

# Bioaerosol Sampling Report

Severn Trent Water

Roundhill Sludge Treatment Plant

27<sup>th</sup> May 2022

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## Approval Sheet

Customer: Severn Trent Water

Site: Roundhill STW  
 Gibbett Lane  
 Kinver  
 Stourbridge  
 DY7 6NZ

Project title: Bioaerosols Sampling



Project Manager: E. Cracknell

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Issue	Status	Date	Prepared By	Signature	Date
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			E. Cracknell		06/06/2022

## Foreword

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

enitial cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outside the agreed scope of works.

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## 1.0 Scope of Work

Enitial was tasked with providing environmental Bioaerosol monitoring for Severn Trent Water at their Roundhill Sludge Treatment Plant.

Due to the potential health risks posed by the facility to nearby receptors, the testing was conducted to assess the amount of airborne bioaerosols being generated by the site that is released into the local environment. The monitoring is to ensure that this exposure is below the industry standard threshold set by the Environment Agency.

The work was carried out on 27<sup>th</sup> May 2022. This document is a presentation of the resulting data.

## 2.0 Background

The bioaerosol monitoring was specifically undertaken to enumerate the quantity of micro-organisms that can be cultured from representative samples of ambient air, collected at pre-determined monitoring points in the locality of the site.

The monitoring was undertaken in accordance with Environment Agency Technical Guidance Note (Monitoring) M9 – Environmental monitoring of bioaerosols at regulated facilities – July 2018 and Regulatory Position Statement (RPS) 209. Monitoring approach was undertaken after a Best Available Technique (BAT) analysis of the topography, wind direction and other site-specific factors to ensure a suitable site monitoring set up for sampling.

Pre-prepared agar sample plates for *Aspergillus fumigatus*, mesophilic micro-organisms (bacteria) were directly impacted with ambient air using an Andersen sampler at the four selected sampling locations.

In the UK no statutory limits have been set for ambient concentrations of bioaerosols. However, as per the Environment Agency Technical Guidance Note M17, guideline levels have been set for acceptable levels at sensitive receptors as the following:

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

## 3.0 Methodology

### 3.1 Sampling Locations

Sample locations should be determined prior to the commencement of the sampling event where possible. Sampling should be carried out at a minimum of four separate locations as follows:

- Upwind location 001 - at least 25m upwind of the operational area and ideally 50m upwind of the operational of the site.
- Downwind location 002 – in line with the upwind location. This point should be the same distance from the operational area as is the distance from the operational area to the nearest sensitive receptor location.
- Downwind location 003 – 30 degrees to the left from the central point of site and downwind location 2. This point should be the same distance from the operational area as is the distance from the operational area to the nearest sensitive receptor location.
- Downwind location 004 – 30 degrees to the right from the central point of site and downwind location 2. This point should be the same distance from the operational area as is the distance from the operational area to the nearest sensitive receptor location.

The selection of appropriate locations should be made by consulting the site plan and in consultation with enitial's account manager, the Client and/or Site/Facility Manager. Upwind sampling should be performed concurrently with downwind locations or central downwind as a minimum where site topography/distance requires further spread. Locations can be adjusted if necessary if locations are unable to be used due to obstacles or health and safety issues as stated in the M9 document. Should a building, installation or structure intervene between the downwind site and the operational area, then sampling should be carried out upwind of that feature at a distance greater than twice its height.

Sensitive receptors will only be monitored if deemed appropriate by the operator or by requirement through permits and/or public officials.

## 3.2 Agar Plates

Following the Regulatory Position Statement (RPS) 209, the following sampling media was used. The types of Agar used were:

Mesophilic micro-organisms: (Total Viable Count [TVC]) – Half Strength Nutrient Agar (also known as 93's – white in colour)

*Aspergillus Fumigatus* / Total Fungi: (colony-forming unit [cfu]) – Malt Extract Agar (also known as 94's – light yellow in colour)

The impacted agar plates were subsequently delivered to a specialist laboratory within 24 hours via a cool box with ice packs where they were cultured and enumerated.

