

**SPORE SAMPLING REPORT  
FOR  
GLENWOOD MIDDLE SCHOOL  
2680 ROUTE 97  
GLENWOOD, MD 21738**

**PREPARED FOR:**

**HOWARD COUNTY PUBLIC SCHOOL SYSTEM  
10910 ROUTE 108  
ELLCOTT CITY, MD 21043**

**PREPARED BY:**



**ARIA ENVIRONMENTAL, INC.  
PO BOX 286  
WOODBINE, MD 21797**

**OCTOBER 29, 2015**

**150876**

**SPORE TRAP SAMPLING REPORT  
FOR GLENWOOD MIDDLE SCHOOL  
OCTOBER 21, 2015**

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**SPORE TRAP SAMPLING REPORT  
FOR GLENWOOD MIDDLE SCHOOL  
OCTOBER 21, 2015**

**EXECUTIVE SUMMARY**

Aria Environmental, Inc. (AE) was contracted by Howard County Public School System to perform spore trap sampling at the Glenwood Middle School at the end of August 2015 due to air quality concerns expressed by staff and parents and to monitor the school after a recent heating, ventilation and air-conditioning (HVAC) system upgrade. AE made measurements for temperature, humidity, carbon monoxide, carbon dioxide and particulate matter and collected microbial spore trap sampling for fungal spore identification and counting on October 21, 2015 as part of a series of spore sampling events that will occur in the first month of the 2015 - 2016 school year and less frequently throughout the school year. This report presents the results of air sampling made on October 21, 2015.

**Spore Trap Sampling Report  
For Glenwood Middle School  
October 21, 2015**

**I. BACKGROUND**

Representatives from Aria Environmental, Inc. (AE) visited Glenwood Middle School on October 21, 2015 to perform air monitoring in response to an ongoing indoor air quality complaint at the school. Measurements for temperature, humidity, carbon monoxide, carbon dioxide and particulate matter and microbial spore trap sampling were collected from classrooms 1, 2, 5, 6, 12, 13, 23 and 24 and portable classrooms 60 and 61. Outdoor air samples were also collected for comparison purposes in one courtyard and outside near portable classroom 60. This monitoring was performed in response to employee and parental complaints and as a follow up to HVAC improvements.

There was no visible evidence of mold growth nor observed odors consistent with mildew in the classrooms sampled. Weather on the day of monitoring was warm and sunny.

**II. OBSERVATIONS AND MEASUREMENTS**

**A. Observations and Measurements on October 21, 2015**

Industry guidelines or standards for seasonal temperature and humidity ranges for thermal comfort are established by the American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standard 55-2013. These ranges are presented in Table 1. The U.S. Environmental Protection Agency (EPA) recommends maintaining indoor relative humidity below 60% and ideally between 30 and 50%. The room air temperature measured between 3:17 PM and 4:43 PM ranged from 73.3 to 80.3° F with an average of 75.0° F. The indoor relative humidity ranged from 34.2 to 41.9 percent. The temperature and relative humidity measurements are considered acceptable for summer thermal comfort in all rooms. The outside temperature at 4:14 PM was 74.1° F and the outdoor relative humidity was 32.1% outside near Portable Classroom 60, and the outside temperature at 4:18 PM was 73.8° F and the relative humidity was 32.5% in the courtyard outside Classroom 18. No windows or doors were observed to be open during the monitoring period. Results of temperature, relative humidity, carbon dioxide and carbon monoxide monitoring are presented in Table 2.

**Table 1- Acceptable Ranges of Temperature and  
Relative Humidity in Summer and Winter<sup>a</sup>**

<b>Relative Humidity</b>	<b>Winter Temperature</b>	<b>Summer Temperature</b>
30%	68.5°F – 76.0°F	74.0°F – 80°F
40%	68.5°F - 75.5°F	73.5°F – 79.5°F
50%	68.5°F - 74.5°F	73.0°F – 79.0°F
60%	68.0°F - 74.0°F	72.5°F – 78.0°F

