

# Bioaerosol Sampling Report

FCC Environment Ltd

Llanddulas Composting Facility

08<sup>th</sup> January 2025

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## Approval Sheet

Customer: FCC Environment

Site: Llanddulas Composting facility.  
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 Conwy,  
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Project title: Bioaerosols Sampling

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Issue	Status	Date	Prepared By	Signature	Date
1	Final	16/01/2025	A. Balkwill-white		16/01/2025
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			J.Taylor	J.Taylor	16/01/2025

## Foreword

Enitial has used its best endeavours, experience, and expertise to provide a meaningful, accurate and relevant representation of the works carried out. The works were based on a defined programme and scope of works and terms and conditions agreed with the Client.

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 08<sup>th</sup> January 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 no statutory limits have been set for ambient concentrations of bioaerosols. However, as per the Environmental Agency Technical Guidance Note M17, guideline levels have been set for acceptable levels at sensitive receptors as the following:

- Total bacteria: 1000 cfu/m<sup>3</sup>
- *Aspergillus Fumigatus*: 500 cfu/m<sup>3</sup>

## 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

#### 3.31 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

### 3.32 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.

### 3.33 Setup and Operation

- The pumps were Pre-run for a specified time at the required flow rate of 28.3l/min ( $\pm 2\%$ ). 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 ( $\pm 2\%$ ) 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.

### 3.34 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: 23<sup>rd</sup> July 2024

Start Time: 12:30

Finish Time: 13:30

Monitoring Technician ID: S. Mullen, C. Wilson

### 4.11 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	SSE	2.23	1001	3	7
Finish	W	0.89	1000	3	7

### 4.12 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	Verge to South East of pad and site.	No odour
Downwind DW002	Verge by NW corner of compost pad.	No odour
Downwind DW003	Far left hand corner of site up from GW35.	No odour
Downwind DW004	SSE verge of field.	Slight smokey order

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
Upwind Location	Deviation in distance and location.	Location limited due to restricted access due to private land, and water droplets from the deodorizer system.
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.

#### 4.4 Field Sampling Record

Table 4: Field Sampling Results

Ambient Sampling: Estimated concentration of bioaerosols								
Site: Llanddulas Sampling Date: 08/01/2025 Estimated Mass of Materials: 2000 tonnes 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/m <sup>3</sup> )	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Upwind (1)  SH 90549 77011	LL001BIOAEM.  Upwind location directly upwind of site facility on centre line.	221m	84°	12:32-12:37	7	-	7	<7
					-	<7		
				12:38-12:43	<7	-		
					-	<7		
				12:44-12:49	<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/m <sup>3</sup> )		Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Downwind (2) SH 90131 77243	LL002BIOAEM. Centre downwind directly downwind of site facility on centre line	259m	266°	12:32-12:37	7	-	14	<7
					-	<7		
				12:38-12:43	21	-		
					-	<7		
				12:44-12:49	14	-		
					-	<7		
Downwind (3) SH 90159 77205	LL003BIOAEM Left downwind location 30° left of the centre line	216m	260°	13:04-13:09	21	-	14	<7
					-	<7		
				13:10-13:15	7	-		
					-	<7		
				13:16-13:21	14	-		
					-	<7		

	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/m <sup>3</sup> )		Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Downwind (4) SH 90124 77294	LL004BIOAEM Right downwind location 30° right of the centre line	294m	274°	13:04-13:09	21	-	49	<7
					-	<7		
				13:10-13:15	56	-		
					-	<7		
				13:16-13:21	49	-		
					-	<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	49	42
Aspergillus fumigatus (YM)	<7	<7	0

## 5.0 Conclusion

### 5.1 Summary of Analytical Results

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 not detected at upwind or downwind sample locations.
3. Upwind location median results remained below the industry standard threshold values of 1000cfu/m<sup>3</sup> for Total Bacteria.
4. Downwind location median process contribution remained below the industry standard threshold values of 1000cfu/m<sup>3</sup> for Total Bacteria.
5. Upwind location median results remained below the industry standard threshold values of 500cfu/m<sup>3</sup> for Aspergillus Fumigatus.
6. Downwind location median process contribution results remained below the industry standard threshold values of 500cfu/m<sup>3</sup> for Aspergillus Fumigatus.
7. Control and Field blanks for QA/QC did not show any evidence of contamination.

