Cwm Environmental (Nantycaws) Composting Facility

Bioaerosols Monitoring

11th December 2025
2nd Half-Year Report 2025

'Open Windrow Composting'

Prepared on behalf of:
Mr Dan Parsons
Cwm Environmental
c/o Compost Site Office
Nantycaws Landfill Site
Llanddarog Rd.
Nant y Caws
Carmarthen
SA 32 8BG

Site Detail:
Composting Facility
Nantycaws Landfill Site
Llanddarog Rd.
Nant y Caws
Carmarthen
SA 32 8BG

EA Officer: Launder, Michael
<Michael.Launder@cyfoethnaturiolcymru.gov.uk>

Prepared by:
D J Baldwin
BSc CEnv. MCIWM
Technical Director
Recogen Ltd
1 Shackleton Way
Shrewsbury
SY3 8SW
Tel: 07785 352993

Sampling date **11th December 2025**
Report date **18th January 2026**

SUMMARY NANTYCAWS BIOAEROSOLS MONITORING

The In Vessel Composting (IVC) and External Windrow (Pad) Composting Operations
The Cwm Environmental composting facilities are located at the Nantycaws Landfill Site Llanddarog Road, Nantycaws, Carmarthenshire. There were two linked sites: the 'In-Vessel Composting Facility and the External Composting Pad. The sites are located in a rural area near to the Nantycaws landfill. The two sites were amalgamated under one bespoke Environmental Permit, (EPR/EP3698FL, November 2012). **The IVC activity was decommissioned in 2020.**

The enclosed process IVC is now closed and not undertaking composting activities.
There are offices, a Civic Amenity site, **Materials Reclamation Facility** and the **Landfill** nearby.

The **Open Windrow Composting facility** is located to the north-west of the Offices and north-north-east of the landfill. To the north-west of the facility is a derelict farmstead 'Ty Hen'. Further to the north is the A48 highway with a petrol station and houses beyond.

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 may be other fungal spores and bacteria that may present environmental effects at or near to composting facilities.

Environment Agency Requirements to Monitor Bioaerosols Emissions
Environment Agency Revised and Updated Policy in regard to Bioaerosols
Bioaerosols comes under the statutory control of the Natural Resources Wales, which has adopted the Environment Agency 'Policy' to provide the basis for monitoring bioaerosols. The Environment Agency (England) guidance is to use the M9 Methodology for the monitoring of bioaerosols.

This report utilises the M9 Method [Appx 2] with regard to upwind/downwind sampling.
In 2021 the NRW advised that the monitoring of bioaerosols could be reduced to twice per year.

This Report
This report provides the **SECOND Half-Year Report** of bioaerosols monitoring results.
Due to abnormally persistent wet weather during the 2025 autumn period, this sampling occasion was undertaken early in December at the first opportunity when there was a forecast of dry weather. The focus was on sampling for the **External Windrow Composting Facilities**. On the day selected, the activity of **Green Waste Shredding** on the **North-Eastern** area of the pad, and **Compost Screening to the West of the Pad** were being undertaken. The wind during the sampling session was from the **South;** arriving from the old landfill area, across stockpiles and windrows and exiting the Composting site towards the **North**; towards the sensitive receptors.
The following may be concluded from the sampling sessions of **11th December 2025:**

Overall Conclusions

The **UPWIND Maximum Median** Total Bacteria bioaerosols level was **9 cfu/m^3**; where-as the Aspergillus Fumigatus bioaerosols was **0 cfu/m^3**. The **DOWNWIND MAXIMUM MEDIAN Total Bacteria** bioaerosols level **was raised to 304 cfu/m^3** (Median 268 cfu/m^3); but the **Aspergillus Fumigatus remained as zero cfu/m^3.** These levels are attributable to the persistent wet autumn weather and good control of the compost process. Overall, the **Total Bacteria and Aspergillus Fumigatus** bioaerosols levels remained at **less than 31%** of the guidance and Permit thresholds.

These levels are well within NRW thresholds and represent minimal risk to the receptors.

CONTENTS

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 Guidance for monitoring bioaerosols.

Reference to The M9 Guidance

The M9 Guidance (refer APPENDIX 2) is referred to throughout; and was used as the basis for the methodology employed during these sampling sessions.

Recogen Ltd. Environmental Quality Reporting – An Independent Assessor

For the purposes of quality assurance in undertaking this risk assessment/monitoring work, Recogen Ltd. is a recognised organisation with appropriately trained, qualified and experienced personnel; *independent* to the composting site operator. This assessment/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.

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 Organic Recycling Group being part of the Renewable Energy 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 (PAS100:2011 and 2018), The Compost Quality Protocol, ISO9001, ISO14001, COSHH and H&S Risk Assessments.

D and F Associates Laboratory (Widnes, Cheshire) was used for provision and enumeration of the Collection Plates. This laboratory operates to the UKAS accredited standards.