<sup>a</sup>adapted from ASHRAE Standard 55-2013

Carbon dioxide and carbon monoxide measurements are used to assess ventilation system performance. The exhaled breath of building occupants is the main indoor source of carbon dioxide; therefore, the build-up of carbon dioxide indicates inadequate ventilation. Air monitoring was performed after school hours when the rooms were mostly unoccupied. Carbon dioxide concentrations ranged from 435 to 1,503 ppm indoors. The concentration of concern for carbon dioxide is set by ASHRAE standard 62.1–2013 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide ranged from 390 to 406 ppm. Carbon dioxide concentrations were within the comfort parameters established by ASHRAE in all areas monitored except for Portable Classroom 61 (1,503 ppm). There were no students in the

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For Glenwood Middle School  
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rooms at the time of monitoring, but the monitoring took place soon after school ended for the day.

Carbon monoxide is mainly attributed to incomplete combustion. Concentrations of CO ranged from 0.2 to 0.3 ppm indoors and the outdoor concentrations ranged from 0.1 ppm in both outdoor locations measured. CO concentrations were below the ASHRAE concentration of concern of 9 ppm.

Particulate matter or PM is the term for a mixture of solid particles and liquid droplets found in the air. It does not distinguish between the types of particles in the air (e.g., pollen, skin cells, mold spores, soil, etc.). Particulate matter includes "inhalable coarse particles," with diameters larger than 2.5 micrometers and smaller than 10 micrometers (PM<sub>10</sub>) and "fine particles," with diameters that are 2.5 micrometers and smaller (PM<sub>2.5</sub>). Particle loads expected to be a part of the school environment include carpet and clothing fiber, soil tracked from outside, paper dust, chalk dust, and dust and fibers from building materials. ASHRAE Standard 62.1–2013 suggests target indoor concentrations for PM<sub>2.5</sub> and PM<sub>10</sub> of 15 µg/m<sup>3</sup> and 50 µg/m<sup>3</sup>, respectively. These concentrations are taken from the EPA's National Ambient Air Quality Standards (NAAQS) based on annual arithmetic means deemed acceptable for outdoor air quality. Occupational standards and guidelines for particles are nearly an order of magnitude higher than concentrations typically found in non-occupational settings and are not appropriate for comparison.

Particle measurements were taken with an Aerocet 531 particulate monitor. The particle monitor takes a two minute averaged sample of particle concentrations in 5 size fractions (PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>7</sub>, PM<sub>10</sub> and total suspended particles (TSP)). Results of particulate monitoring, presented in Table 2, revealed that PM<sub>2.5</sub> and PM<sub>10</sub> particle concentrations were well below the ASHRAE target concentrations in all areas monitored.

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For Glenwood Middle School  
October 21, 2015**

**Table 2: Particle, Temperature, Relative Humidity, Carbon Dioxide and Carbon Monoxide  
Measurements Collected on October 21, 2015 at Glenwood Middle School**

Location	Time	PM1 ( $\mu\text{g}/\text{m}^3$ )	PM2.5 ( $\mu\text{g}/\text{m}^3$ )	PM7 ( $\mu\text{g}/\text{m}^3$ )	PM10 ( $\mu\text{g}/\text{m}^3$ )	TSP ( $\mu\text{g}/\text{m}^3$ )	Temp (°F)	Rh (%)	CO (ppm)	CO <sub>2</sub> (ppm)
CR 01	3:17 PM	0	0	0	1	1	74.2	35.2	0.3	491
CR 02	3:20 PM	0	0	1	1	2	73.7	36.3	0.3	548
CR 05	3:23 PM	0	0	1	1	6	73.3	35.2	0.3	461
CR 06	3:25 PM	0	0	1	1	2	73.3	35.4	0.2	435
CR 12	3:47 PM	0	0	0	1	1	75.0	34.2	0.2	468
CR 13	3:49 PM	0	0	1	2	3	74.3	34.5	0.2	455
CR 23	4:00 PM	0	0	11	14	20	73.8	35.6	0.2	463
CR 24	4:02 PM	0	0	3	4	9	74.1	36.0	0.2	475
PCR 60	4:32 PM	0	1	4	5	6	79.2	41.5	0.2	914
PCR 61	4:43 PM	0	2	11	14	16	80.3	41.9	0.3	<b>1,503</b>
Out 2 CY	4:14 PM	0	1	5	8	12	73.8	32.5	0.1	406
Out 1	4:18 PM	0	1	6	8	13	74.1	32.1	0.1	390

