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Report: **Bioaerosol Monitoring**
Client: Yorkshire Water Services Ltd
Date of Site Work: 17th August 2022

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Issued by: 

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Executive Summary

Tom Broderick of Yorkshire Water Services Ltd requested that Element Materials Technology Environmental UK Limited undertake monitoring of bioaerosols at its Woodhouse Mill site. Monitoring was undertaken in accordance with Technical Guidance Note M9 'Environmental Monitoring of Bioaerosols at Regulated Facilities'.

Site work was undertaken by Abigail Pickard on 17th August 2022.

The purpose of the bioaerosol monitoring exercise was to establish the concentration of bioaerosols being dispersed from the site to the nearest sensitive receptor.

Monitoring Findings:

Sampling Location	Analyte	Guidance Limit (CFU/m ³)	Median Concentration of Parallel Samples (CFU/m ³)
Upwind	Total bacteria	1000	375
	<i>Aspergillus fumigatus</i>	500	<125
Downwind	Total bacteria	1000	125
	<i>Aspergillus fumigatus</i>	500	<125
Downwind Left Hand Fan	Total bacteria	1000	<125
	<i>Aspergillus fumigatus</i>	500	<125
Downwind Right Hand Fan	Total bacteria	1000	250
	<i>Aspergillus fumigatus</i>	500	<125
Sampling Point 1	Total bacteria	1000	<125
	<i>Aspergillus fumigatus</i>	500	<125
Sampling Point 2	Total bacteria	1000	<125
	<i>Aspergillus fumigatus</i>	500	<125
Sampling Point 3	Total bacteria	1000	<125
	<i>Aspergillus fumigatus</i>	500	<125
Sampling Point 4	Total bacteria	1000	<125
	<i>Aspergillus fumigatus</i>	500	<125

< Less than

CFU/m³

Colony Forming Units Per Cubic Metre

Below Limit

Exceeds Limit

1. Introduction

Element Materials Technology Environmental UK Ltd was commissioned by Yorkshire Water Services Ltd to carry out a bioaerosol monitoring exercise at the Waste Water Treatment Works at their site in Woodhouse Mill.

The purpose of the bioaerosol monitoring exercise was to establish the concentration of bioaerosols being dispersed from the site to the nearest sensitive receptor, as part of a permit application.

Monitoring was undertaken in accordance with Technical Guidance Note M9 'Environmental Monitoring of Bioaerosols at Regulated Facilities'. This report details the survey methodology and results on the monitoring of all locations.

Site work was undertaken by Abigail Pickard of Element Materials Technology Environmental UK Ltd on 17th August 2022.

2. Measurement Methodology

Measurements were carried out in accordance with parameters specified in Technical Guidance Note M9 'Environmental Monitoring of Bioaerosols at Regulated Facilities'. Of the methods suggested in the protocol, the filter method was utilised in this project.

On site calibration checks were performed on the pumps used and were found to be within the permitted tolerance of the standard.

For all measurements the sample head was located 1.5 metres above ground level. The upwind sample was taken further away from the centre of operations than recommended in the guidance. This was to ensure the sample was outside the operational area and represented a true upwind value.

Triplicate samples were carried out at each selected sampling location. Once completed, filters were transferred in a refrigerated container to the laboratory within 24 hours.

The IOM heads containing a polycarbonate filter were used to determine the bioaerosol exposure under the test conditions. Upon arrival at the laboratory the bioaerosols impacted on each filter were recovered in 2 ml maximum recovery diluent. The target micro-organisms were cultured using appropriate dilutions on the following media.

Half-strength nutrient agar (1/2NA) plates were used for total mesophilic bacteria. Malt extract agar (MEA) plates were used for *Aspergillus fumigatus*.

Samples were incubated for up to seven days at 37°C (total mesophilic bacteria), and for two days at 45°C (*Aspergillus fumigatus*).