Notes:
1. Culture media supplied by D and F Associates Laboratory (Widnes, Cheshire) is in accordance with that specified in the M9 Guidance. The mediums used are particularly useful for the identification of bacteria and the type used for the mould species and allows the Laboratory to accurately identify and quantify *Aspergillus Fumigatus* on plates that may contain many other mould species.

2. D and F Associates Laboratory (Widnes, Cheshire) operates to the UKAS accredited standards and also runs its own internal Quality Management System. All media preparation and storage is carried-out in accordance with UKAS approved Standard Operating Procedures and fully recorded to appropriate standards. D and F Associates Laboratory is an approved supplier of services to 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 more serious health problems appear to arise from *Aspergillus Fumigatus*, but there are other fungal spores and bacteria that may 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
'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.

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 <u>are attributable</u> to the composting operations.
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}

D. J. Baldwin (Technical Director)
MCIWM CEnv. Tel: 07785 352993

1.0 SITE LOCATION (External Composting Facility)

The Composting Facility
Cwm Environmental
Nantycaws Landfill Site
Llanddarog Rd.
Nant y Caws
Carmarthen
SA 32 8BG

Figure 1: Nantycaws Composting Site Location Map

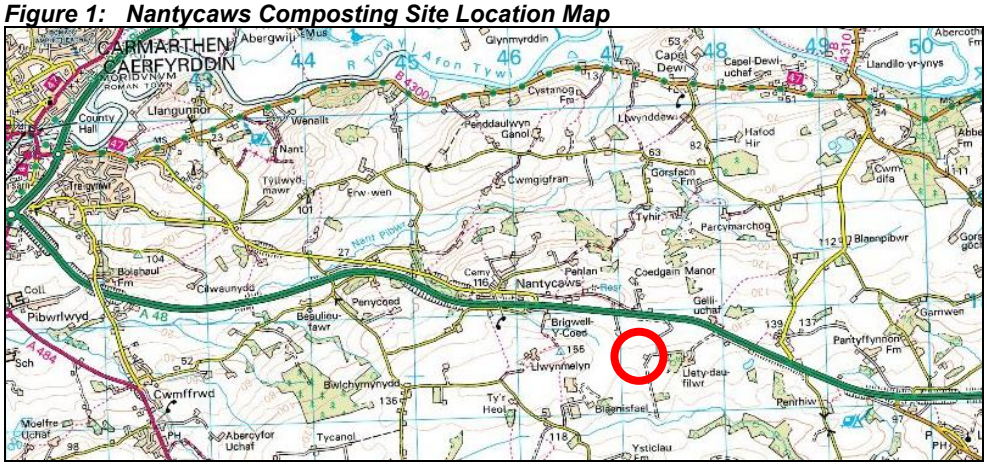
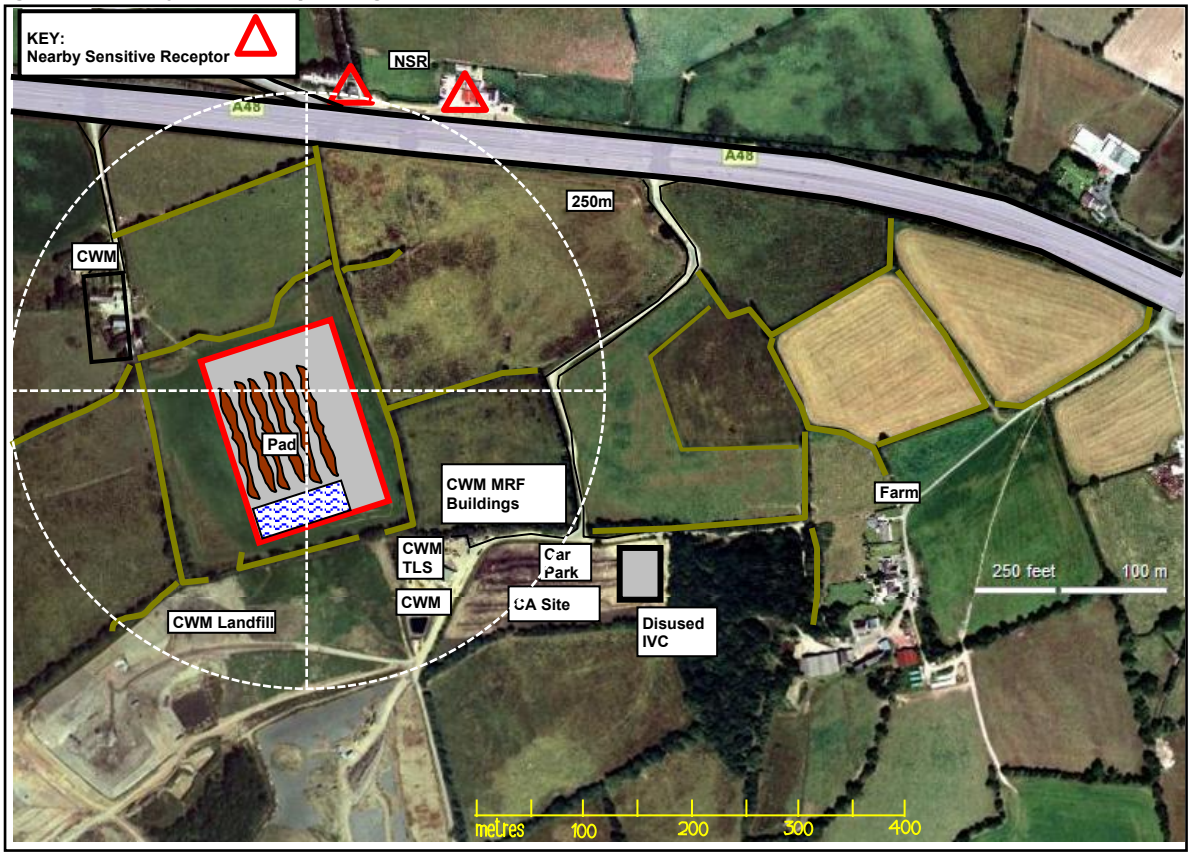