CR = Classroom; PCR = Portable Classroom; CY = Courtyard; Bold type indicates measurements above the guidelines

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**B. Air Monitoring for Fungal Identification and Counting on October 21, 2015**

In the absence of visual sources of mold amplification and growth in the classrooms, non-viable spore trap samples were collected from eight classrooms within the main school building (Classrooms 1, 2, 5, 6, 12, 13, 23 and 24), two portable classrooms (60 and 61) and two outdoor locations to determine whether there was a difference between mold spore loads inside the building versus outside.

The spore trap samples were collected using AllergenCo-D cassettes attached to a Buck BioAire™ sampling pump calibrated to 15 liter per minute (LPM) air flow. The samples were collected for a period of ten minutes, the time period recommended for spore trap sampling in a clean indoor environment. The spore trap samples were submitted to Aerobiology Laboratory for analysis. The sample results are reported as the spores per cubic meter of air (spores per m<sup>3</sup>) of hyphal fragments and total fungal spores. Depending upon the morphology of the spores, they were counted by their unique genus or were grouped into spores exhibiting common characteristics (e.g., *Penicillium*/*Aspergillus* group). Tables 3 and 4 present the results of the spore trap samples collected at Glenwood Middle School on October 21, 2015.

Indoor spore counts ranged from 307 to 493 total spores per cubic meter of air (m<sup>3</sup>) in the main school building and from 973 to 2,367 in the portable classrooms on October 21, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 11,447 to 20,560 spores per m<sup>3</sup>. All individual spore types detected indoors had counts lower than the outdoor sample counts. Windows were not open during sampling.

No secondary colonizers including *Chaetomium* or *Stachybotrys* were detected in the indoor air samples. Hyphal elements were detected in six of the eight main building classrooms and in both of the portable classrooms. Indoor samples ranged from 7 to 27 hyphal elements per m<sup>3</sup>, and all detected indoor hyphal elements were lower than the outdoor sample hyphal element counts ranging from 200 to 307 elements per m<sup>3</sup>. Variations in outdoor spore concentrations are a function of diurnal rhythms of spore release, weather-related factors (e.g., wind, rain, snow cover, temperature), and physical spatial factors. Certificates of analysis are included as Attachment B.

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**Table 3: Results of Spore Trap Sampling in Selected Classrooms in Glenwood Middle School on October 21, 2015**

Location	Outside near Room 60 (Out 1)	Outside in Courtyard (Out 2)	Room 1 (GM 01)	Room 2 (GM 02)	Room 5 (GM 05)	Room 6 (GM 06)	Room 12 (GM 12)	Room 13 (GM 13)	Room 23 (GM 23)	Room 24 (GM 24)
Spore Type	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>
<b>Alternaria</b>	87	40	-	-	7	-	-	-	-	-
<b>Ascospores</b>	67	53	7	13	33	20	-	60	-	27
<b>Basidiospores</b>	5,333	4,800	320	267	213	240	267	213	307	293
<b>Cercospora</b>	20	20	-	-	-	-	-	-	-	-
<b>Cladosporium</b>	3,627	4,267	20	40	140	67	27	33	13	93
<b>Curvularia</b>	13	-	-	-	-	-	-	-	-	-
<b>Epicoccum</b>	20	-	-	-	-	-	-	-	-	-
<b>Drechslera/Bipolaris group</b>	240	-	-	7	-	-	-	-	-	-
<b>Hyphal Elements</b>	200	307	7	-	-	7	7	27	13	27
<b>Penicillium/ Aspergillus</b>	33	220	7	47	87	40	7	20	-	-
<b>Rusts</b>	20	13	-	-	-	-	-	-	-	-
<b>Smuts, Periconia, myxomycetes</b>	10,880	1,707	-	7	13	20	-	-	13	33
<b>Torula</b>	-	20	-	-	-	-	-	-	-	-
<b>Unknown</b>	20	-	-	-	-	-	-	-	-	-
<b>Total Fungi</b>	20,560	11,447	360	380	493	393	307	353	347	473

Bold numbers represent spore concentrations above the outdoor counts. Dashes designate none detected.



