

**EVALUATION OF AMBIENT BIOAEROSOLS AT:
WREXHAM RECYCLING MBT FACILITY (PHASE 2)
WREXHAM INDUSTRIAL ESTATE
WREXHAM
LL13 9UT**

28th JUNE 2018

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1. BACKGROUND & SITE DESCRIPTION:

D&F Associates Ltd has been commissioned by FCC Environment to evaluate ambient bioaerosol levels at a Mechanical Biological Treatment (MBT) Facility (Phase 2) situated at Wrexham Recycling Park, Bryn Lane, Wrexham LL13 9UT.

The facility is situated in an industrial estate and is bounded by a Household Waste Recycling Centre (HWRC) to the North, In-Vessel Composting (IVC) and Materials Recycling (MRF) facility's to the West (Phase 1) and commercial premises including a Council Depot to the South/ Southwest.

Waste treatment operations at the MBT are carried out in accordance with Animal By-Products Regulations (ABPR) in enclosed buildings fitted with an air management system and biofilters.

2. SAMPLING POINTS & SAMPLING PROTOCOL:

The Environment Agency Technical Guidance Notes M17 (Monitoring of particulate matter in ambient air around waste facilities, version 2, 2013) and M9 (Environmental monitoring of bioaerosols at regulated facilities, version 1, January 2017) provide guidance for monitoring bioaerosols. M9 offers a standardised approach to bioaerosol sampling and enumeration to compliment The Association for Organic Recycling (AfOR) guidance 'A standardised protocol for the monitoring of bioaerosols at open composting facilities', 2009 (the AfOR Protocol).

In addition to the sampling methods described in M9, Natural Resources Wales Air Quality and Risk Assessment Team (AQMRAT) have confirmed that Merck MAS-100 air sampling instruments may be used (with provisions) to assess outdoor ambient bioaerosol levels.

The MBT facility at Bryn Lane is complex. The close proximity of process buildings to operational boundaries and the site traffic management system prevent bioaerosol sampling at the site using the ambient sampling strategy suggested in M9. Sampling has followed the strategy suggested in the AfOR guidance (2009) and the conditions specified in the site permit where possible. It should also be noted that ambient sampling techniques are not reliable for assessing bioaerosol emissions from biofilter stacks.

2.1 Samples

Sample locations were chosen in accordance with the guidelines given in the site permit and the prevailing wind direction indicated by the site weather station on the day of monitoring. Sample points are dependent on weather conditions and points may therefore be expected to change for each assessment.

The sample points evaluated for this assessment are described below and their respective locations are illustrated on the site diagram attached as Appendix 1 (Page 9).

Sample Point 1: Downwind (at the South perimeter adjacent to the Welfare Buildings). Grid reference SJ 38774 49821 (SP1).

Sample Point 2: Upwind/Sensitive Receptor (on land to the North of the MBT buildings and biofilter in the direction of the HWRC). Grid reference SJ 38778 49982 (SP2).

2.2 Sampling, Storage & Transportation

Two Merck MAS-100 *Eco* air sampling instruments fitted with baffles were used in parallel to draw air over prepared agar plates containing half strength nutrient agar (NA), malt extract agar (MEA) and MacConkey agar (MAC). Sampling upwind and downwind was carried out concurrently and the volume of air sampled at each location was determined by the proximity of the sampling equipment to bioaerosol sources. The sampling start and stop times for each set of duplicate plates were recorded. An electrically controlled coolbox operating at 4°C was used to store and transport exposed plates to D&F Associates Ltd laboratory where they were processed the same day.

2.3 Laboratory Enumeration

D&F Associates Ltd is a small independent laboratory approved and audited by REAL. The company operates a quality management system in accordance with ISO 17025 and is working towards formal accreditation to the ISO 17025 standard. Microbiological growth media was prepared as described in section 6.1.1 of M9 and in accordance with BS EN ISO 11133:2014: Microbiology of food, animal feed and water, preparation, production, storage and performance testing of culture media. Prepared plates were pre-incubated and quality checked before use. Exposed plates were enumerated as described in section 6.3 of M9.

2.4 Calculation of Results

Concentrations of culturable micro-organisms were calculated using a positive hole conversion chart and reported as colony forming units per cubic metre of air (cfu/m³). Arithmetic means (cfu/m³) were calculated using three replicate sets of results for each microbial species. The calculated mean represents the average emission at each sample point for the sampling period.

