facility to nearby receptors.

4.0 Presentation of Data

The following pages consist of meteorological conditions found on site, a presentation of the estimated concentrations of airborne micro-organisms, a plan displaying sample locations and the laboratory data.

4.1 Field Sampling Report

Site: Llanddulas Composting Facility

Site Operator: FCC Environment

Date: 3rd December 2025

Start Time: 11:00
Finish Time: 14:10

Monitoring Technician ID: R. Chau, L. Kiernan

4.1.1 Meteorological Conditions

The table below shows the weather conditions used during this monitoring survey,

Table 1: Weather Conditions

Parameter	Wind Direction	Wind Speed (m/s)	Pressure (mb)	Temperature (°C)	Cloud Cover (0-8)
Start	SSW	5.3	1003	8	2
Finish	SSW	5.3	1003	13	2

4.1.2 Site Description

Llanddulas composting facility is located in a quarry, near Conway in North Wales. The nearest sensitive receptor are residential farm buildings to the west of the composting facility located within 250 metres.

During the sampling period the site was under normal operations with turning of windrows taking place. The Screener was in operation and movements of green waste were observed.

4.2 Sampling Locations & Field Comments

The locations were chosen on the day of sampling according to the wind direction and agreed with site management.

The three downwind samples were set up as far apart as possible in order to achieve a 30° (+-3°) angle from the upwind/downwind axis.

Table 2: Sampling Locations

Location	Description	Comments
Upwind UW001	Quarry edge along tree line between BH33 and BH34	No odour detected
Downwind DW002	Quarry edge along track	Faint green waste odour
Downwind DW003	Quarry edge along track	Faint green waste odour
Downwind DW004	Quarry edge along track, left hand side of BH35	No odour detected

An aerial plan, as well as photographs of the locations are presented in *Appendix A* and *Appendix B* respectively.

4.3 Deviations from Methods

The locations were assessed to take into account the effect of features and obstructions which may impact the effectiveness of the monitoring. The sampling locations were restricted to where safe physical access was possible along with being legally accessible. Any deviations to the locations, as well as other potential impacts to the assessment are presented in *Table 3* below.

Table 3: Deviations

Location	Deviation	Reason
Downwind Locations	Distance and shape of plume of downwind locations	Location limited to edge of quarry due to health and safety. Health and safety restrictions of vegetation and terrain.
Downwind Locations	Deviation in time DW003 and DW004 sampled concurrently after UW001 and DW002	In order to achieve spread of the downwind locations as per M9 document. No access between downwind locations for simultaneous sampling due to health and safety.
Downwind Location 004	Plate 94B was resampled therefore slight deviation on sampling time with 003 – 94B	Cracks in plate were noticed after sampling and therefore sampling was repeated with new plate.

4.4 Field Sampling Record

Table 4: Field Sampling Results

Ambient Sampling: Estimated concentration of bioaerosols								
Site: Llanddulas Sampling Date: 03/12/2025 Estimated Mass of Materials: 5,500 tonnes Green Waste Activities affecting the concentration of Bioaerosols: on site processes				Site Operator: FCC Monitoring Contractor: Enitial Type of Materials Processed on Site: Green waste/ compost Site Activity: Normal activities				
Location and grid reference	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m³) **Total Count (TVC)**	Concentration of bioaerosols (CFU/m³) **Aspergillus Fumigatus (YM)**	Median of samples (CFU/m³)	
							TVC	**YM**
Upwind (1) SH 90179 77040	LL001BIOAEM Upwind location directly upwind of site facility on centre line.	151m	23.5°	12:10-12:15	7	-	7	<7
					-	<7		
				12:16-12:21	14	-		
					-	<7		
				12:22-12:27	7	-		
					-	<7		

Location and grid reference	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m³) **Total Count (TVC)**	Concentration of bioaerosols (CFU/m³) **Aspergillus Fumigatus (YM)**	Median of samples (CFU/m³) **TVC**	Median of samples (CFU/m³) **YM**
Downwind (2) SH 90470 77230	LL002BIOAEM Centre downwind directly downwind of site facility on centre line	200m	218.5°	12:10-12:15	63	-	91	<7
					-	<7		
				12:16-12:21	105	-		
					-	<7		
				12:22-12:27	91	-		
					-	<7		
Downwind (3) SH 90416 77292	LL003BIOAEM Left downwind location 30° left of the centre line	196m	196.5°	12:48-12:53	147	-	182	<7
					-	<7		
				12:54-12:59	182	-		
					-	<7		
				13:00-13:05	203	-		
					-	<7		