## 3.3 Equipment

### 3.3.1 List of Equipment

The equipment used is as follows:

- Continuous operation mobile weather station (wind speed, direction, temperature, humidity) and tripod
- Digital stopwatch
- GPS device
- 4 x single-stage Andersen samplers
- 4 x tripods
- 4 x hemicylindrical baffles
- 4 x stoppers for Andersen samplers
- 4 x fully charged vacuum pumps (individual capacity of at least 35l per min) and connecting tubing
- Rotameter to fit vacuum pump
- Agar plates – variety dependent on required test
- 2 x sealable airtight sterile plastic containers
- Cool box with ice packs for transport
- 70% v/v aqueous solution / wipes of ethanol or industrial methylated spirits cleaning solution or other suitable disinfectants



### 3.32 Cleaning of Equipment

All parts of the sampling equipment that were in contact with the samples, work surfaces or storage containers were cleaned with a 70% aqueous solution or wipes of ethanol or methylated spirits, or other suitable disinfectants prior to use. Equipment was completely dried, through air drying before the sampling exercise was commenced.

On completion of cleaning the Andersen single-stage samplers, a stopper was placed in the cone entrance to stop any contamination occurring before the sampling event.

### 3.33 Setup and Operation

- The pumps were Pre-run for a specified time at the required flow rate of 28.3l/min ( $\pm 2\%$ ). This pump test was undertaken once before the start of the monitoring exercise.
- The Andersen single-stage samplers were mounted on to the tripods securely at a height of 1.5-1.8m above ground and the baffles were fitted on the tripod to form a rear shield when aligned to the desired sampling direction.
- The vacuum pump was connected to the rotameter using an appropriate length and diameter of the tubing. Using the rotameter, the flow rate was adjusted to ensure it is running at a constant flow of 28.3l/min ( $\pm 2\%$ ) for each pump.
- On completion of the pump test, the tubing from the dry gas flow meters was disconnected from the rotameter then connected to the inlet on the corresponding Andersen single-stage sampler.
- Fresh sample plates were installed in turn by removing the lid and being placed within the Andersen single-stage sampler
- The stoppers in the inlet of the Andersen single-stage samplers were removed.
- When the Andersen single-stage samplers were fitted with plates the vacuum pumps were activated and the start time recorded on the stopwatch or pump timer. All pumps were switched on/off at the same time or at a maximum interval of up to 10% of the total run time.
- When the sample duration was completed the pumps were stopped and the finish time recorded.
- The plates were carefully removed ensuring that no contact was made with the exposed agar surface,
- The dish cover was replaced on to the plate and secured with masking tape.
- Each plate was placed into an individual plastic bag and sealed.
- The plates were stored in an upright, protective and cooled container and transported to the laboratory within 24 hours.
- Control blank samples were taken at the site. The steps stated above were adhered to however the sample pump was not switched on. One of each sample media was

inserted within the Andersen single-stage samplers, left in for the same period of sampling time, then packaged.

- Field blank samples were taken. The sample media were placed in re-sealable packaging without being opened.

The impacted agar plates were subsequently delivered to a specialist laboratory via a cool box with an ice pack. The analysis took place within 24 hours from sample collection

## 4.0 Presentation of Data

The following pages consist of meteorological conditions found on site, a presentation of the estimated concentrations of airborne micro-organisms, a plan displaying sample locations and the laboratory data.

### 4.1 Field Sampling Report

Site: Roundhill Sludge Treatment Plant

Site Operator: Severn Trent Water

Date: 27<sup>th</sup> May 2022

Start Time: 09:00

Finish Time: 11:30

Monitoring Technician ID: A. Hammersley, A. Lovell

#### 4.11 Meteorological Conditions

*Table 1: Weather Conditions*

Parameter	Wind Direction	Wind Speed (m/s)	Pressure (mb)	Temperature (°C)	Cloud Cover (0-8)
Start	WNW	4.4	1026	14	3
Finish	NW	4.8	1026	15	2

#### 4.12 Site Description

Roundhill Sludge Treatment Plant is located as part of a sewage treatment works near Stourbridge, Dudley, west of Birmingham.

The Sludge Treatment Plant was under normal operations during the sampling period.

## 4.2 Field Sampling Comments

Samples were taken at an upwind and three downwind locations (photographs of locations are presented in *Appendix C*) using Andersen samplers. Ambient air samples were collected by the technique of direct impaction, where a known quantity of air was directed onto an agar plate. The agar samples were then cultured and counted by a specialist laboratory. The count result provides a quantification of the potential health risks posed by the facility to nearby receptors.

An aerial plan of sampling locations is presented in *Appendix A*

Upwind Location:

- Upwind sample location 001; was located on a grass bank near to the AD plant close to trees and thick vegetation.

Downwind Locations:

- Downwind location 002; was located on a grass verge next to the haul road and storm tanks.
- Downwind location 003; was located on a grass verge next to the haul road and storm tanks
- Downwind location 004; was located on a grass verge next to the haul road and storm tanks near to the site office.