2.5 Other Considerations

Equipment, consumables and microbiological growth media were assessed in the laboratory for quality assurance before use or release. Results and records of QA and QC checks are maintained as part of Good Laboratory Practice procedures. IMS was used to sterilise equipment in the field and 'Control Samples' were collected as part of the assessment to confirm aseptic handling. Procedures are followed to prevent external contamination.

3. METEOROLOGICAL/ WEATHER CONDITIONS:

The onsite weather station suggested that predominant winds at the facility were from the North Northeast between 13:00-13:30pm GMT (*i.e.* 12:00-12:30pm BST). Two Kestrel 4500 portable weather stations were used to measure wind speed, wind direction, temperature and relative humidity at each sample location. Measurements were logged at 1-minute intervals.

4. SITE ACTIVITIES:

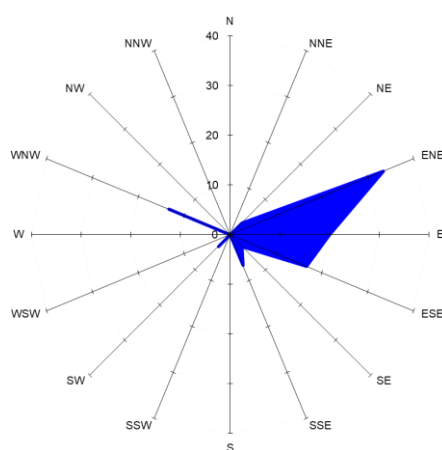
Operations in the enclosed treatment tunnels are continuous. Waste deliveries to the recycling facility were recorded throughout the evaluation.

5. RESULTS OF EVALUATION:

5.1 Meteorological Information:

The meteorological data recorded is summarised in the Meteorological Conditions Table (Page 6). The mean wind direction for the assessment was calculated from 95° (East). Wind influences were recorded from the Northeast, East Northeast, East, East Southeast, Southeast, South Southeast, South Southwest and West Northwest (Figure 1).

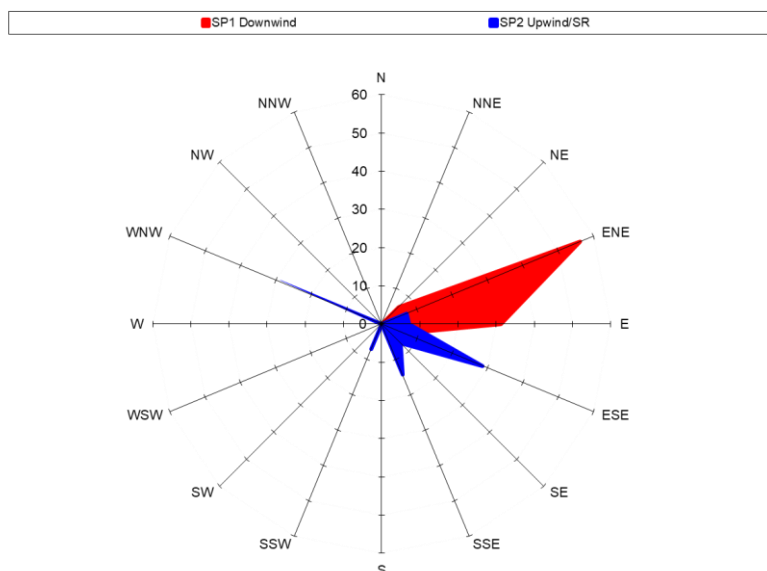
Figure 1: Wind Rose Illustrating Mean Wind Direction from the East.



Note: Units in Percentage Contribution. Wind speed ranged from 0.0-2.5 m/s.

Figure 2 illustrates the wind patterns experienced at each sample location during the sampling periods. The mean wind bearings given in the Meteorological Conditions Table have been calculated using the AfOR method described on Page 30 of the Protocol. However, the mean wind bearing at each sample point may not reflect the bearing calculated for the whole of the assessment. It should also be noted that the mean bearing calculated for the assessment may be different than the predominant wind direction. This can be due to the influence of landscape, topography and nearby structures on air movement at the sample location and this should be considered if wind direction patterns at different sampling locations are compared. The calculated mean wind directions are illustrated on the site map attached as Appendix 1 (Page 9).

Figure 2: Wind Rose Illustrating Wind Patterns at SP1 and SP2.



The mean wind direction at SP1 (Downwind) was calculated from 77° (East Northeast). Variable winds were recorded from the Northeast, East Northeast, East and East Southeast. Wind speeds were recorded within the range 0.0-1.3 m/s with an average wind speed of 0.8 m/s calculated.