The laboratory retained information regarding each sample. Dates and times of preparation, incubation times, batch numbers, personnel responsible, storage medium and incubator temperature were all recorded.

3. Site Information

Yorkshire Water Services Ltd operates a Waste Water Treatment Works at their site in Woodhouse Mill, Yorkshire. The site currently is not required to undertake ambient air monitoring but has done so to support a permit application.

The site is not currently permitted, with an application being submitted in the near future. As such the limits used are the standard limits used by the Environment Agency (EA).

Parameter	Threshold limit (CFU/m ³)
Total bacteria (TB)	1000
<i>Aspergillus fumigatus</i> (AF)	500

Table 1. Environmental Parameters - Bioaerosol monitoring							Job Number 113776
Site:		Woodhouse Mill, Yorkshire		Site Operator		Yorkshire Water Services Ltd	
Date:		17/08/22		Commissioning Laboratory		EMT Environmental	
		Types of materials processed on site				Waste Water	
Location	Bearing of samplers from boundary of operational area (degrees °)	Mean direction the wind blows to during the sampling period (degrees °)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Mean wind speed (mph)	Arithmetic mean of air temperature °C	Arithmetic mean of relative humidity (%)	Prevailing weather conditions including cloud cover
Upwind	190	10	180	12	15	84	Cloudy. 8/8
Downwind	10	10	0	12	15	84	Cloudy. 8/8
Downwind Left Hand Fan	340	10	30	12	15	84	Cloudy. 8/8
Downwind Right Hand Fan	40	10	30	12	15	84	Cloudy. 8/8

4. Measurement Results

The results for measurements undertaken at all locations are shown within a number of standardised tables on the following pages:

Table 2. Upwind: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire		Site Operator:			Yorkshire Water Services Ltd	
Date:			17/08/22		Commissioning Laboratory:			EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None		Types of materials processed on site:			Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Upwind	UW1	70	180	11:46 – 12:46	60	TB	2500	TB: 375	-
	UW2	70	180			TB	<125		
	UW3	70	180			TB	375		
Upwind	UW1	70	180	11:46 – 12:46	60	AF	<125	AF: <125	-
	UW2	70	180			AF	<125		
	UW3	70	180			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 3. Downwind: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire			Site Operator:		Yorkshire Water Services Ltd	
Date:			17/08/22			Commissioning Laboratory:		EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None			Types of materials processed on site:		Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Downwind	DW1	90	0	12:04 – 13:04	60	TB	<125	TB: 125	-
	DW2	90	0			TB	<125		
	DW3	90	0			TB	1625		
Downwind	DW1	90	0	12:04 – 13:04	60	AF	<125	AF: <125	-
	DW2	90	0			AF	<125		
	DW3	90	0			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 4. Downwind Left Hand Fan: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire			Site Operator:		Yorkshire Water Services Ltd	
Date:			17/08/22			Commissioning Laboratory:		EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None			Types of materials processed on site:		Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Downwind Left Hand Fan	LHS1	100	30	12:11 – 13:11	60	TB	<125	TB: <125	-
	LHS2	100	30			TB	<125		
	LHS3	100	30			TB	<125		
Downwind Left Hand Fan	LHS1	100	30	12:11 – 13:11	60	AF	<125	AF: <125	-
	LHS2	100	30			AF	<125		
	LHS3	100	30			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 5. Downwind Right Hand Fan: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire		Site Operator:			Yorkshire Water Services Ltd	
Date:			17/08/22		Commissioning Laboratory:			EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None		Types of materials processed on site:			Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Downwind Right Hand Fan	RHS1	80	30	11:56 – 12:56	60	TB	<125	TB: 250	-
	RHS2	80	30			TB	250		
	RHS3	80	30			TB	375		
Downwind Right Hand Fan	RHS1	80	30	11:56 – 12:56	60	AF	<125	AF: <125	-
	RHS2	80	30			AF	<125		
	RHS3	80	30			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 6. Sample Point 1: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire			Site Operator:		Yorkshire Water Services Ltd	
Date:			17/08/22			Commissioning Laboratory:		EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None			Types of materials processed on site:		Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Sample Point 1	S1A	95	25	09:56 – 10:56	60	TB	125	TB: <125	-
	S1B	95	25			TB	<125		
	S1C	95	25			TB	<125		
Sample Point 1	S1A	95	25	09:56 – 10:56	60	AF	<125	AF: <125	-
	S1B	95	25			AF	<125		
	S1C	95	25			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 7. Sampling Point 2: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire		Site Operator:			Yorkshire Water Services Ltd	
Date:			17/08/22		Commissioning Laboratory:			EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None		Types of materials processed on site:			Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Sample Point 2	S2A	60	150	10:04 – 11:04	60	TB	<125	TB: <125	-
	S2B	60	150			TB	<125		
	S2C	60	150			TB	<125		
Sample Point 2	S2A	60	150	10:04 – 11:04	60	AF	<125	AF: <125	-
	S2B	60	150			AF	<125		
	S2C	60	150			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 8. Sample Point 3: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire			Site Operator:		Yorkshire Water Services Ltd	
Date:			17/08/22			Commissioning Laboratory:		EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None			Types of materials processed on site:		Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Sample Point 3	S3A	75	30	10:16 – 11:16	60	TB	125	TB: <125	-
	S3B	75	30			TB	<125		
	S3C	75	30			TB	<125		
Sample Point 3	S3A	75	30	10:16 – 11:16	60	AF	<125	AF: <125	-
	S3B	75	30			AF	<125		
	S3C	75	30			AF	<125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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Table 9. Sample Point 4: Bioaerosol monitoring – Estimated Concentrations of Airborne Micro-organisms								Job Number 113776	
Site:			Woodhouse Mill, Yorkshire			Site Operator:		Yorkshire Water Services Ltd	
Date:			17/08/22			Commissioning Laboratory:		EMT Environmental	
Activities affecting Bioaerosol Conc ⁿ			None			Types of materials processed on site:		Waste Water	
Location	Sample REF	Distance from centre of operational area (m)	Difference in bearing between location of samplers from boundary and mean direction wind blows to (degrees °)	Sampling Times	Sampling duration (mins)	Microbial Type	Calculated concentration of airborne microorganisms (CFU/m ³)*	Median of parallel samples (CFU/m ³)	Comments
Sample Point 4	S4A	150	120	10:25 – 11:25	60	TB	<125	TB: <125	-
	S4B	150	120			TB	<125		
	S4C	150	120			TB	5750		
Sample Point 4	S4A	150	120	10:25 – 11:25	60	AF	<125	AF: <125	-
	S4B	150	120			AF	<125		
	S4C	150	120			AF	125		