## 5.2 Discussion of Results

1. Distribution of sample locations were limited to accessible areas around the edge of the cliff face above the composting facility located within the quarry. The site was assessed during a site walkover to ensure locations complied with the relevant predominant wind direction and any health and safety concerns due to terrain.
2. The sampled wind direction was selected by observing the site weather station, as well as observed conditions by the Enitial technicians in the vicinity of the composting site.
3. Higher readings at the downwind sampling locations compared to the upwind location show the downwind locations did effectively catch the plume of bioaerosols during the sampling period.

**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 Quarry 08/01/2025  
 Aerial Plan Showing Bioaerosol Sample Locations

## APPENDIX B

### Meteorological Conditions

## METEOROLOGICAL CONDITIONS

SITE:	Llanddulas	SITE OPERATOR:	FCC
SAMPLING DATE:	08/01/2025	COMMISSIONING LABORATORY:	Southern Microbiological Services
ESTIMATED MASS OF MATERIALS:	2000 tonne	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	117 SH 90549 77011	33	84	1.56	3	87
Downwind	LL002BIOAEM	299 SH 90131 77243	33	266	1.56	3	87
Downwind	LL003BIOAEM	293 SH 90159 77205	33	260	1.56	3	87
Downwind	LL004BIOAEM	307 SH 90124 77294	33	274	1.56	3	87

APPENDIX C  
Photograph Sheet

**MONITORING PHOTOGRAPH RECORD**

**Site:** FCC Llanddulas

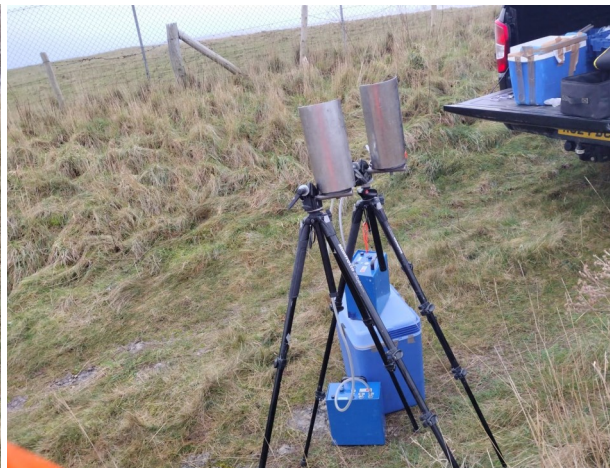
**Date:** 08/01/2025



**Title:** Bioaerosol Sampling



Upwind 001 location looking towards site



Upwind 001 location looking away from site



Downwind 002 location looking towards site



Downwind 002 location looking away from site



Downwind 003 location looking towards site



Downwind 003 location looking away from site

**MONITORING PHOTOGRAPH RECORD**

**Site:** FCC Llanddulas

**Date:** 08/01/2025



**Title:** Bioaerosol Sampling



Downwind 004 location looking towards site



Downwind 004 location looking away from site

APPENDIX D  
Laboratory Certificate



## SOUTHERN MICROBIOLOGICAL SERVICES LTD

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 WV10 7DE

### TEST REPORT

**Enitial Anderson Plates Site: Handdulees Date sampled: 08/01/2025**  
**PO:ENI106127.**

Report Reference: 1250101107  
 Date Reported: 14 January 2025  
 Page 1 of 3

\* \*

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
1250106170	09/01/25	001BIOAEM (93.)	---	144.5	---	7 cfu/m3	
1250106171	09/01/25	001BIOAEM (94.)	---	144.5	---		< 7 cfu/m3
1250106172	09/01/25	001BIOAEM (93.A)	---	144.5	---	< 7 cfu/m3	
1250106173	09/01/25	001BIOAEM (94.A)	---	144.5	---		< 7 cfu/m3
1250106174	09/01/25	001BIOAEM (93.B)	---	144.5	---	< 7 cfu/m3	
1250106175	09/01/25	001BIOAEM (94.B)	---	144.5	---		< 7 cfu/m3

Enitial Anderson Plates Site: Handdulees Date sampled: 08/01/2025  
 PO:ENI106127.