The mean wind direction at SP2 (Upwind/Sensitive Receptor) was calculated from 133° (Southeast). Variable winds were recorded from the East Northeast, East, East Southeast, Southeast, South Southeast, South Southwest and West Northwest. Wind speeds were recorded within the range 0.0-2.5 m/s with an average wind speed of 0.9 m/s calculated.

5.2 Results for Airborne Micro-organisms:

5.2.1 Current Limits (Based on Open Windrow Composting Systems)

The Environment Agency considers acceptable bioaerosol levels as:

- i. Those before the start of the composting process; or
- ii. Bioaerosol levels that are no greater than 1,000 cfu/m³ for total bacteria, 500 cfu/m³ for the thermophilic fungus *Aspergillus fumigatus* and 300 cfu/m³ for Gram negative bacteria.

5.2.2 Microbiological Results:

The microbiological results obtained for this assessment are given in the Estimated Concentrations of Airborne Micro-organisms Tables (Pages 7-8). The following results discuss the colony forming units per cubic metre of air (cfu/m³) as calculated average means.

Downwind - SP1

Sampling was undertaken adjacent to South perimeter adjacent to the Welfare Buildings. SP1 was downwind of the MBT. Mesophilic bacteria were estimated at 1,303 cfu/m³, *Aspergillus fumigatus* at 1,033 cfu/m³ and Gram negative bacteria at less than 137 cfu/m³.

Upwind/Sensitive Receptor - SP2

Sampling was undertaken on land to the North of the MBT buildings and biofilter in the direction of the HWRC. Due to variable winds SP1 was both upwind and downwind of process operations and material deliveries. Mesophilic bacteria were estimated at 98 cfu/m³, *Aspergillus fumigatus* at less than 23 cfu/m³ and Gram negative bacteria at 18 cfu/m³.

6. CONCLUSIONS & DISCUSSION:

- Mean results for mesophilic bacteria and *Aspergillus fumigatus* were above the EA guidance levels downwind of the MBT, *i.e.* at SP1. The mean result for Gram negative bacteria was below the guidance level.
- Mean results for mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were below EA guidance levels upwind of the MBT, *i.e.* at SP2. Due to variable winds, SP2 was both upwind and downwind of the MBT.

3. Sample locations were chosen in accordance with the wind direction indicated by the site weather station on the day of monitoring. Wind from the North Northeast was recorded by the weather station during the sampling period.
4. Meteorological data recorded at each sample location identified variable winds. The mean wind direction for the assessment was calculated from the East.
5. The HWRC and Phase 1 of Wrexham Recycling Park were predominantly upwind of Phase 2 on the day of the assessment. The HWRC and Phase 1 (*i.e.* composting in the IVC and material recycling in the MRF) have the potential to generate other sources of bioaerosols in the vicinity of Phase 2.
6. The results suggest that the risk of exposure to composting bioaerosols at sensitive receptors within 250m of the facility was likely to have been low on the day of the assessment.

7. SUMMARY:

An appraisal of airborne micro-organisms was undertaken at Phase 2 Wrexham MBT Facility on 28th June 2018 using MAS100 air sampling units. Sampling followed the strategy suggested in the AfOR guidance (2009) and the conditions specified in the site permit where possible.

Mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were calculated below EA guidance levels upwind of the MBT buildings and biofilter, however, levels of mesophilic bacteria and *Aspergillus fumigatus* were calculated above the guidance levels downwind.

The site weather station indicated winds from the North Northeast during the assessment. Variable winds were recorded at both of the sample locations and the mean wind direction for the assessment was calculated from the East. The results suggest that the risk of exposure to composting bioaerosols at sensitive receptors within 250m of the MBT facility was likely to have been low.

METEOROLOGICAL CONDITIONS

Site:		Phase 2 Wrexham MBT Facility			Site Operator:		FCC Environment	
Date Sampled:		28 th June 2018			Commissioning Laboratory:		D&F Associates Ltd	
Date Processed at Laboratory:		28 th June 2018						
Estimated Mass of Materials:		<2,500 Tonnes			Type of Material Processed:		Mixed Household Wastes	
Location	Sample Reference Number	Bearing of samplers from boundary of operational area (° from true north) Grid Reference	Mean wind direction (° from true north)	Difference in bearing between location of samplers from boundary/ source and mean direction of wind (°)	Mean wind speed during sampling (m/s)	Arithmetic mean of air temperature (°C)	Arithmetic mean of relative humidity (%)	Prevailing weather conditions
Downwind	SP1	270-40 SJ 38774 49821	77 (ENE)	0	0.8 (Range 0.0-1.3)	25.1	45.7	Cloud cover = 0/10 Dry and bright.
Upwind/ Sensitive Receptor	SP2	140-240 SJ 38778 49982	133 (SE)	7-107	0.9 (Range 0.0-2.5)	24.4	47.5	Cloud cover = 0/10 Dry and bright.
Site Weather Station (BST)			NNE		3.0	23.6		