Figure 2: Nantycaws Composting Site Plan View



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, or when leachate is recirculated, 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 nominal values as reference levels for risk.

2.3 Environment Agency Policy and Approach to Bioaerosols.

The Environment Agency (The EA) has recently reviewed, updated and re-published ([Ref 3] 2010) its 'Policy' in regard to bioaerosols. This built 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. In summary, **the 2009 policy** highlighted ***the need to maintain bioaerosols at appropriate levels at any dwelling or workplace.***

In regard to this (see definitions in the Introduction on page 1) the M9 2018 follows the 2009 policy and provides the following: '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 range from 1- 1,000 cfu/m^3 or more.

2.4 Applying the Bioaerosols Policy to the Composting Site.

The open windrow Composting Facility at Nantycaws is situated within 250m of third-party workplaces and/or dwellings (see fig 2). These have been taken into account during monitoring.

3.0 COMPOSTING SITE - SENSITIVE RECEPTORS

3.1 IVC Site Situation with Regard to Sensitive Receptors

At this time the IVC facility was not in operation for composting. The IVC composting facility is located in the east of the site, in a rural setting and is separated from sensitive receptors by distances of >200 m. There is a farmstead and dwellings to the east that are >250m distant.

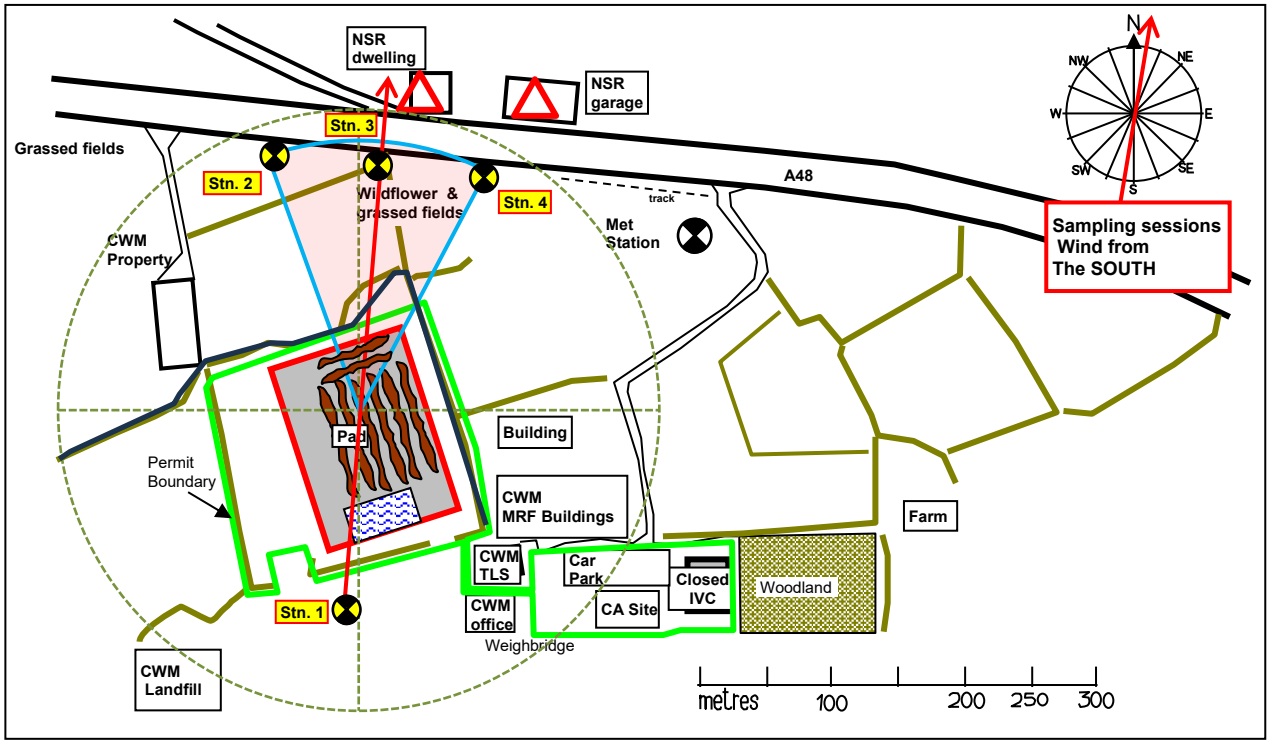
3.2 External Windrow Site Situation in Regard to Sensitive Receptors

The external windrow composting area is located within a rural area and is separated from sensitive receptors by distances of ~225 m. The Nearest Sensitive Receptors (NSR's) **are the garage and dwellings on the northern side of the A48 carriageway** and north of the facility.