A transient sludge/ sewage odour was detected at the downwind locations. The three downwind samples were set up as far apart as possible to achieve a 30° (+-3°) angle from the upwind/downwind axis.

### 4.3 Deviations from Methods

The locations were assessed to take into account the effect of features and obstructions which may impact the effectiveness of the monitoring. The sampling locations were restricted to where safe physical access was possible along with being legally accessible. (See the enclosed annotated image presented in *Appendix A*)

Slight deviations were made to the upwind sample location due to the infrastructure of the AD plant.

Downwind locations were placed in areas where restrictions of infrastructure allowed enough space for the monitoring equipment to be deployed.

Deviation of monitoring time was made to achieve suitable sample location points; Upwind 001 and downwind 002 ran simultaneously and Downwind 003 and 004 ran simultaneously. This was to achieve the required distance and spread of the downwind samples while overcoming access restrictions as per stated in the M9 documentation.

#### 4.4 Field Sampling Record

Table 2: Field Sampling Results

Ambient Sampling: Estimated concentration of bioaerosols								
Site: Roundhill Sampling Date: 27/05/2022 Estimated Mass of Materials: Unknown Activities affecting the concentration of Bioaerosols: Exposed sludge cake, sewage/ sludge treatment processes					Site Operator: Severn Trent Water Monitoring Contractor: Enitial Type of Materials Processed on Site: Sewage and Sludge Site Activity: Normal Operations			
Location and grid reference	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Upwind (1) SO 86937 84075	R0001BIOAEM. Upwind location on grass verge near AD plant	270m	164°	10:08-10:13	56	-	70	140
				10:08-10:13	-	21		
				10:15-10:20	84	-		
				10:15-10:20	-	145		
				10:22-10:27	70	-		
				10:22-10:27	-	140		

Location and grid reference	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Downwind (2)  SO 87370 83995	R0002BIOAEM.  Centre downwind on grass verge next to haul road	180m	3°	10:08-10:13	126	-	182	406
				10:08-10:13	-	420		
				10:15-10:20	182	-		
				10:15-10:20	-	406		
				10:22-10:27	294	-		
				10:22-10:27	-	294		
Downwind (3)  SO 87353 84039	R0003BIOAEM  Left downwind on grass verge next to haul road	150m	20°	10:36-10:41	126	-	154	385
				10:36-10:41	-	574		
				10:43-10:48	252	-		
				10:43-10:48	-	385		
				10:50-10:55	154	-		
				10:50-10:55	-	350		

	Sample reference number	Distance from centre of active area (m)	Difference in bearing between location of samplers and mean direction wind blows to (°)	Sampling start/end times (HH:MM)	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Concentration of bioaerosols (CFU/m <sup>3</sup> )	Median of samples (CFU/m <sup>3</sup> )	
					Total Count (TVC)	Aspergillus Fumigatus (YM)	TVC	YM
Downwind (4)  SO 87365 83919	RO004BIOAEM  Right downwind location on grass verge next to haul road	200m	12°	10:36-10:41	343	-	343	399
				10:36-10:41	-	399		
				10:43-10:48	469	-		
				10:43-10:48	-	336		
				10:50-10:55	238	-		
				10:50-10:55	-	434		
Control	ROControlBIOAEM	N/A	N/A	N/A	<1	-	N/A	
	At same location as Upwind				-	<1		
Field	ROFieldBIOAEM	N/A	N/A	N/A	<1	-	N/A	
	Not removed from package. For QA/QC				-	<1		



#### 4.5 Process Contribution Results

The median is routinely used for statistics and probability theory as the results are less likely to be skewed by extremely high or low values that are not representative of the data set. The median is located by finding the middle value by evenly separating the data set. The median for each location has been calculated and then the highest result for the downwind locations identified. The process contribution has then been calculated by subtracting the upwind median value from the highest downwind median value. The process contribution shows the input the activity of the site has on the ambient bioaerosols concentrations. In the table below the process contribution is shown.