* Site permit limits: Total Bacteria (TB) = 1000 CFU/m³

Aspergillus fumigatus (AF) = 500 CFU/m³

Below permit limit	Exceeds permit limit
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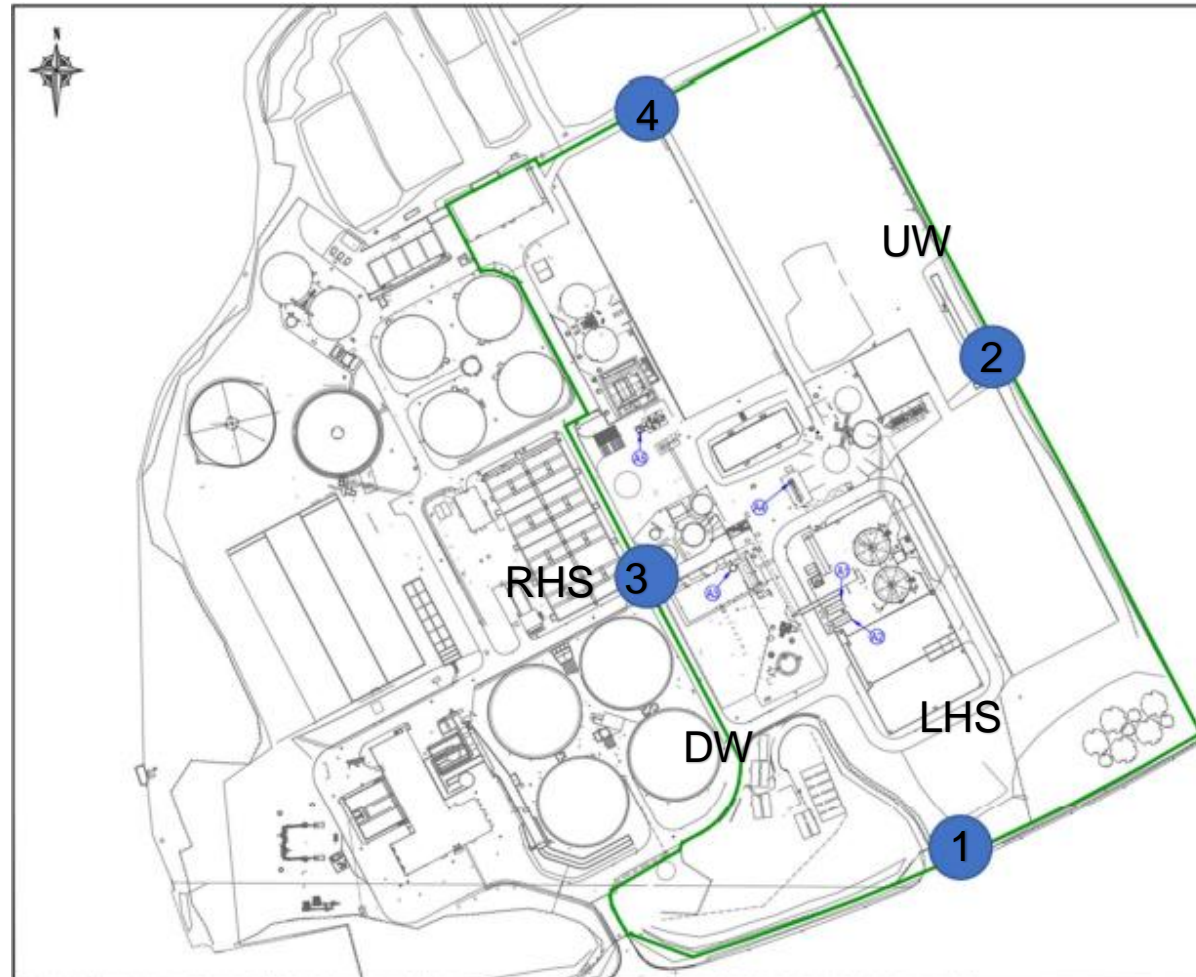
Table 6. Controls and Filter Counts - Bioaerosol monitoring				Job Number: 113776
Site: Woodhouse Mill, Yorkshire		Date: 17/08/22	Site Operator : Yorkshire Water Services Ltd	Commissioning Laboratory : EMT Environmental
Types of materials processed on site : Waste Water				
Location	Sample Ref Number	Microbial Type	Average Count of microorganisms (CFU/filter)	Comments
Upwind	UW1	TB	20	None received
		AF	0	
Upwind	UW2	TB	0	None received
		AF	0	
Upwind	UW3	TB	3	None received
		AF	0	
Downwind	DW1	TB	1	None received
		AF	0	
Downwind	DW2	TB	1	None received
		AF	0	
Downwind	DW3	TB	13	None received
		AF	0	
Downwind Left Hand Fan	LHS1	TB	0	None received
		AF	0	
Downwind Left Hand Fan	LHS2	TB	0	None received
		AF	0	
Downwind Left Hand Fan	LHS3	TB	0	None received
		AF	0	
Downwind Right Hand Fan	RHS1	TB	0	None received
		AF	0	
Downwind Right Hand Fan	RHS2	TB	2	None received
		AF	0	
Downwind Right Hand Fan	RHS3	TB	3	None received
		AF	0	

5. Plan

A standard map is shown on the next page. The operational boundary of the site is shown in red and the sample points are shown and labelled.