4.0 BIOAEROSOL SAMPLING STATIONS

The following plan for sampling stations was utilised. The wind from the **South** was consistently towards the **North** throughout the sessions and the sampling stations were located to provide data in accordance with the 'upwind' and 'downwind'; at locations as shown in Figure 3.

Figure 3: Sampling Station Locations – Open Windrow Composting Facility - SA 32 8BG



Station 1.	SN 47152, 17593	Located to the **S**outh, 50m from site **150m UPWIND** of the Shredding/Screening activities
Station 2.	SN 47051, 17955	Located **140m from the site** to **NNW**, at the edge of the Ty Hen grassed field **200m** from centre of activity to provide the **DOWNWIND** sample to the **LEFT of the centreline.**
Station 3.	SN 47169, 17938	Located **120m from the site** to **NORTH**, at the edge of northern Ty Hen grassed field **190m** from centre of activity to provide the central **DOWNWIND** sample.
Station 4.	SN47268, 17931	Located **140m from the site** to the **NNE**, at the edge of large grassed field **200m** from centre of activity to provide the **DOWNWIND** sample to the **RIGHT of the centreline.**

The Materials Recovery Facility (MRF) treats municipal waste under a separate permit.
Any emissions from this were not measured specifically but may have affected the downwind results.

5.0 BIOAEROSOL TYPES

The following types of bioaerosol were enumerated

Description	Total Bacteria	Aspergillus Fumigatus	Gram Negative bacteria
	cfu/m^3	cfu/m^3	*Not required*

These types relate to the EA guidance given earlier (Section 2.3 on page 3)
The gram-negative bacteria are NOT included because there is no IVC (and M9 does not require these to be sampled).

6.0 BIOAEROSOL SAMPLING PROCEDURE

6.1 Standardised sampling Procedure

The procedure was based on the **M9 Methodology.** Although the Garage 'Sensitive Receptor' **to the North** was upwind of the site, it's distance was used to determine locations from the site for the downwind stations. Each of the stations for the UPWIND and DOWNWIND samples were retained in their respective locations during all sessions as the variations in the wind directions were not so great as to entail significant variation within the downwind 'fan'.

6.2 Sampling Equipment

6.2.1 Samplers

Samplers comprised the 3 part 'Andersen' type sampler design, with base, sampling hole manifold and collection funnel. Hemi-cylindrical air stagnation baffles extending 150mm above the inlet to the cone were fitted during sampling. The samplers were mounted as a pair on a platform at the top of an adjustable tripod that enabled the inlet cone to be held at 1.5 - 1.8m above ground level.

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.

6.3 Sample Collection media and Enumeration

The collection media and laboratory-based incubation and enumeration was undertaken by 'D&F Associates Labs' a laboratory working to UKAS accredited procedures.

6.4 Weather Monitoring Equipment

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

6.5 Sampler Locations

The sampling station locations are shown at figure 3.

6.6 Sample Management

The sample 'plates' were kept in a portable 12-volt refrigerator during the session and transport. The samples were delivered into the laboratory within 12 hours of the session completion.

7.0 MET DATA DURING SAMPLING

Weather data was recorded during the sessions of sampling. The Station was a Kestrel 4500, mounted on a tripod and mast at approx. 2.0m height above ground level. It was located on a clear open area of grass, approx. 25m west of the cattle grid near the main-road access. The station comprises a wind vane, anemometer, temperature and humidity sensors and programmable data-logger set at a logging interval of 1 minute. The data is shown at Table 1.The raw data is shown at Appendix 3.

Table 1: Meteorological Conditions Cwm Environmental, NantyCaws – 11th December 2025

Meteorological Conditions											
Site:		**NantyCaws Landfill, Carmarthen**			Site Operator:			**Cwm Environmental**			
Sampling Date:		**11th December 2025**			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 degrees ° to N	Difference in bearing of samplers and mean direction wind blows TO degrees ° to N	Wind Speed as sampling ms^{-1} @ 2m | @10m		Mean Air Temp as sampling °C	Mean Air RH Mean RH%	Prevailing Weather Pressure mbar	Cloud Cover 1/8 ths (okta)
C	1A Dual Upwind	Upwind Stn. 1	184	**3**	**181**	5.1	7.1	11.7	88.6	1004	6/8
C	1B Dual Left	Downwind Stn. 2	-21		-23.8						
C	1C Dual Centre	Downwind Stn. 3	4		1						
C	1D Dual Right	Downwind Stn. 4	29		26						
C	2A Dual U2wind	Upwind Stn. 1	184	**5**	**179**	5.1	7.1	11.5	86.6	1003	6/8
C	2B Dual Left	Downwind Stn. 2	-21		-25.8						
C	2C Dual Centre	Downwind Stn. 3	4		-1						
C	2D Dual Right	Downwind Stn. 4	29		24						
C	3A Dual Upwind	Upwind Stn. 1	184	**6**	**178**	3.8	5.3	11.4	86.5	1003	5/8
C	3B Dual Left	Downwind Stn. 2	-21		-27.0						
C	3C Dual Centre	Downwind Stn. 3	4		-2						
C	3D Dual Right	Downwind Stn. 4	29		23						