Table 3: Process Contribution Results

<b>Process Contribution Results</b>			
<b>Sample Type</b>	<b>Upwind Median Results</b>	<b>Downwind Median Highest Results</b>	<b>Process Contribution</b>
Total Bacteria viable Count (TVC)	70	343	<b>273</b>
Aspergillus fumigatus (YM)	140	406	<b>266</b>

## 5.0 Summary of Analytical Results

The above report indicates that at the time of sampling:

1. Mesophilic micro-organisms - Total Viable Count (TVC) shows higher readings at the downwind locations compared to the upwind location.
2. Aspergillus Fumigatus readings were detected at both upwind and downwind locations.
3. Upwind location median results remained below the industry standard threshold values of 1000cfu/m<sup>3</sup> for Total Bacteria.
4. The downwind location median process contribution results of **273cfu/m<sup>3</sup>** were 72.7% below the industry standard threshold values of 1000cfu/m<sup>3</sup> for Total Bacteria.
5. Upwind location median results remained below the industry standard threshold values of 500cfu/m<sup>3</sup> for Aspergillus Fumigatus.
6. Downwind location median process contribution results of **266cfu/m<sup>3</sup>** remained 46.8% below the industry standard threshold values of 500cfu/m<sup>3</sup> for Aspergillus Fumigatus.
7. Control and Field blanks for QA/QC did not show any evidence of contamination.

APPENDIX A  
Aerial Plan

**Key**

**1** – Upwind

**2** – Downwind Centre

**3** – Downwind Left

**4** – Downwind Right

**Blue area** – Emission source

**Red Box** – Site area



STW –Roundhill Sludge Treatment Centre 27/05/2022  
Aerial Plan Showing Bioaerosol Sample Locations

APPENDIX B  
Meteorological Conditions

### METEOROLOGICAL CONDITIONS

SITE:	Roundhill	SITE OPERATOR:	Severn Trent Water
SAMPLING DATE:	27/05/2022	COMMISSIONING LABORATORY:	Southern Microbiological Services
ESTIMATED MASS OF MATERIALS:	Unknown	TYPE OF MATERIALS PROCESSED ON SITE:	Sludge and Sewage

Location	Sample Reference Number	Bearing of samplers from boundary of operational area or turning/ screening operation (° from true north) - GPS	Mean direction the wind blows to during the sampling period (° from true north)	Difference in bearing between location of samples from boundary/ source and mean direction wind blows to (°)	Mean wind speed during sampling (m/s)	Arithmetic mean of air temperature (°C)	Arithmetic mean of relative humidity (%)
Upwind	RO001BIOAEM	277 SO 86937 84075	113	164	4.6	14.5	47
Downwind	RO002BIOAEM	110 SO 87370 83995	113	3	4.6	14.5	47
Downwind	RO003BIOAEM	93 SO 87353 84039	113	20	4.6	14.5	47
Downwind	RO004BIOAEM	125 SO 87365 83919	113	12	4.6	14.5	47

APPENDIX C  
Photograph Sheet



# MONITORING PHOTOGRAPH RECORD

Site: STW Roundhill Sludge Treatment Plant

Date: 27/05/2022



Title: Bioaerosol Sampling

Ref: RO20220527



Upwind 001 location looking towards site



Upwind 001 location looking away from site



Downwind 002 location looking towards site



Downwind 002 location looking away from site



Downwind 003 location looking towards site



Downwind 003 location looking away from site



**MONITORING PHOTOGRAPH RECORD**

**Site:** STW Roundhill Sludge Treatment Plant

**Date:** 27/05/2022



**Title:** Bioaerosol Sampling

**Ref:** RO20220527



Downwind 004 location looking towards site



Downwind 004 location looking away from site

APPENDIX D  
Laboratory Certificate



## SOUTHERN MICROBIOLOGICAL SERVICES LTD

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 WV10 7DE

### TEST REPORT

**Enitial Anderson Plates. PO: EN101873 Site - Roundhill. Date Sampled 27.05.22**

Report Reference: 1220504551

Date Reported: 03 June 2022

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\* \*

<u>SMS Reference</u>	<u>Date Tested</u>	<u>Sample Code</u>	<u>Sample Details</u>	<u>Ltrs of Air filtered</u>	<u>Further Details 2</u>	<u>TVC cfu/m3 (2 day pr</u>	<u>Asp fumigatus cfu/m3</u>
1220529041	30/05/22	RO001BIOAE M (93)	---	140	---	56 cfu/m3	
1220529042	30/05/22	RO001BIOAE M (94)	---	140	---		21 cfu/m3
1220529043	30/05/22	RO001BIOAE M (93.A)	---	140	---	84 cfu/m3	
1220529044	30/05/22	RO001BIOAE M (94.A)	---	140	---		145 cfu/m3
1220529045	30/05/22	RO001BIOAE M (93.B)	---	140	---	70 cfu/m3	
1220529046	30/05/22	RO001BIOAE M (94.B)	---	140	---		140 cfu/m3