N/A – Not Available

ESTIMATED CONCENTRATIONS OF AIRBORNE MICRO-ORGANISMS											
Site:			Phase 2 Wrexham MBT Facility				Site Operator:			FCC Environment	
Date Sampled:			28 th June 2018				Commissioning Laboratory:			D&F Associates Ltd	
Date Processed at Laboratory:			28 th June 2018								
Estimated Mass of Materials:			<2,500 Tonnes				Type of Material Processed:			Mixed Household Wastes	
Location	Sample Reference Number	Distance From Boundary	Sample Volume	Microbial Type	Site Activity	Materials Processed	Count per Plate		Calculated Concentra-tion of Airborne Micro-organisms	Calculated Mean of Samples	Comments
		(Metres)	(Litres)					(cfu/m³)	(cfu/m³)		
Downwind SP1 (12:11:49-12:27:10 hrs)	1A	0	50	MB	Waste Delivery & Continuous Treatment Processes	Mixed Household Waste	125	150	3,000	1,303	The mean result for Gram negative bacteria was below the EA guidance level. Mean results for mesophilic bacteria and <i>Aspergillus fumigatus</i> were above the guidance levels. Sampling was undertaken at the South perimeter adjacent to the Welfare Buildings. The mean wind direction was calculated from 77° (East Northeast). Variable winds were recorded at the sample point during the sampling period.
	1B						113	133	2,660		
	1G						49	52	1,040		
	1H						43	45	900		
	1M						5	5	100		
	1N						6	6	120		
	1C			AF			14	14	280	1,033	
	1D						7	7	140		
	1I						78	87	1,740		
	1J						78	87	1,740		
	1O						62	67	1,340		
	1P						45	48	960		
	1E			MAC			5	5	100	<137	
	1F						3	3	60		
	1K						0	0	<20		
	1L						1	1	20		
	1Q						17	17	340		
	1R						14	14	280		

MB - Mesophilic Bacteria (Control = 0 cfu/plate)

AF - *Aspergillus fumigatus* (Control = 0 cfu/plate)

MAC - Gram -ve Bacteria (Control = 0 cfu/plate)

N/A - Not Applicable

TNTC - Too Numerous To Count

ESTIMATED CONCENTRATIONS OF AIRBORNE MICRO-ORGANISMS											
Site:			Phase 2 Wrexham MBT Facility				Site Operator:			FCC Environment	
Date Sampled:			28 th June 2018				Commissioning Laboratory:			D&F Associates Ltd	
Date Processed at Laboratory:			28 th June 2018								
Estimated Mass of Materials:			<2,500 Tonnes				Type of Material Processed:			Mixed Household Wastes	
Location	Sample Reference Number	Distance From Boundary	Sample Volume	Microbial Type	Site Activity	Materials Processed	Count per Plate		Calculated Concentra-tion of Airborne Micro-organisms	Calculated Mean of Samples	Comments
		(Metres)	(Litres)					(cfu/m³)	(cfu/m³)		
Upwind/ Sensitive Receptor SP2 (12:12:23-12:27:54 hrs)	2A	0	100	MB	Waste Delivery & Continuous Treatment Processes	Mixed Household Waste	11	11	110	98	Mean results for mesophilic bacteria, <i>Aspergillus fumigatus</i> and Gram negative bacteria were below EA guidance levels. Sampling was undertaken on land to North of the MBT and biofilter in the direction of the HWRC. SP2 was upwind and occasionally downwind of the MBT and material deliveries. The mean wind direction was calculated from 133° (Southeast). Variable winds were recorded at the sample point during the sampling period with predominant directions from the East Southeast and West Northwest.
	2B						10	10	100		
	2G						16	16	160		
	2H						10	10	100		
	2M						6	6	60		
	2N						6	6	60		
	2C			AF			3	3	30	<23	
	2D						1	1	10		
	2I						0	0	<10		
	2J						1	1	10		
	2O						5	5	50		
	2P						3	3	30		
	2E			MAC			3	3	30	18	
	2F						2	2	20		
	2K						1	1	10		
	2L						2	2	20		
	2Q						2	2	20		
	2R						1	1	10		