Bioaerosol Monitoring – Estimated Concentrations of Airborne Micro Organisms		Job Number 113776	
Site	Woodhouse Mill, Yorkshire	Site Operator	Yorkshire Water Services Ltd
Date	17/08/22	Commissioning Laboratory	EMT Environmental
Types of materials processed on site	Municipal solid waste		

Site boundary marked on in Green.



6. Discussion

Samples for this monitoring were collected using the filter option of the guidance document M9.

It is important to continue to monitor the site. It would be particularly useful to monitor on a day when the prevailing wind is in a different direction.

Whilst it is possible to replicate the sampling points, many other variables will have changed such as temperature, wind speed and wind direction. As such this monitoring is only a snapshot of the situation on site, not a complete picture. The sampling should be carried out at least quarterly to build up an idea of the characteristics of the site.

There were no nearby activities observed which could adversely impact the upwind results.

All results for total bacteria and *Aspergillus fumigatus* (AF) were below the limits. Some individual filter results were above the 1000 cfu/m³ limit for total bacteria but the median results at all locations were below the limit.

It should be noted that the fixed points were undertaken in addition to the required sampling locations at the request of Yorkshire Water.

7. Conclusions

Element Materials Technology Environmental UK Limited was commissioned by Yorkshire Water Services Ltd to carry out a bioaerosol monitoring exercise at the Waste Water Treatment Works at their site in Woodhouse Mill, Yorkshire.

Measurements were carried out in accordance with parameters specified in Technical Guidance Note M9 'Environmental monitoring of bioaerosols at regulated facilities'. Of the methods suggested in the protocol, the filter method was utilised in this project.

All results for total bacteria and *Aspergillus fumigatus* (AF) were below the limits.

The site would be due to be re-assessed in November 2022 assuming the standard frequency requested by the Environment Agency.

Appendix 1. Analysis Certificates

ELE/22/11
Issue no.1**University of
Hertfordshire**
Hatfield Herts
AL10 9AB**Biodet**Direct line 01707 284545
Laboratory 01707 284522
Fax 01707 285046Abi Pickard
Element Materials Technology,
Lawton Square,
Delph,
Oldham,
OL3 5DT

Our Ref: ELE/22/11

Date: 1st September 2022**BIOAEROSOL EXPOSURE REPORT**Log No. 2879
Sample date. 17th August 2022
Engineer: Abigail Pickard
Job no.: 113776Twenty-six IOM bioaerosol exposure heads were received on 18th August 2022.
Occupational exposure events were monitored:

Sample no.	Sample ID	Date	Volume (litres)
Bio1	S1A	17/08/2022	120
Bio2	S1B	17/08/2022	120
Bio3	S1C	17/08/2022	120
Bio4	S2A	17/08/2022	120
Bio5	S2B	17/08/2022	120
Bio6	S2C	17/08/2022	120
Bio7	S3A	17/08/2022	120
Bio8	S3B	17/08/2022	120
Bio9	S3C	17/08/2022	120
Bio10	S4A	17/08/2022	120
Bio11	S4B	17/08/2022	120
Bio12	S4C	17/08/2022	120
Bio13	UW1	17/08/2022	120
Bio14	UW2	17/08/2022	120
Bio15	UW3	17/08/2022	120
Bio16	RHS1	17/08/2022	120
Bio17	RHS2	17/08/2022	120
Bio18	RHS3	17/08/2022	120
Bio19	DW1	17/08/2022	120
Bio20	DW2	17/08/2022	120
Bio21	DW3	17/08/2022	120
Bio22	LHS1	17/08/2022	120

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Bio23	LHS2	17/08/2022	120
Bio24	LHS3	17/08/2022	120
Bio25	Blank 1	17/08/2022	120
Bio26	Blank 2	17/08/2022	120

The IOM heads containing a polycarbonate filter were used to determine the bioaerosol exposure under the test conditions. Upon arrival at the laboratory the bioaerosols impacted on each filter were recovered in 3 ml maximum recovery diluent. The target micro-organisms were cultured using appropriate dilutions on the following media.