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**Table 4: Results of Spore Trap Sampling in Portable Classrooms  
at Glenwood Middle School on October 21, 2015**

Location	Outside near Room 60 (Out 1)	Outside in Courtyard (Out 2)	Room 60 (GM 60)	Room 61 (GM 61)
Spore Type	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>	Spores/ m <sup>3</sup>
<b>Alternaria</b>	87	40	-	-
<b>Ascospores</b>	67	53	13	20
<b>Basidiospores</b>	5,333	4,800	1,600	107
<b>Cercospora</b>	20	20	-	-
<b>Cladosporium</b>	3,627	4,267	660	647
<b>Curvularia</b>	13	-	-	-
<b>Epicoccum</b>	20	-	-	-
<b>Drechslera/Bipolaris group</b>	240	-	-	-
<b>Hyphal Elements</b>	200	307	20	27
<b>Penicillium/ Aspergillus</b>	33	220	27	127
<b>Rusts</b>	20	13	-	-
<b>Smuts, Periconia, myxomycetes</b>	10,880	1,707	47	47
<b>Torula</b>	-	20	-	-
<b>Unknown</b>	20	-	-	-
<b>Total Fungi</b>	20,560	11,447	2,367	973

Bold numbers represent spore concentrations above the outdoor counts.  
Dashes designate none detected.

**Spore Sampling Report  
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October 21, 2015**

**III. CONCLUSIONS AND RECOMMENDATIONS**

Aria Environmental, Inc. (AE) was contracted by Howard County Public School System to perform spore trap sampling at the Glenwood Middle School at the end of August 2015 due to air quality concerns expressed by staff and parents and to monitor the school after a recent heating, ventilation and air-conditioning (HVAC) system upgrade. AE made measurements for temperature, humidity, carbon monoxide, carbon dioxide and particulate matter and collected microbial spore trap samples on October 21, 2015.

Thermal comfort parameters of temperature and humidity were measured and found to be mostly within the comfort ranges established by ASHRAE. Carbon dioxide was elevated in one portable classroom (61). Carbon monoxide and particulate matter measurements were within acceptable ranges for good indoor air quality in all areas.

Indoor spore counts ranged from 307 to 493 total spores per cubic meter of air (m<sup>3</sup>) in the main school building classrooms and from 973 to 2,367 in the portable classrooms on October 21, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 11,447 to 20,560 spores per m<sup>3</sup>. All individual spore types detected indoors had counts lower than the outdoor sample counts. Indoor hyphal elements ranged from 7 to 27 elements per m<sup>3</sup>. All indoor hyphal element counts were lower than the outdoor samples ranging from 200 to 307 elements per m<sup>3</sup>. Windows were not open during sampling.

Table 5 presents a summary of spore sampling results to date in the 2015 - 2016 school year. The indoor and outdoor ranges demonstrate the variable nature of spore counts.

**Table 5 – Summary of Spore Sampling Results to Date at GMS in the 2015-2016 School Year**

<b>Date</b>	<b>Indoor Spore Count Range Spores per m<sup>3</sup></b>	<b>Outdoor Spore Count Range Spores per m<sup>3</sup></b>
August 25, 2015	1,787 to 8,807	34,001 to 37,316
August 27, 2015	400 to 747	9,433 to 10,960
September 2, 2015	1,860 to 7,960	33,294 to 37,306
September 9, 2015	1,053 to 3,173	21,890 to 31,876
September 16, 2015	447 to 3,493	17,543 to 20,287
September 24, 2015	273 to 2,480	24,680 to 25,020
September 30, 2015	1,267 to 12,767	55,396 to 69,421
October 7, 2015	213 to 14,120	49,146 to 51,759
October 14, 2015	140 to 2,700	8,807 to 10,153
October 21, 2015	307 to 2,367	11,447 to 20,560

Spore measurements collected in classrooms were generally acceptable compared to outdoor samples with outdoor total spore counts over 24 times higher than the indoor counts on average. Indoor sample total spore counts and individual spore counts were all lower than the outdoor sample counts. Follow up air sampling is scheduled for October 27, 2015 and will be performed regularly in order to monitor changes in conditions affected by seasonal variations and the new HVAC system.