Location and grid reference	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m³) **Total Count (TVC)**	Concentration of bioaerosols (CFU/m³) **Aspergillus Fumigatus (YM)**	Median of samples (CFU/m³)	
							TVC	**YM**
Downwind (4) SH 90509 77166	LL004BIOAEM Right downwind location 30° right of the centre line	222m	239.5°	12:48-12:53	35	-	35	<7
					-	<7		
				12:54-12:59	21	-		
					-	<7		
				13:00-13:05	49	-		
				13:20-13:25	-	<7		
Control	LLControlBIOAEM At same location as Upwind	N/A	N/A	N/A	<1	-	N/A	
					-	<1		
Field	LLFieldBIOAEM Not removed from package. For QA/QC	N/A	N/A	N/A	<1	-	N/A	
					-	<1		

4.5 Process Contribution Results

The median is routinely used for statistics and probability theory as the results are less likely to be skewed by extremely high or low values that are not representative of the data set. The median is located by finding the middle value by evenly separating the data set. The median for each location has been calculated and then the highest result for the downwind locations identified. The process contribution has then been calculated by subtracting the upwind median value from the highest downwind median value. The process contribution shows the input the activity of the site has on the ambient bioaerosols concentrations. In the table below the process contribution is shown.

Table 5: Process Contribution Results

Sample Type	Upwind Median Results	Downwind Median Highest Results	Process Contribution
Total Bacteria viable Count (TVC)	7	182	**175**
Aspergillus fumigatus (YM)	<7	<7	**0**

5.0 Conclusion

The above reports indicate that at the time of sampling:

1. Mesophilic micro-organisms - Total Viable Count (TVC) shows higher readings at the downwind locations compared to the upwind location.

2. Aspergillus readings were consistent at the downwind sample location compared to the upwind location.

3. Upwind location median results of 7cfu/m^3 remained **below** the industry standard threshold values of 1000cfu/m^3 for Total Bacteria.

4. Downwind location median process contribution results of 175cfu/m^3 remained **below** the industry standard threshold values of 1000cfu/m^3 for Total Bacteria.

5. Upwind location median results remained **below** the industry standard threshold values of 500cfu/m^3 for Aspergillus Fumigatus.

6. Downwind location median process contribution results remained **below** the industry standard threshold values of 500cfu/m^3 for Aspergillus Fumigatus.

7. Control and Field blanks for QA/QC did not show any evidence of contamination.

APPENDIX A
Aerial Plan

Key

1 – Upwind

2 – Downwind Centre

3 – Downwind Left

4 – Downwind Right

Blue area – Emission source

Red Box – Site area

FCC – Llanddulas 03/12/2025

Aerial Plan Showing Bioaerosol Sample Locations

Enitial part of Cawood

APPENDIX B
Meteorological Conditions

METEOROLOGICAL CONDITIONS

SITE:	Llanddulas	SITE OPERATOR:	FCC
SAMPLING DATE:	03/12/2025	COMMISSIONING LABORATORY:	Southern Microbiological Services
ESTIMATED MASS OF MATERIALS:	5500 tonnes	TYPE OF MATERIALS PROCESSED ON SITE:	Compost/ Green waste

Location	Sample Reference Number	Bearing of samplers from boundary of operational area or turning/ screening operation (° from true north) - GPS	Mean direction the wind blows to during the sampling period (° from true north)	Difference in bearing between location of samples from boundary/ source and mean direction wind blows to (°)	Mean wind speed during sampling (m/s)	Arithmetic mean of air temperature (°C)	Arithmetic mean of relative humidity (%)
Upwind	LL001BIOAEM	46° SH 90179 77040	22.5°	23.5°	5.3	8	80
Downwind	LL002BIOAEM	241° SH 90470 77230	22.5°	218.5°	5.3	8	80
Downwind	LL003BIOAEM	219° SH 90416 77292	22.5°	196.5°	5.3	8	80
Downwind	LL004BIOAEM	262° SH 90509 77166	22.5°	239.5°	5.3	8	80

APPENDIX C
Photograph Sheet

Pictures

001 Upwind

002 Downwind

003 Downwind

004 Downwind

APPENDIX D
Laboratory Certificate

SOUTHERN MICROBIOLOGICAL SERVICES LTD

Unit3, Georges Farm, West Buckland, Wellington, Somerset, TA21 9LE
Telephone: 01823 662062 Fax: 01823 660505
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Enitial
Enterprise Drive
Four Ashes,
Wolverhampton
WV10 7DE