Enitial Anderson Plates. PO: ENI101873 Site - Roundhill. Date Sampled 27.05.22

Report Reference: 1220504551

Date Reported: 03 June 2022

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SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	TVC cfu/m3 (2 day pr)	Asp fumigatus cfu/m3
1220529047	30/05/22	RO002BIOAE M (93)	---	140	---	126 cfu/m3	
1220529048	30/05/22	RO002BIOAE M (94)	---	140	---		420 cfu/m3
1220529049	30/05/22	RO002BIOAE M (93.A)	---	140	---	182 cfu/m3	
1220529050	30/05/22	RO002BIOAE M (94.A)	---	140	---		406 cfu/m3
1220529051	30/05/22	RO002BIOAE M (93.B)	---	140	---	294 cfu/m3	
1220529052	30/05/22	RO002BIOAE M (94.B)	---	140	---		294 cfu/m3
1220529053	30/05/22	RO003BIOAE M (93)	---	140	---	126 cfu/m3	
1220529054	30/05/22	RO003BIOAE M (94)	---	140	---		574 cfu/m3
1220529055	30/05/22	RO003BIOAE M (93.A)	---	140	---	252 cfu/m3	
1220529056	30/05/22	RO003BIOAE M (94.A)	---	140	---		385 cfu/m3
1220529057	30/05/22	RO003BIOAE M (93.B)	---	140	---	154 cfu/m3	
1220529058	30/05/22	RO003BIOAE M (94.B)	---	140	---		350 cfu/m3

Enitial Anderson Plates. PO: ENI101873 Site - Roundhill. Date Sampled 27.05.22

Report Reference: 1220504551

Date Reported: 03 June 2022

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SMS Reference	Date Tested	Sample Code	Sample Details	Ltrs of Air filtered	Further Details 2	TVC cfu/m3 (2 day pr)	Asp fumigatus cfu/m3
1220529059	30/05/22	RO004BIOAE M (93)	---	140	---	343 cfu/m3	
1220529060	30/05/22	RO004BIOAE M (94)	---	140	---		399 cfu/m3
1220529061	30/05/22	RO004BIOAE M (93.A)	---	140	---	469 cfu/m3	
1220529062	30/05/22	RO004BIOAE M (94.A)	---	140	---		336 cfu/m3
1220529063	30/05/22	RO004BIOAE M (93.B)	---	140	---	238 cfu/m3	
1220529064	30/05/22	RO004BIOAE M (94.B)	---	140	---		434 cfu/m3

Unless otherwise indicated, all samples were received in good condition, tests were performed at the above address and results apply to the sample as received. Date tested equals date received.



Carol Macready  
 Technical Administration Manager

\* Tests marked with a \* in this report are not included in the UKAS Accreditation Schedule for our laboratory



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### TEST REPORT

**Enitial Anderson Plates Controls. PO: ENI101873 Site - Roundhill. Date sampled - 27.05.22**

Report Reference: 1220504552

Date Reported: 03 June 2022

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<u>SMS Reference</u>	<u>Date Tested</u>	<u>Sample Code</u>	<u>Sample Details</u>	<u>Ltrs of Air filtered</u>	<u>Further Details 2</u>	<u>TVC/plate</u>	<u>Asp. Fumigatus Plate</u>
1220529065	30/05/22	RO_CONTROLBIOAEM (93-C)	---	---	---	< 1 cfu / plate	
1220529066	30/05/22	RO_CONTROLBIOAEM (94-C)	---	---	---		< 1 cfu / plate
1220529067	30/05/22	RO_FIELDBIOAEM (93-F)	---	---	---	< 1 cfu / plate	
1220529068	30/05/22	RO_FIELDBIOAEM (94-F)	---	---	---		< 1 cfu / plate

Enitial Anderson Plates Controls. PO: ENI101873 Site - Roundhill. Date  
sampled - 27.05.22

Report Reference: 1220504552

Date Reported: 03 June 2022

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<u>SMS Reference</u>	<u>Date Tested</u>	<u>Sample Code</u>	<u>Sample Details</u>	<u>Ltrs of Air filtered</u>	<u>Further Details 2</u>	<u>TVC/plate</u>	<u>Asp. Fumigatus Plate</u>
--------------------------	------------------------	--------------------	---------------------------	---------------------------------	------------------------------	------------------	-------------------------------------

Unless otherwise indicated, all samples were received in good condition, tests were performed at the above address and results apply to the sample as received. Date tested equals date received.



Carol Macready

Technical Administration Manager