The data recording and monitoring was started 11:15 in the late morning. In the middle of the day, the temperature was mild at 11.5° C and fairly steady, but with a gusting wind from the South of 5.1m/sec decreasing slightly to 3.8 m/sec later. The sky remained with high cloud at 7/8 improving to 6/8 later. The air was damp with the relative humidity falling from 88.6 ~86.5% RH.

8.0 THE BIOAEROSOL SAMPLING RESULTS

The full raw results are shown in Appendix 1. 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 2 and 3 in accordance with the M9 Guidance. Table 2 shows the Results for **Total Viable Bacteria** and Table 3 shows the results for the **Aspergillus Fumigatus**.

The tables reveal the **MEAN** of the **UPWIND** results; and the **MEDIAN** of the **DOWNWIND** sampling results. The overall Median value is derived from all of the individual results.

Table 2: Sampling Results – TOTAL BACTERIA – Cwm Environmental – 11th December 2025

Site:	**NantyCaws Landfill, Carmarthen**			Type of materials on site			**Composted Green Waste**		
Sampling Date:		**11th December 2025**		Estimated material on site			5500 tonnes		
Site Operator:		**Cwm Environmental**		Type of Activity			Open Windrow Composting		
Monitoring Contractor:		**Recogen Ltd** of Shrewsbury.		Activities affecting bioaerosols release			**Green Waste Shredding. Compost Screening. Other vehicle movements around the site.**		
				Bioaerosol Type:			**TOTAL BACTERIA**		
Sample Ref Nos. Station Location ref. **All Sample Refs: 'T' (Total Viable Bacteria)**		**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** **Total Viable Bacteria cfu/m³**	**Median** of **UPWIND** Samples **Total Bacteria cfu/m³**	**Median** of **DOWNWIND** Samples **Total Bacteria cfu/m³**
C1 AT	UW Stn. 1	184	150	-181	11:17	11:33	**2**	2	
C1 BT	DW Stn. 2	-21	200	-24	11:23	11:27	**54**		
C1 CT	DW Stn. 3	4	200	1	11:25	11:29	**268**		268
C1 DT	DW Stn. 4	29	200	26	11:27	11:31	**286**		
C2 AT	UW Stn. 1	184	150	-179	11:44	12:00	**9**	9	
C2 BT	DW Stn. 2	-21	200	-26	11:50	11:54	**107**		
C2 CT	DW Stn. 3	4	200	-1	11:52	11:56	**348**		107
C2 DT	DW Stn. 4	29	200	24	11:54	11:58	**63**		
C3 AT	UW Stn. 1	184	150	-178	12:11	12:27	**7**	7	
C3 BT	DW Stn. 2	-21	200	-27	12:17	12:21	**509**		
C3 CT	DW Stn. 3	4	200	-2	12:19	12:23	**304**		304
C3 DT	DW Stn. 4	29	200	-27	12:21	12:25	**45**		
				MEDIAN UP and DOWNWIND VALUE				**7**	**268**
				MAXIMUM MEDIAN UP & DOWNWIND VALUE				**9**	**304**

Commentary to assist interpretation

1. The wind during the sampling session was from the **South;** arriving from the old landfill area, over the Composting site and out towards the **North.**

2. The **UPWIND** values for Total Bacteria were **EXTREMELY LOW i.e. median of 7 cfu/m³.**

3. The **DOWNWIND MEDIAN** values for **Total Bacteria** showed **an increase** compared to the samples in the Upwind; **and were LOW**. The **DOWNWIND MEDIAN** value was **268cfu/m³.** There was some variations with session 3 showing some moderate values.

4. The **MAXIMUM MEDIAN VALUE** for **Total Bacteria** (derived from all values) was **304 cfu/m³.**

Table 3: Sampling Results – ASPERGILLUS FUMIGATUS - Cwm Environmental - 11th December 2025

