D&F Associates

EVALUATION OF AMBIENT BIOAEROSOLS AT:

BRYN LANE WASTE RECYCLING AND COMPOSTING FACILITY (PHASE 1)
WREXHAM INDUSTRIAL ESTATE
WREXHAM
LL13 9UT

5th SEPTEMBER 2018

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11th September 2018

1. BACKGROUND & SITE DESCRIPTION:

D&F Associates Ltd has been commissioned by FCC Environment to evaluate ambient bioaerosol levels at an In-vessel Composting (IVC) Facility (Phase 1) situated at Bryn Lane Waste Recycling and Composting Facility, Wrexham Industrial Estate, Wrexham LL13 9UT. The facility is situated in an industrial estate and is bounded by a Household Waste Recycling Centre (HWRC) to the North (near to the site entrance), a Mechanical Biological Treatment Facility (MBT) to the East and a Council Depot to the South. A Material Recycling Facility (MRF) is situated to the West of the IVC buildings. The MRF and MBT are operated by FCC Environment. The HWRC, MBT and MRF have the potential to generate other sources of bioaerosols in the vicinity of the Waste Recycling and Composting Facility.

Composting operations at Bryn Lane 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 waste recycling and composting 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 site permit and winds 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/ Sensitive Receptor 1 (at the Southeast perimeter fence shared with the neighbouring Council Depot). Grid reference SJ 38648 49906 (SP1).

Sample Point 2: Upwind/Sensitive Receptor 2 (at the North perimeter fence shared with the neighbouring HWRC). Grid reference SJ 38765 50053 (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 4ºC 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/m^3). Arithmetic means (cfu/m^3) 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 recorded winds from the North and North Northwest (11:30-12:00pm (GMT)/10:30-11:00am (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:

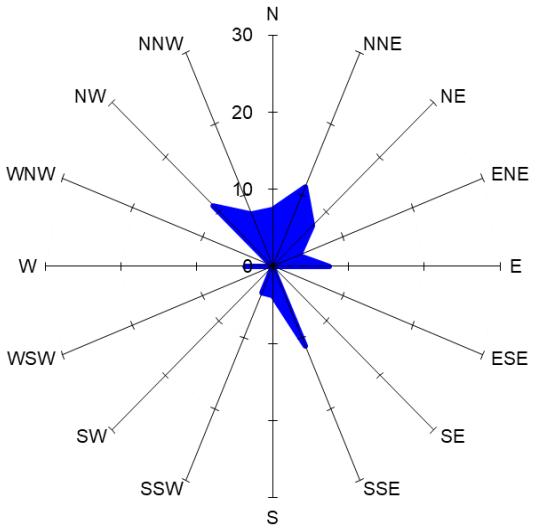
Continuous composting operations in the enclosed composting tunnels were in progress throughout the evaluation.

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 5° (North). Wind influences were recorded from the North, North Northeast, Northeast, East Northeast, East, South Southeast, South, South Southwest, West, Northwest and North Northwest (Figure 1).

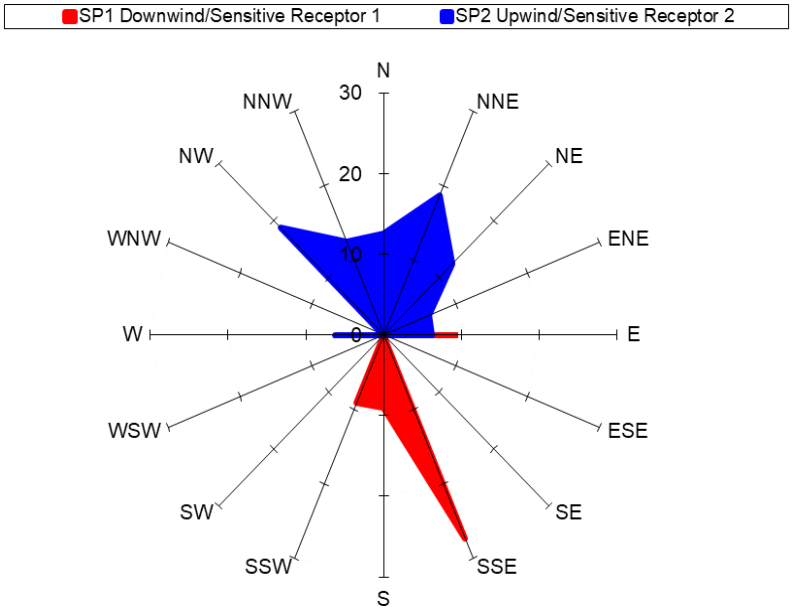
Figure 1: Wind Rose Illustrating Mean Wind Direction from the North.