Nutrient agar (NA) agar plates were used for total bacteria.
Malt extract agar (MEA) agar plates were used for *Aspergillus fumigatus*.

The samples were incubated for 2 days at 37C (total bacteria) and for 2 days at 44C (*Aspergillus fumigatus*).


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 Issue no.1

**University of
Hertfordshire**
 Hatfield Herts
 AL10 9AB

Results:

Job number 113776
Date 17th August 2022
Comments: All polycarbonate filters and filter heads were in good condition.

Table 1. Microbiological Culture Plate Data:

Sample no.	Sample ID	Volume (litres)	Total Bacteria (cfu per plate)	Total <i>Aspergillus fumigatus</i> (cfu per plate)
Bio1	S1A	120	1, 0	0, 0
Bio2	S1B	120	0, 0	0, 0
Bio3	S1C	120	0, 0	0, 0
Bio4	S2A	120	0, 0	0, 0
Bio5	S2B	120	0, 0	0, 0
Bio6	S2C	120	0, 0	0, 0
Bio7	S3A	120	1, 0	0, 0
Bio8	S3B	120	0, 0	0, 0
Bio9	S3C	120	0, 0	0, 0
Bio10	S4A	120	0, 0	0, 0
Bio11	S4B	120	0, 0	0, 0
Bio12	S4C	120	22, 24	1, 0
Bio13	UW1	120	10, 10	0, 0
Bio14	UW2	120	0, 0	0, 0
Bio15	UW3	120	2, 1	0, 0
Bio16	RHS1	120	0, 0	0, 0
Bio17	RHS2	120	2, 0	0, 0
Bio18	RHS3	120	2, 1	0, 0
Bio19	DW1	120	1, 0	0, 0
Bio20	DW2	120	1, 0	0, 0
Bio21	DW3	120	8, 5	0, 0
Bio22	LHS1	120	0, 0	0, 0
Bio23	LHS2	120	0, 0	0, 0
Bio24	LHS3	120	0, 0	0, 0
Bio25	Blank 1	120	0, 0	0, 0
Bio26	Blank 2	120	0, 0	0, 0

Table 2. Microbiological Results:

Sample no.	Sample ID	Volume (litres)	Total Bacteria (cfu per m ³)	Total <i>Aspergillus fumigatus</i> (cfu per m ³)
Bio1	S1A	120	125	<125
Bio2	S1B	120	<125	<125
Bio3	S1C	120	<125	<125
Bio4	S2A	120	<125	<125
Bio5	S2B	120	<125	<125
Bio6	S2C	120	<125	<125
Bio7	S3A	120	125	<125
Bio8	S3B	120	<125	<125
Bio9	S3C	120	<125	<125
Bio10	S4A	120	<125	<125
Bio11	S4B	120	<125	<125
Bio12	S4C	120	5750	125
Bio13	UW1	120	2500	<125
Bio14	UW2	120	<125	<125
Bio15	UW3	120	375	<125
Bio16	RHS1	120	<125	<125
Bio17	RHS2	120	250	<125
Bio18	RHS3	120	375	<125
Bio19	DW1	120	125	<125
Bio20	DW2	120	125	<125
Bio21	DW3	120	1625	<125
Bio22	LHS1	120	<125	<125
Bio23	LHS2	120	<125	<125
Bio24	LHS3	120	<125	<125
Bio25	Blank 1	120	<125	<125
Bio26	Blank 2	120	<125	<125

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Exposure results are expressed as total micro-organisms per cubic metre collected during the exposure time.



BIODET

1st September 2022