Site:	**NantyCaws Landfill, Carmarthen**			Type of materials on site			**Composted Green Waste**		
Sampling Date:		***11th December 2025***		Estimated material on site			5500 tonnes		
Site Operator:		**Cwm Environmental**		Type of Activity			Open Windrow Composting		
Monitoring Contractor:		**Recogen Ltd** of Shrewsbury.		Activities affecting bioaerosols release			**Green Waste Shredding. Other vehicle movements around the site.**		
				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	Sampling Period End Time	Concentration of bioaerosols Aspergillus Fumigatus cfu/m^3	**Median** of UPWIND Samples Aspergillus Fumigatus cfu/m^3	**Median** of DOWNWIND Samples Aspergillus Fumigatus cfu/m^3
C1 AF	UW Stn. 1	184	150	-181	11:17	11:33	0	0	
C1 BF	DW Stn. 2	-21	200	-24	11:23	11:27	0		
C1 CF	DW Stn. 3	4	200	1	11:25	11:29	9		0
C1 DT	DW Stn. 4	29	200	26	11:27	11:31	0		
C2 AF	UW Stn. 1	184	150	-179	11:44	12:00	0	0	
C2 BF	DW Stn. 2	-21	200	-26	11:50	11:54	0		
C2 CF	DW Stn. 3	4	200	-1	11:52	11:56	9		0
C2 DF	DW Stn. 4	29	200	24	11:54	11:58	0		
C3 AF	UW Stn. 1	184	150	-178	12:11	12:27	0	0	
C3 BF	DW Stn. 2	-21	200	-27	12:17	12:21	9		
C3 CF	DW Stn. 3	4	200	-2	12:19	12:23	0		0
C3 DF	DW Stn. 4	29	200	-27	12:21	12:25	0		
				MEDIAN UP and DOWNWIND VALUE				**0**	**0**
				MAXIMUM MEDIAN UP & DOWNWIND VALUE				**0**	**0**

Commentary to assist interpretation

1. The wind during the sampling session was from the **South;** arriving from the old landfill area, over the Composting site and out towards the **North.**

2. The **UPWIND** values for Aspergillus Fumigatus were **NIL i.e. Maximum median of 0 cfu/m^3.**

3. The **DOWNWIND** values for **Aspergillus Fumigatus** showed some evidence of fungi bioaerosols, but returned a **DOWNWIND MEDIAN** value as **0 cfu/m^3.** The **MAXIMUM MEDIAN VALUE** (derived from all values) was similarly **0 cfu/m^3.**

4. The results reveal that the Aspergillus Fumigatus was not prevalent in the composting material.

5. While the almost non-existent evidence of fungi bioaerosols is notable, it is not uncommon; and due to the pattern of wet rainy weather (damped or wetted surfaces) and the cold nights, the conditions are good for suppressing Aspergillus Fumigatus type fungi.

9.0 DISCUSSION OF RESULTS

9.1 Summary – Site Conditions and Activity During Sampling

Due to abnormally persistent wet weather during the 2025 autumn period, this sampling occasion was undertaken early in December at the first opportunity when there was a forecast of dry weather. On site, there were movements of vehicles (loading shovels/equipment) moving materials on the main composting pad; and specifically undertaking the **SHREDDING of GREEN WASTE**; and SCREENING of compost product. The Downwind sampling stations were located at approximately 200m from the centre of the two

activities. The results show only a **modest rise** in the **bacteria type bioaerosols values** due to the shredding and screening activities. Table 4 provides a summary of results.

9.2 Summary - Bioaerosol levels

Table 4 – Summary of results Cwm Environmental Composting Facility 11th December 2025

		Total Bacteria			Asp. Fumigatus	
	Activities	**Median UW**	**Median DW**		**Median UW**	**Median DW**
		cfu/m^3	cfu/m^3		cfu/m^3	cfu/m^3
Session 1	**Compost windrow turning**	**2**	**268**		**0**	**0**
Session 2	**Compost windrow turning**	**9**	**107**		**0**	**0**
Session 3	**Compost windrow turning**	**7**	**304**		**0**	**0**
Overall	**Median UW and Median Downwind**	**7**	**268**		**0**	**0**
Maximum Median Upwind & Downwind		**9**	**304**		**0**	**0**

The results show that in each sampling session, there was a modest increase in the **Total Bacteria** but nothing in the **Aspergillus Fumigatus** bioaerosol levels. Clearly the shredding and screening activities releases emissions (as expected); however, the levels were generally only **LOW** and remained **less than 31%** of the allowable (Permit) levels.

10.0 CONCLUSIONS-BIOAEROSOL SAMPLING

10.1 General Conclusions

The following may be concluded from the air quality results sampled **11th December 2025:**

1. In general, the results in the samples taken **UPWIND** of the site show **VERY LOW** levels of Total Bacteria and **NIL** levels of Aspergillus Fumigatus (AF).

2. In the **DOWNWIND,** the **MEDIAN Bacteria** type bioaerosol level was **LOW at 268 cfu/m^3** in the air downwind of the facility**;** while the **MEDIAN of the Aspergillus Fumigatus** bioaerosols was **NEGLIGIBLE**.

3. On this occasion the results showed a modest contribution to the **Total Bacteria Bioaerosols resulting in the MAXIMUM MEDIAN** of **304 cfu/m^3** in the air downwind of the facility. However, there was no increase in the **Aspergillus Fumigatus where the MAXIMUM MEDIAN** remained **NIL** i.e. **0 cfu/m^3** .

4. While the absence of fungi bioaerosols is notable, it is not uncommon; and due to the pattern of wet rainy weather (damped or wetted surfaces) and the cold nights, the conditions are good for suppressing Aspergillus Fumigatus type fungi.