Note: Units in Percentage Contribution. Wind speed ranged from 0.0-1.4 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 Directions at Sample Locations SP1 and SP2



The mean wind direction at SP1 (Downwind/Sensitive Receptor 1) was calculated from 165° (South Southeast) with winds recorded from the East, South Southeast, South and South Southwest. Wind speeds were recorded within the range 0.0-1.2 m/s with an average wind speed of 0.3 m/s calculated.

The mean wind direction at SP2 (Upwind/Sensitive Receptor 2) was calculated from 359° (North) with winds recorded from the North, North Northeast, Northeast, East Northeast, East, West, Northwest and North Northwest. Wind speeds were recorded within the range 0.0-1.4 m/s with an average wind speed of 0.8 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/m^3 for total bacteria, 500 cfu/m^3 for the thermophilic fungus *Aspergillus fumigatus* and 300 cfu/m^3 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/m^3) as calculated average means.

Downwind/Sensitive Receptor 1 - SP1

Sampling was undertaken at the Southeast perimeter fence shared with the Council Depot. SP1 was downwind of the IVC and biofilters (site weather station). Mesophilic bacteria were estimated at 323 cfu/m^3, *Aspergillus fumigatus* at 420 cfu/m^3 and Gram negative bacteria at 227 cfu/m^3.

Upwind/Sensitive Receptor 2 - SP2

Sampling was undertaken at the North perimeter fence shared with the HWRC. SP2 was upwind of the IVC and biofilters. Mesophilic bacteria were estimated at 78 cfu/m^3, *Aspergillus fumigatus* at less than 13 cfu/m^3 and Gram negative bacteria at 55 cfu/m^3.

6. CONCLUSIONS & DISCUSSION:

1. Sample locations were chosen in accordance with the wind direction indicated by the site weather station on the day of the assessment (*i.e*. winds from the North and North Northwest 10:30-11:00am BST).
2. Mean results for mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were calculated below EA guidance levels at the upwind and downwind boundaries of the site and in the direction of the Council Depot to the South and the HWRC to the North, *i.e.* at SP1 and SP2.

3. The mean wind direction for the assessment was calculated from the North and the results suggest that the risk of exposure to composting bioaerosols at sensitive receptors within 250m of the facility on the day of the evaluation was likely to be low.

7. SUMMARY:

An appraisal of airborne micro-organisms was undertaken at Phase 1 Bryn Lane Waste Recycling and Composting Facility on 5th September 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.

Sample locations were chosen in accordance with the wind direction indicated by the site weather station between 10:30-11:00 BST/11:30-12:00 GMT (*i.e.* winds from the North and North Northwest).

Mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were calculated below EA guidance levels at the upwind and downwind boundaries of the site and in the direction of the Council Depot to the South and the HWRC to the North.

The mean wind direction for the assessment was calculated from the North and the results suggest that the risk of exposure to composting bioaerosols at sensitive receptors within 250m of the facility on the day of the evaluation was likely to be low.