MB - Mesophilic Bacteria (Control = 0 cfu/plate)

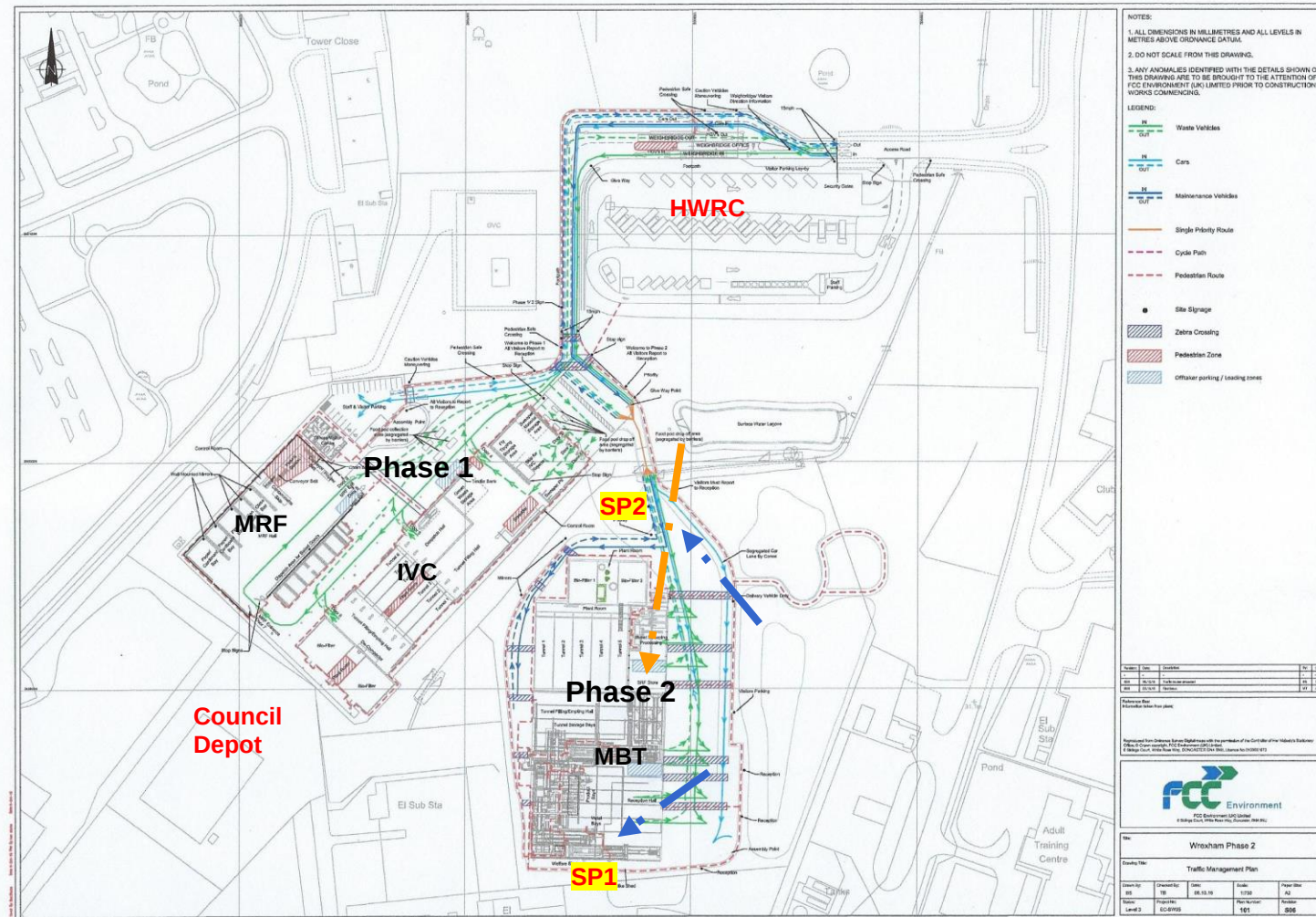
AF - *Aspergillus fumigatus* (Control = 0 cfu/plate)

MAC - Gram -ve Bacteria (Control = 0 cfu/plate)

N/A - Not Applicable

TNTC - Too Numerous To Count

Illustration of Sample Points Evaluated at Phase 2 Wrexham Recycling Centre on 28th June 2018



Indicates Mean Wind Direction at the Sample Point
Indicates Wind Direction using Site Weather Station