10.2 Overall Conclusion

The **UPWIND Maximum Median** Total Bacteria bioaerosols level was **9 cfu/m^3**; where-as the Aspergillus Fumigatus bioaerosols was **0 cfu/m^3**. The **DOWNWIND MAXIMUM MEDIAN Total Bacteria** bioaerosols level **was raised to 304 cfu/m^3** (Median 268 cfu/m^3); but the **Aspergillus Fumigatus remained as zero cfu/m^3.** These levels are attributable to the persistent wet autumn weather and good control of the compost process. Overall, the **Total Bacteria and Aspergillus Fumigatus** bioaerosols levels remained at **less than 31%** of the guidance and Permit thresholds.

These levels are well within NRW thresholds and represent minimal risk to the receptors.

APPENDIX 1. Bioaerosols Sampling Record and Results

Results Table A1.1: Session 1: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler position	Sampler station location	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}
C1 A	TVC	UPWIND A	1	YA	P1	28	11:17	11:33	16.00	**1**	2	
C1 B	TVC	DOWNWIND B	2	YB	P2	28	11:23	11:27	4.00	**6**	54	
C1 C	TVC	DOWNWIND C	3	RA	P3	28	11:25	11:29	4.00	**30**	268	
C1 D	TVC	DOWNWIND D	4	RB	P4	28	11:27	11:31	4.00	**32**	286	
C1 A	AF	UPWIND A	1	GA	Q1	28	11:17	11:33	16.00	**0**		0
C1 B	AF	DOWNWIND B	2	GB	Q2	28	11:23	11:27	4.00	**0**		0
C1 C	AF	DOWNWIND C	3	BA	Q3	28	11:25	11:29	4.00	**1**		9
C1 D	AF	DOWNWIND D	4	BB	Q4	28	11:27	11:31	4.00	**0**		0

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

Results Table A1.2: Session 2: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler position	Sampler station location	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}
C2 A	TVC	UPWIND A	1	YA	P1	28	11:44	12:00	16.00	**4**	9	
C2 B	TVC	DOWNWIND B	2	YB	P2	28	11:50	11:54	4.00	**12**	107	
C2 C	TVC	DOWNWIND C	3	RA	P3	28	11:52	11:56	4.00	**39**	348	
C2 D	TVC	DOWNWIND D	4	RB	P4	28	11:54	11:58	4.00	**7**	63	
C2 A	AF	UPWIND A	1	GA	Q1	28	11:44	12:00	16.00	**0**		0
C2 B	AF	DOWNWIND B	2	GB	Q2	28	11:50	11:54	4.00	**0**		0
C2 C	AF	DOWNWIND C	3	BA	Q3	28	11:52	11:56	4.00	**1**		9
C2 D	AF	DOWNWIND D	4	BB	Q4	28	11:54	11:58	4.00	**0**		0

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

Results Table A1.3: Session 3: Bioaerosol levels UPWIND and DOWNWIND of the Compost Facility.

Run No.	Sample Type	Sampler position	Sampler station location	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}
C3 A	TVC	UPWIND A	1	YA	P1	28	12:11	12:27	16.00	**3**	7	
C3 B	TVC	DOWNWIND B	2	YB	P2	28	12:17	12:21	4.00	**57**	509	
C3 C	TVC	DOWNWIND C	3	RA	P3	28	12:19	12:23	4.00	**34**	304	
C3 D	TVC	DOWNWIND D	4	RB	P4	28	12:21	12:25	4.00	**5**	45	
C3 A	AF	UPWIND A	1	GA	Q1	28	12:11	12:27	16.00	**0**		0
C3 B	AF	DOWNWIND B	2	GB	Q2	28	12:17	12:21	4.00	**1**		9
C3 C	AF	DOWNWIND C	3	BA	Q3	28	12:19	12:23	4.00	**0**		0
C3 D	AF	DOWNWIND D	4	BB	Q4	28	12:21	12:25	4.00	**0**		0

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

Results Table A1.4: CONTROL PLATES

Control Type	Total Bacteria Cfu/Plate (T)		Aspergillus Fumigatus Cfu/Plate (F)
Passive Un-exposed Control	CT1 =0, CT2 =0		CF1 =0, CF2 =0

APPENDIX 2. The M9v2 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.

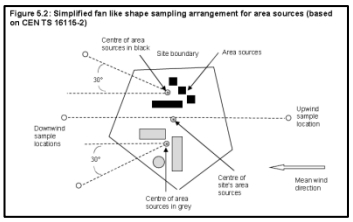


Figure 5.2: Simplified fan like shape sampling arrangement for area sources (based on CEN TS 16116-2)

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*.

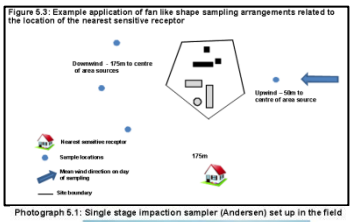


Figure 5.3: Example application of fan like shape sampling arrangements related to the location of the nearest sensitive receptor

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 3: METEOROLOGICAL DATA Recorded by the Met Station.