**IV. LIMITATIONS**

This report has been prepared for the exclusive use of the Howard County Public School System and/or their agents. This service has been performed in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made. Our conclusions and

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recommendations are based, in part, upon information provided to us by others and our site observations. We have not verified the completeness or accuracy of the information provided to us by others, unless otherwise noted. Our observations and recommendations are based upon conditions readily visible at the site at the time of our site visit, and upon current industry standards. Destructive sampling was not performed as part of this survey. No observations were made behind solid walls, ceilings or in pipe chases that weren't already openly visible.

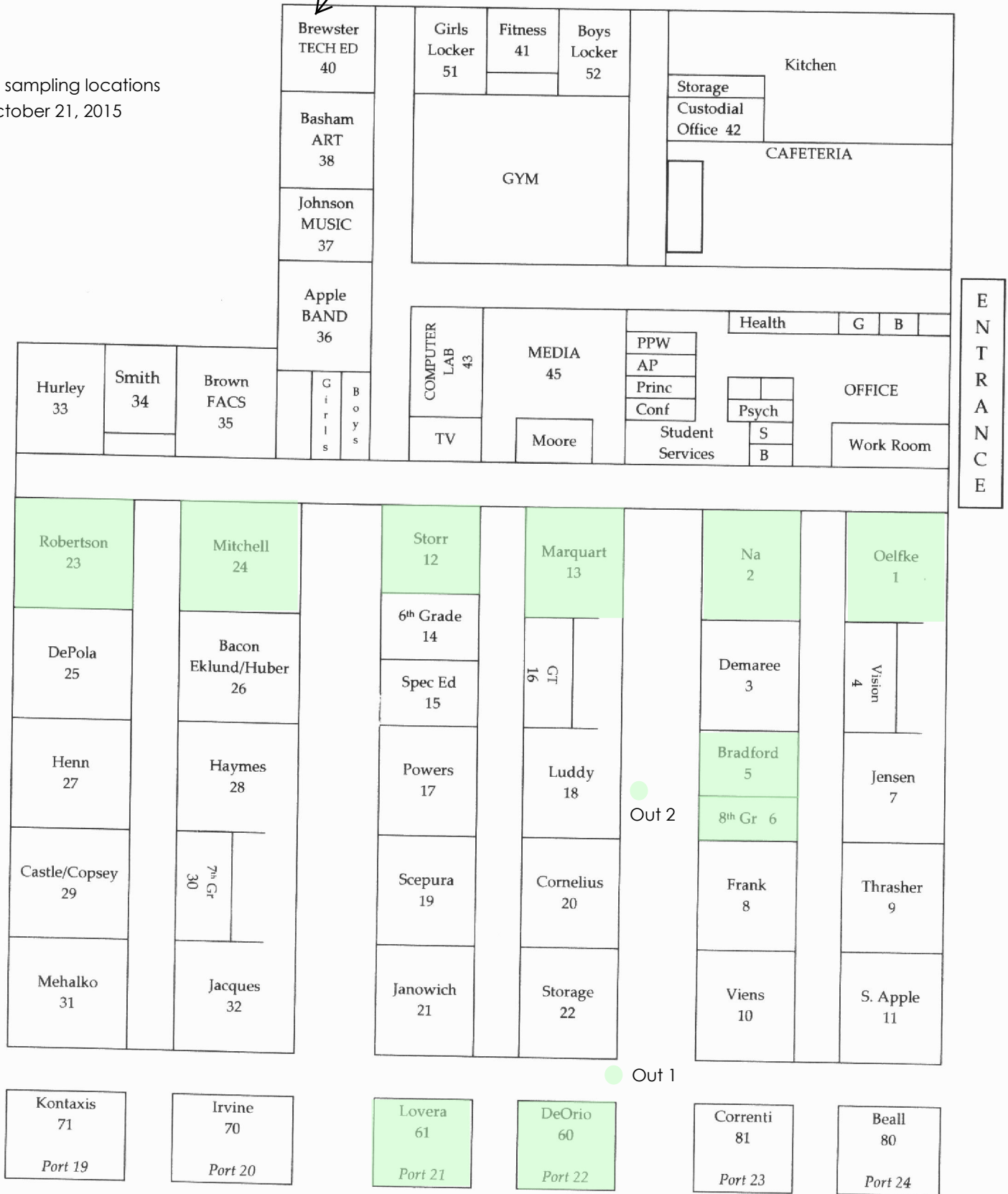
By virtue of providing the services described in this report, the preparer does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential danger to public health, safety, or the environment. It is the Client's responsibility to notify the appropriate local, state, or federal public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety, or the environment. Under this scope of services, the preparer assumes no responsibility regarding response actions (e.g. abatement, removal, etc.) initiated as a result of these findings. Response actions are the sole responsibility of the Client and should be conducted in accordance with local, state, and/or federal requirements, and should be performed by appropriately licensed personnel as warranted.