Report Reference: 1250101107  
 Date Reported: 14 January 2025  
 Page 2 of 3

\* \*

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
1250106176	09/01/25	002BIOAEM (93.)	---	144.5	---	7 cfu/m3	
1250106177	09/01/25	002BIOAEM (94.)	---	144.5	---		< 7 cfu/m3
1250106178	09/01/25	002BIOAEM (93.A)	---	144.5	---	21 cfu/m3	
1250106179	09/01/25	002BIOAEM (94.A)	---	144.5	---		< 7 cfu/m3
1250106180	09/01/25	002BIOAEM (93.B)	---	144.5	---	14 cfu/m3	
1250106181	09/01/25	002BIOAEM (94.B)	---	144.5	---		< 7 cfu/m3
1250106182	09/01/25	003BIOAEM (93.)	---	144.5	---	21 cfu/m3	
1250106183	09/01/25	003BIOAEM (94.)	---	144.5	---		< 7 cfu/m3
1250106184	09/01/25	003BIOAEM (93.A)	---	144.5	---	7 cfu/m3	
1250106185	09/01/25	003BIOAEM (94.A)	---	144.5	---		< 7 cfu/m3
1250106186	09/01/25	003BIOAEM (93.B)	---	144.5	---	14 cfu/m3	
1250106187	09/01/25	003BIOAEM (94.B)	---	144.5	---		< 7 cfu/m3

Enitial Anderson Plates Site: Handdulees Date sampled: 08/01/2025  
 PO:ENI106127.

Report Reference: 1250101107  
 Date Reported: 14 January 2025  
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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
1250106188	09/01/25	004BIOAEM (93.)	---	144.5	---	21 cfu/m3	
1250106189	09/01/25	004BIOAEM (94.)	---	144.5	---		< 7 cfu/m3
1250106190	09/01/25	004BIOAEM (93.A)	---	144.5	---	56 cfu/m3	
1250106191	09/01/25	004BIOAEM (94.A)	---	144.5	---		< 7 cfu/m3
1250106192	09/01/25	004BIOAEM (93.B)	---	144.5	---	49 cfu/m3	
1250106193	09/01/25	004BIOAEM (94.B)	---	144.5	---		< 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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### TEST REPORT

**Enitial Anderson Plates Controls Site: Handdulees Date sampled: 08/01/2025  
PO: ENI106127.**

Report Reference: 1250101108

Date Reported: 14 January 2025

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<u>SMS Reference</u>	<u>Date Tested</u>	<u>Sample Code</u>	<u>Sample Details</u>	<u>Ltrs of Air filtered</u>	<u>Further Details 2</u>	<u>TVC/plate</u>	<u>Asp. Fumigatus Plate</u>
1250106194	09/01/25	_CONTOROL BIOAEM (93- C)	---	---	---	< 1 cfu / plate	
1250106195	09/01/25	_CONTROLBI OAEM (94-C)	---	---	---		< 1 cfu / plate
1250106196	09/01/25	_FIELDBIOAE M (93-F)	---	---	---	< 1 cfu / plate	
1250106197	09/01/25	_FIELDBIOAE M (94-F)	---	---	---		< 1 cfu / plate

Enitial Anderson Plates Controls Site: Handdulees Date sampled: 08/01/2025  
PO: ENI106127.

Report Reference: 1250101108  
Date Reported: 14 January 2025  
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<u>SMS Reference</u>	<u>Date Tested</u>	<u>Sample Code</u>	<u>Sample Details</u>	<u>Ltrs of Air filtered</u>	<u>Further Details 2</u>	<u>TVC/plate</u>	<u>Asp. Fumigatus Plate</u>
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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