Table A3.1: Meteorological Data 11th December 2025

Time	Wind Bearing	Wind Direction	Wind Speed ms^{-1}	Air Temp °C	RH %	BP mb		Time	Wind Bearing	Wind Direction	Wind Speed ms^{-1}	Air Temp °C	RH %	BP mb
11:15:00	183	S	6	11.1	87	1004		11:55:00	179	S	8.2	11.8	88	1004
11:16:00	191	S	4.4	11.1	88	1004		11:56:00	191	S	8.1	11.5	87	1004
11:17:00	184	S	5.3	11.1	88	1004		11:57:00	188	S	2.4	11.5	86	1003
11:18:00	177	S	5.8	11.1	88	1004		11:58:00	185	S	5.8	11.5	87	1003
11:19:00	181	S	4.2	11.2	87	1004		11:59:00	192	SSW	4.9	11.4	86	1003
11:20:00	196	SSW	4.5	11.2	88	1004		12:00:00	185	S	4.2	11.5	86	1003
11:21:00	185	S	6.6	11.4	89	1004		12:01:00	185	S	5.2	11.5	86	1003
11:22:00	178	S	3.6	11.6	88	1004		12:02:00	178	S	3.1	11.5	86	1003
11:23:00	184	S	3.2	11.8	88	1004		12:03:00	198	SSW	6.1	11.5	87	1003
11:24:00	183	S	3.5	11.5	88	1004		12:04:00	196	SSW	6.8	11.4	87	1003
11:25:00	179	S	6.4	11.6	89	1004		12:05:00	182	S	3.6	11.4	86	1003
11:26:00	177	S	6	11.7	89	1004		12:06:00	186	S	5.6	11.4	87	1003
11:27:00	177	S	3.6	12	89	1004		12:07:00	176	S	6.7	11.4	87	1003
11:28:00	177	S	6.5	11.8	89	1004		12:08:00	180	S	4.7	11.5	86	1003
11:29:00	191	S	5.9	11.9	89	1005		12:09:00	178	S	2.7	11.5	86	1003
11:30:00	178	S	4.3	12	89	1004		12:10:00	191	S	3.2	11.4	87	1003
11:31:00	190	S	8.4	11.8	89	1005		12:11:00	176	S	8.7	11.4	87	1003
11:32:00	184	S	3	12.1	88	1004		12:12:00	180	S	4	11.5	86	1003
11:33:00	183	S	6.8	11.8	89	1004		12:13:00	184	S	6	11.4	86	1003
11:34:00	177	S	3.6	12	88	1004		12:14:00	178	S	4.7	11.5	86	1003
11:35:00	192	SSW	8.2	11.4	87	1004		12:15:00	193	SSW	3	11.5	86	1003
11:36:00	183	S	4	11.4	86	1004		12:16:00	196	SSW	4.5	11.4	86	1003
11:37:00	200	SSW	7.4	11.4	86	1004		12:17:00	180	S	3	11.4	86	1003
11:38:00	188	S	3.6	11.4	86	1004		12:18:00	195	SSW	3.3	11.4	87	1003
11:39:00	177	S	4.4	11.3	86	1004		12:19:00	189	S	3.9	11.4	86	1003
11:40:00	184	S	5.8	11.3	87	1004		12:20:00	185	S	3.6	11.4	86	1003
11:41:00	183	S	8	11.3	86	1004		12:21:00	187	S	4.1	11.4	87	1003
11:42:00	191	S	5.1	11.4	87	1004		12:22:00	189	S	3.2	11.4	87	1003
11:43:00	190	S	6.2	11.5	87	1004		12:23:00	180	S	4	11.3	87	1003
11:44:00	191	S	3.4	11.5	87	1004		12:24:00	188	S	3.9	11.4	87	1003
11:45:00	189	S	6.1	11.6	87	1004		12:25:00	189	S	2.1	11.4	87	1003
11:46:00	180	S	4.5	11.8	87	1004		12:26:00	177	S	2.8	11.4	87	1003
11:47:00	186	S	3.9	11.5	86	1004		12:27:00	188	S	5.4	11.4	87	1003
11:48:00	175	S	3.4	11.5	86	1003		12:28:00	176	S	5.9	11.5	86	1003
11:49:00	185	S	3.9	11.4	86	1004		12:29:00	187	S	3.9	11.5	86	1003
11:50:00	179	S	4.1	11.4	87	1003		12:30:00	181	S	2.8	11.4	87	1003
11:51:00	192	SSW	3.7	11.5	87	1003		12:31:00	188	S	6.5	11.4	87	1003
11:52:00	174	S	1.8	11.5	86	1003		12:32:00	177	S	5.2	11.4	87	1003
11:53:00	181	S	11.3	11.5	87	1004		12:33:00	181	S	5.6	11.4	87	1003
11:54:00	190	S	5.8	11.8	88	1003		12:34:00	181	S	4.5	11.4	87	1003