**Attachment A:**

**Building Layout and Sample Location Plan for October 21, 2015**

TECH ED CLASSROOM AND LAB (39 and 40)

Spore sampling locations  
for October 21, 2015



Glenwood Middle School Floor Plan

As of 8/02/13

**Attachment B:**

**Report of Analysis and Chain of Custody Forms  
October 21, 2015**

Aria Environmental  
P.O. Box 286  
Woodbine, Maryland 21797  
Attn: Julie Barth  
Project: **J15-876 GMS Glenwood MS**  
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/21/2015  
Date Received: 10/26/2015  
Date Analyzed: 10/28/2015  
Date Reported: 10/28/2015  
Project ID: 15027550

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1054 Spore Trap Analysis: SOP 3.8

Client Sample Number	GM-01				Out 2 CY			
Sample Location	Classroom 1				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-001				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	1	7	2	1/8	8	53	<1	-
basidiospores	12	320	89	1/15	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	3	20	6	1/213	40	4267	37	-
hyphal elements	1	7	2	1/46	46	307	3	-
Penicillium/Aspergillus group	1	7	2	1/33	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>3</b>			
Analytical Sensitivity	Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>				Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>			
Comments								
Total *See Footnotes	18	360	~100%	1/32	202	11447	~100%	-

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Date Collected: 10/21/2015  
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Date Analyzed: 10/28/2015  
Date Reported: 10/28/2015  
Project ID: 15027550  
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Client Sample Number	GM-02				Out 2 CY			
Sample Location	Classroom 2				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-002				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	2	13	4	1/4	8	53	<1	-
basidiospores	10	267	70	1/18	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	6	40	11	1/107	40	4267	37	-
Drechslera/Bipolaris group	1	7	2	-	-	-	-	-
hyphal elements	-	-	-	-	46	307	3	-
Penicillium/Aspergillus group	7	47	12	1/5	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	1	7	2	1/256	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>3</b>			
Analytical Sensitivity	Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>				Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>			
Comments								
Total *See Footnotes	27	380	~100%	1/30	202	11447	~100%	-



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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/21/2015  
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Date Reported: 10/28/2015  
Project ID: 15027550

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Client Sample Number	GM-05				Out 2 CY			
Sample Location	Room 5				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-003				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	1	7	1	1/6	6	40	<1	-
ascospores	5	33	7	1/2	8	53	<1	-
basidiospores	8	213	43	1/23	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	21	140	28	1/30	40	4267	37	-
hyphal elements	-	-	-	-	46	307	3	-
Penicillium/Aspergillus group	13	87	18	1/3	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	2	13	3	1/128	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	50	493	~100%	1/23	202	11447	~100%	-

Client Sample Number	GM-06				Out 2 CY			
Sample Location	Room 6				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-004				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	3	20	5	1/3	8	53	<1	-
basidiospores	9	240	61	1/20	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	10	67	17	1/64	40	4267	37	-
hyphal elements	1	7	2	1/46	46	307	3	-
Penicillium/Aspergillus group	6	40	10	1/6	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	3	20	5	1/85	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	32	393	~100%	1/29	202	11447	~100%	-