METEOROLOGICAL CONDITIONS								
Site:		Phase 1 Bryn Lane IVC Facility			**Site Operator:**		FCC Environment	
Date Sampled:		5th September 2018			**Commissioning Laboratory:**		D&F Associates Ltd	
Date Processed at Laboratory:		5th September 2018						
Estimated Mass of Materials:		<1,500 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/ Sensitive Receptor 1	SP1	320-80 SJ 38648 49906	165 (SSE)	85-155	0.3 (Range 0.0-1.2)	17.3	58.1	Cloud cover = 5/10 Dry and bright.
Upwind/ Sensitive Receptor 2	SP2	170-260 SJ 38765 50053	359 (N)	99-171	0.8 (Range 0.0-1.4)	17.9	57.9	Cloud cover = 4/10 Dry and bright.
Site Weather Station (BST)			N/NNW		7.0	16.2		

N/A – Not Available

ESTIMATED CONCENTRATIONS OF AIRBORNE MICRO-ORGANISMS

Site:	Phase 1 Bryn Lane IVC Facility	**Site Operator:**	FCC Environment
Date Sampled:	5th September 2018	**Commissioning Laboratory:**	D&F Associates Ltd
Date Processed at Laboratory:	5th September 2018		
Estimated Mass of Materials:	<1,500 Tonnes	**Type of Material Processed:**	Mixed Household Wastes

Location	Sample Reference Number	Distance From Boundary (Metres)	Sample Volume (Litres)	Microbial Type	Site Activity	Materials Processed	Count per Plate Actual	Count per Plate MPR	Calculated Concentration of Airborne Micro-organisms (cfu/m^3)	Calculated Mean of Samples (cfu/m^3)	Comments
Downwind/ Sensitive Receptor 1 **SP1** (10:55:56-11:06:35 hrs)	1A 1B 1G 1H 1M 1N	~1.0	50	MB	Continuous Composting Processes	Mixed Kerbside Waste	17 18 15 14 19 14	17 18 15 14 19 14	340 360 300 280 380 280	**323**	**Mean results for mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were below EA guidance levels.** Sampling was undertaken at the Southeast perimeter fence adjacent to the Council Depot. SP1 was downwind of the IVC and biofilters (site weather station). The mean wind direction was calculated from 165° (South Southeast).
	1C 1D 1I 1J 1O 1P			AF			38 23 21 11 16 16	40 24 22 11 16 13	800 480 440 220 320 260	**420**	
	1E 1F 1K 1L 1Q 1R			MAC			4 6 17 22 8 10	4 6 17 23 8 10	80 120 340 460 160 200	**227**	

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 1 Bryn Lane IVC Facility	**Site Operator:**	FCC Environment
Date Sampled:	5th September 2018	**Commissioning Laboratory:**	D&F Associates Ltd
Date Processed at Laboratory:	5th September 2018		
Estimated Mass of Materials:	<1,500 Tonnes	**Type of Material Processed:**	Mixed Household Wastes

Location	Sample Reference Number	Distance From Boundary (Metres)	Sample Volume (Litres)	Microbial Type	Site Activity	Materials Processed	Count per Plate Actual	Count per Plate MPR	Calculated Concentration of Airborne Micro-organisms (cfu/m^3)	Calculated Mean of Samples (cfu/m^3)	Comments
Upwind/ Sensitive Receptor 2 **SP2** (10:54:42-11:09:14 hrs)	2A 2B 2G 2H 2M 2N	~1.0	100	MB	Continuous Composting Processes	Mixed Kerbside Waste	13 13 2 4 6 9	13 13 2 4 6 9	130 130 20 40 60 90	**78**	**Mean results for mesophilic bacteria, *Aspergillus fumigatus* and Gram negative bacteria were below EA guidance levels.** Sampling was undertaken at the North perimeter fence shared with the HWRC. SP2 was upwind of the IVC and biofilters. The mean wind direction was calculated from 359° (North).
	2C 2D 2I 2J 2O 2P			AF			2 0 0 0 2 1	2 0 0 0 2 1	20 <10 <10 <10 20 10	**<13**	
	2E 2F 2K 2L 2Q 2R			MAC			3 4 3 5 9 9	3 4 3 5 9 9	30 40 30 50 90 90	**55**	