TEST REPORT

Report Reference: 1251201043
Date Reported: 09 December 2025

Enitial Anderson Plates Site FCC Llanddulas Date sampled 3/12/2025 PO ENI 107824

						*	*
SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	*TVC cfu/m3 (2 day pr*	*Asp fumigatus cfu/m3*
1251205819	04/12/25	001BIOAEM (93.)	---	141.5	---	7 cfu/m3	
1251205820	04/12/25	001BIOAEM (94.)	---	141.5	---		< 7 cfu/m3
1251205821	04/12/25	001BIOAEM (93.A)	---	141.5	---	14 cfu/m3	
1251205822	04/12/25	001BIOAEM (94.A)	---	141.5	---		< 7 cfu/m3
1251205823	04/12/25	001BIOAEM (93.B)	---	141.5	---	7 cfu/m3	
1251205824	04/12/25	001BIOAEM (94.B)	---	141.5	---		< 7 cfu/m3

Enitial Anderson Plates Site FCC Llanddulas Date sampled 3/12/2025 PO ENI 107824

						*	*
SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	*TVC cfu/m3 (2 day pr*	*Asp fumigatus cfu/m3*
1251205825	04/12/25	002BIOAEM (93.)	---	141.5	---	63 cfu/m3	
1251205826	04/12/25	002BIOAEM (94.)	---	141.5	---		< 7 cfu/m3
1251205827	04/12/25	002BIOAEM (93.A)	---	141.5	---	105 cfu/m3	
1251205828	04/12/25	002BIOAEM (94.A)	---	141.5	---		< 7 cfu/m3
1251205829	04/12/25	002BIOAEM (93.B)	---	141.5	---	91 cfu/m3	
1251205830	04/12/25	002BIOAEM (94.B)	---	141.5	---		< 7 cfu/m3
1251205831	04/12/25	003BIOAEM (93.)	---	141.5	---	147 cfu/m3	
1251205832	04/12/25	003BIOAEM (94.)	---	141.5	---		< 7 cfu/m3
1251205833	04/12/25	003BIOAEM (93.A)	---	141.5	---	182 cfu/m3	
1251205834	04/12/25	003BIOAEM (94.A)	---	141.5	---		< 7 cfu/m3
1251205835	04/12/25	003BIOAEM (93.B)	---	141.5	---	203 cfu/m3	
1251205836	04/12/25	003BIOAEM (94.B)	---	141.5	---		< 7 cfu/m3

Enitial Anderson Plates Site FCC Llanddulas Date sampled 3/12/2025 PO ENI 107824

						*	*
SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	*TVC cfu/m3 (2 day pr*	*Asp fumigatus cfu/m3*
1251205837	04/12/25	004BIOAEM (93.)	---	141.5	---	35 cfu/m3	
1251205838	04/12/25	004BIOAEM (94.)	---	141.5	---		< 7 cfu/m3
1251205839	04/12/25	004BIOAEM (93.A)	---	141.5	---	21 cfu/m3	
1251205840	04/12/25	004BIOAEM (94.A)	---	141.5	---		< 7 cfu/m3
1251205841	04/12/25	004BIOAEM (93.B)	---	141.5	---	49 cfu/m3	
1251205842	04/12/25	004BIOAEM (94.B)	---	141.5	---		< 7 cfu/m3

Unless otherwise indicated, all samples were received in good condition, tests were performed at the above address and results apply to the sample as received. Date tested equals date received.

Where there is a greater than 40% difference in bacterial duplicates, these are genuine results.

Carol Macready
Technical Administration Manager

* Tests marked with a * in this report are not included in the UKAS Accreditation Schedule for our laboratory

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Four Ashes,
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WV10 7DE

TEST REPORT

Report Reference: 1251201046
Date Reported: 09 December 2025

Enitial Anderson Plates Controls Site FCC Llanddulas Date sampled 3/12/2025
PO ENI 2025

SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	*TVC/plate*	*Asp. Fumigatus Plate*
1251205843	04/12/25	CONTROLBIO AEM (93-C)	---	---	---	< 1 cfu / plate	
1251205844	04/12/25	CONTROLBIO AEM (94-C)	---	---	---		< 1 cfu / plate
1251205845	04/12/25	FIELDBIOAEM (93-F)	---	---	---	< 1 cfu / plate	
1251205846	04/12/25	FIELDBIOAEM (94-F)	---	---	---		< 1 cfu / plate

Enitial Anderson Plates Controls Site FCC Llanddulas Date sampled 3/12/2025
PO ENI 2025

SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	*TVC/plate*	*Asp. Fumigatus Plate*

Unless otherwise indicated, all samples were received in good condition, tests were performed at the above address and results apply to the sample as received. Date tested equals date received.

Carol Macready
Technical Administration Manager