Aria Environmental  
P.O. Box 286  
Woodbine, Maryland 21797  
Attn: Julie Barth  
Project: **J15-876 GMS Glenwood MS**  
Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 10/21/2015  
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Project ID: 15027550

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Client Sample Number	GM-12				Out 2 CY			
Sample Location	Classroom 12				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-005				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	-	-	-	-	8	53	<1	-
basidiospores	10	267	87	1/18	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	4	27	9	1/160	40	4267	37	-
hyphal elements	1	7	2	1/46	46	307	3	-
Penicillium/Aspergillus group	1	7	2	1/33	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>3</b>			
Analytical Sensitivity	Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>				Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>			
Comments								
Total *See Footnotes	16	307	~100%	1/37	202	11447	~100%	-

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Attn: Julie Barth  
Project: **J15-876 GMS Glenwood MS**  
Condition of Sample(s) Upon Receipt: Acceptable

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Client Sample Number	GM-13				Out 2 CY			
Sample Location	Classroom 13				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-006				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	9	60	17	1/1	8	53	<1	-
basidiospores	8	213	60	1/23	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	5	33	9	1/128	40	4267	37	-
hyphal elements	4	27	8	1/12	46	307	3	-
Penicillium/Aspergillus group	3	20	6	1/11	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	29	353	~100%	1/32	202	11447	~100%	-

Client Sample Number	GM-23				Out 2 CY			
Sample Location	Classroom 23				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-007				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	-	-	-	-	8	53	<1	-
basidiospores	46	307	88	1/16	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	2	13	4	1/320	40	4267	37	-
hyphal elements	2	13	4	1/23	46	307	3	-
Penicillium/Aspergillus group	-	-	-	-	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	2	13	4	1/128	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	52	347	~100%	1/33	202	11447	~100%	-

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Client Sample Number	GM-24				Out 2 CY			
Sample Location	Classroom 24				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-008				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	4	27	6	1/2	8	53	<1	-
basidiospores	44	293	62	1/16	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	14	93	20	1/46	40	4267	37	-
hyphal elements	4	27	6	1/12	46	307	3	-
Penicillium/Aspergillus group	-	-	-	-	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	5	33	7	1/51	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	71	473	~100%	1/24	202	11447	~100%	-

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Client Sample Number	GM-60				Out 2 CY			
Sample Location	Portable Classroom 60				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-009				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	2	13	1	1/4	8	53	<1	-
basidiospores	60	1600	68	1/3	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	99	660	28	1/6	40	4267	37	-
hyphal elements	3	20	1	1/15	46	307	3	-
Penicillium/Aspergillus group	4	27	1	1/8	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	7	47	2	1/37	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	175	2367	~100%	1/5	202	11447	~100%	-

Client Sample Number	GM-61				Out 2 CY			
Sample Location	Portable Classroom 61				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-010				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	6	40	<1	-
ascospores	3	20	2	1/3	8	53	<1	-
basidiospores	4	107	11	1/45	45	4800	42	-
Cercospora	-	-	-	-	3	20	<1	-
Cladosporium	97	647	66	1/7	40	4267	37	-
hyphal elements	4	27	3	1/12	46	307	3	-
Penicillium/Aspergillus group	19	127	13	1/2	33	220	2	-
Rusts	-	-	-	-	2	13	<1	-
Smuts,Periconia,Myxomycetes	7	47	5	1/37	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	134	973	~100%	1/12	202	11447	~100%	-

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Client Sample Number	Out 1				Out 2 CY			
Sample Location	Outside Near PCR 60				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15027550-011				15027550-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	13	87	<1	2/1	6	40	<1	-
ascospores	10	67	<1	1/1	8	53	<1	-
basidiospores	50	5333	26	1/1	45	4800	42	-
Cercospora	3	20	<1	1/1	3	20	<1	-
Cladosporium	34	3627	18	1/1	40	4267	37	-
Curvularia	2	13	<1	-	-	-	-	-
Epicoccum	3	20	<1	-	-	-	-	-
hyphal elements	36	240	1	1/1	46	307	3	-
Penicillium/Aspergillus group	30	200	1	1/1	33	220	2	-
Pithomyces	5	33	<1	-	-	-	-	-
Rusts	3	20	<1	2/1	2	13	<1	-
Smuts,Periconia,Myxomycetes	102	10880	53	6/1	16	1707	15	-
Torula	-	-	-	-	3	20	<1	-
Unknown	3	20	<1	-	-	-	-	-
	Debris Rating <b>3</b>				Debris Rating <b>3</b>			
Analytical Sensitivity	Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>				Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>			
Comments								
Total *See Footnotes	294	20560	~100%	2/1	202	11447	~100%	-