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

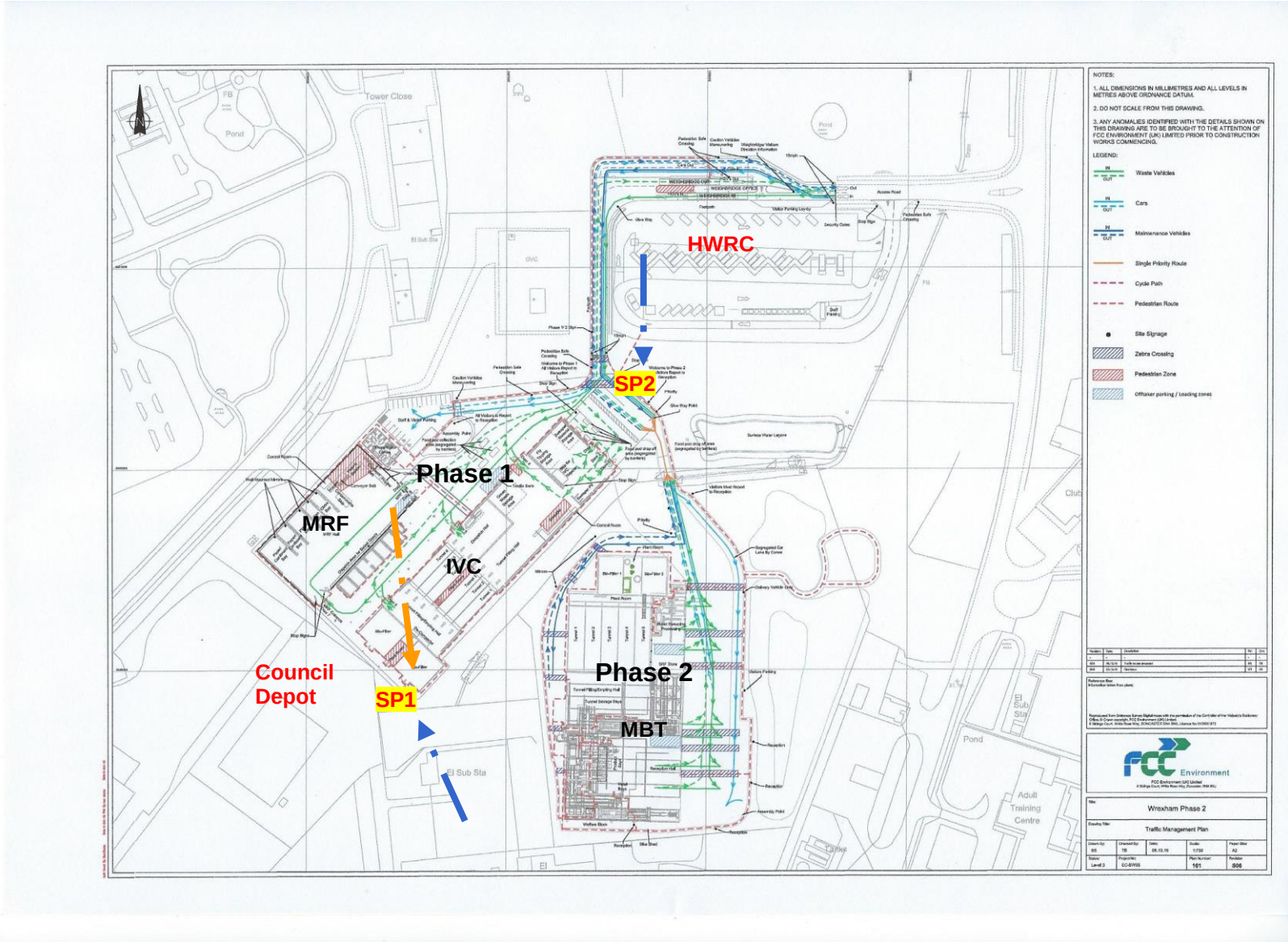
AF - *Aspergillus fumigatus* (Control = 0 cfu/plate)

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

N/A - Not Applicable

TNTC - Too Numerous To Count

Illustration of Sample Points Evaluated at Phase 1 Bryn Lane Recycling and Composting Facility on 5th September 2018



Indicates Mean Wind Direction at the Sample Point

Indicates Mean Wind Direction using Site Weather Station

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