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## Footnotes and Additional Report Information

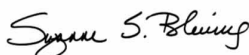
### Debris Rating Table

1	Minimal (<5%) particulate present	Reported values are minimally affected by particulate load.
2	5% to 25% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
3	26% to 75% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
4	75% to 90% of the trace occluded with particulate	Negative bias is expected. The degree of bias increases directly with the percent of the trace that is occluded.
5	Greater than 90% of the trace occluded with particulate	Quantification not possible due to large negative bias. A new sample should be collected at a shorter time interval or other measures taken to reduce particulate load.

1. Penicillium/Aspergillus group spores are characterized by their small size, round to ovoid shape, being unicellular, and usually colorless to lightly pigmented. There are numerous genera of fungi whose spore morphology is similar to that of the Penicillium/Aspergillus type. Two common examples would be Paecilomyces and Acremonium. Although the majority of spores placed in this group are Penicillium, Aspergillus, or a combination of both. Keep in mind that these are not the only two possibilities.
2. Ascospores are sexually produced fungal spores formed within an ascus. An ascus is a sac-like structure designed to discharge the ascospores into the environment, e.g. Ascobolus.
3. Basidiospores are typically blown indoors from outdoors and rarely have an indoor source. However, in certain situations a high basidiospore count indoors may be indicative of a wood decay problem or wet soil.
4. The colorless group contains colorless spores which were unidentifiable to a specific genus. Examples of this group include Acremonium, Aphanocladium, Beauveria, Chrysosporium, Engyodontium microconidia, yeast, some arthrospores, as well as many others.
5. Hyphae are the vegetative mode of fungi. Hyphal elements are fragments of individual Hyphae. They can break apart and become airborne much like spores and are potentially allergenic. A mass of hyphal elements is termed the mycelium. Hyphae in high concentration may be indicative of colonization.
6. Dash (-) in this report, under raw count column means 'not detected (ND)'; otherwise 'not applicable' (NA).
7. The positive-hole correction factor is a statistical tool which calculates a probable count from the raw count, taking into consideration that multiple particles can impact on the same hole; for this reason the sum of the calculated counts may be less than the positive hole corrected total.
8. Due to rounding totals may not equal 100%.
9. Analytical Sensitivity for each spores is different for Non-viable sample when the spores are read at different percentage.
10. Minimum Reporting Limits (MRL) for BULKS, DUSTS, SWABS, and WATER samples are a calculation based on the sample size and the dilution plate on which the organism was counted. Results are a compilation of counts taken from multiple dilutions and multiple medias. This means that every genus of fungi or bacteria recovered can be counted on the plate on which it is best represented.
11. If the final quantitative result is corrected for contamination based on the blank, the blank correction is stated in the sample comments section of the report.
12. Analysis conducted on non-viable spore traps is completed using Indoor Environmental Standards Organization (IESO) Standard 2210.
13. The results in this report are related to this project and these samples only.
14. For samples with an air volume of < 100L, the number of significant figures in the result should be considered (2) two. For samples with air volumes between 100-999L, the number of significant figures in the result should be considered (3) three. For example, a sample with a result of 55,443 spr/m<sup>3</sup> from a 75L sample using significant figures should be considered 55,000. The same result of 55,443 from a 150L sample using significant figures should be considered 55,400 spr/m<sup>3</sup>.
15. If the In/Out ratio is greater than 100 times it is indicated >100/1, rather than showing the real value.

#### Terminology Used in Direct Exam Reporting

**Conidiophores are a type of modified hyphae from which spores are born. When seen on a surface sample in moderate to numerous concentrations they may be indicative of fungal growth.**



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