

**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**

**DECEMBER 18, 2015**

**150876**

**SPORE TRAP SAMPLING REPORT  
FOR GLENWOOD MIDDLE SCHOOL  
DECEMBER 3, 2015**

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**SPORE TRAP SAMPLING REPORT  
FOR GLENWOOD MIDDLE SCHOOL  
DECEMBER 3, 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 December 3, 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 December 3, 2015.

**Spore Trap Sampling Report  
For Glenwood Middle School  
December 3, 2015**

**I. BACKGROUND**

Representatives from Aria Environmental, Inc. (AE) visited Glenwood Middle School on December 3, 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 3, 7, 15, 16, 25, 26, 33, 34 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. There were after school activities occurring on the day of sampling that ended very shortly before sampling occurred. Classroom 3 was the only area sampled that had student activities on that day. It was reported by a teacher that approximately 25 students left Classroom 3 about five minutes prior to the start of sampling. Weather on the day of monitoring was cool with a light breeze.

**II. OBSERVATIONS AND MEASUREMENTS**

**A. Observations and Measurements on December 3, 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 3:08 PM and 4:08 PM ranged from 70.1 to 75.6° F with an average of 72° F. The indoor relative humidity ranged from 20.6 to 28.9 percent. The temperature measurements are considered acceptable for winter thermal comfort in all rooms. Relative humidity measurements are slightly below the comfort range minimum of 30%. Lower humidity is expected in the winter months in buildings that do not add humidity. The comfort ranges are only set for the Summer and Winter seasons when temperatures are usually consistent. There are no Fall or Spring ranges because these seasons can include both heating and cooling modes of HVAC operation. The outside temperature at 4:16 PM was 49.1° F and the outdoor relative humidity was 32.9% outside near Portable Classroom 60, and the outside temperature at 4:18 PM was 42.5° F and the relative humidity was 51.1% in the courtyard outside Classroom 20. 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 – 80.0°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

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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 on a day when students had after school activities, but the rooms were unoccupied during sampling. Carbon dioxide concentrations ranged from 429 to 918 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 423 to 429 ppm. Carbon dioxide concentrations were within the comfort parameters established by ASHRAE in all areas monitored.

Carbon monoxide is mainly attributed to incomplete combustion. Concentrations of CO ranged from 0.0 to 1.0 ppm indoors and the outdoor concentrations ranged from 0.4 to 1.7 ppm in the two 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 10) and "fine particles," with diameters that are 2.5 micrometers and smaller (PM 2.5). 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 2.5 and PM 10 of 15  $\mu\text{g}/\text{m}^3$  and 50  $\mu\text{g}/\text{m}^3$ , 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 1, PM 2.5, PM 7, PM 10 and total suspended particles (TSP)). Results of particulate monitoring, presented in Table 2, revealed that PM 2.5 and PM 10 particle concentrations were well below the ASHRAE target concentrations in all areas monitored except for Classroom 3 where the PM10 concentration was 170  $\mu\text{g}/\text{m}^3$ . Approximately 25 students were in this classroom for after-school activities 5 minutes prior to air sampling.

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For Glenwood Middle School  
December 3, 2015**

**Table 2: Particle, Temperature, Relative Humidity, Carbon Dioxide and Carbon Monoxide Measurements Collected on December 3, 2015 at Glenwood Middle School**

Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	Temp (°F)	Rh (%)	CO (ppm)	CO <sub>2</sub> (ppm)
CR 03	3:08 PM	1	11	118	170	300	75.6	<b>23.6</b>	1.0	918
CR 07	3:11 PM	0	0	0	0	1	73.7	<b>20.6</b>	0.5	487
CR 15	3:17 PM	0	0	1	2	5	71.9	<b>24.9</b>	0.3	488
CR 16	3:27 PM	0	0	2	4	7	71.8	<b>26.5</b>	0.0	513
CR 25	3:33 PM	0	0	0	1	6	74.5	<b>25.2</b>	0.1	463
CR 26	3:37 PM	0	0	2	4	7	74.2	<b>25.3</b>	0.2	515
CR 33	3:46 PM	0	0	2	4	4	71.2	<b>28.1</b>	0.3	581
CR 34	3:50 PM	0	0	1	2	2	70.6	<b>28.9</b>	0.3	513
PCR 60	4:03 PM	0	0	0	0	0	70.9	<b>26.2</b>	0.0	449
PCR 61	4:08 PM	0	0	0	0	0	70.1	<b>25.8</b>	0.0	429
Out 1	4:16 PM	0	0	1	1	5	49.1	32.9	1.7	423
Out 2 CY	4:18 PM	0	0	1	1	2	42.5	51.1	0.4	429

CR = Classroom; PCR = Portable Classroom; CY = Courtyard; Bold type indicates measurements outside of guidelines

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**B. Air Monitoring for Fungal Identification and Counting on December 3, 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 3, 7, 15, 16, 25, 26, 33, 34, 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 December 3, 2015.

Indoor spore counts ranged from 100 to 4,900 total spores per cubic meter of air (m<sup>3</sup>) in the main school building and from 147 to 233 in the portable classrooms on December 3, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 5,340 to 6,207 spores per m<sup>3</sup>. All individual spore types detected indoors had counts lower than the outdoor sample counts except for Penicillium/Aspergillus group spores found in the Classroom 3 sample at 4,373 spores/m<sup>3</sup>. These spore types were found in the outdoor samples at 7 to 207 spores/m<sup>3</sup>. Approximately 25 students were in this classroom for after-school activities 5 minutes prior to air sampling. 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 four of the ten indoor samples and ranged from 7 to 33 hyphal elements per m<sup>3</sup> each, and the detected indoor hyphal elements were lower than the outdoor sample hyphal element counts ranging from 120 to 140 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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For Glenwood Middle School  
December 3, 2015**

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

Location	Outside near PCR 60 (Out 1)	Outside in Courtyard (Out 2)	Room 03 (GM 03)	Room 07 (GM 07)	Room 15 (GM 15)	Room 16 (GM 16)	Room 25 (GM 25)	Room 26 (GM 26)	Room 33 (GM 33)	Room 34 (GM 34)
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>
<i>Alternaria</i>	7	27	-	-	-	-	7	-	-	-
<i>Ascospores</i>	693	427	7	-	-	7	-	-	13	13
<i>Basidiospores</i>	4,000	2,133	427	213	60	133	213	213	47	40
<i>Cercospora</i>	-	7	-	-	-	-	-	-	-	-
<i>Cladosporium</i>	1,280	2,027	27	33	40	7	-	20	13	27
<i>Colorless</i>	7	-	-	-	-	-	-	-	-	-
<i>Epicoccum</i>	20	13	7	-	-	-	-	-	-	-
<i>Hyphal Elements</i>	120	140	33	-	-	13	-	-	-	7
<i>Penicillium/Aspergillus</i>	7	207	<b>4,373</b>	33	40	27	20	27	40	7
<i>Pithomyces</i>	13	-	7	-	-	7	-	7	-	-
<i>Rusts</i>	-	7	-	7	-	-	-	-	-	-
<i>Smuts, Periconia, myxomycetes</i>	53	327	20	7	7	7	-	-	-	7
<i>Unknown</i>	7	27	-	-	-	-	-	-	-	-
<b>Total Fungi</b>	6,207	5,340	4,900	293	147	200	240	267	113	100

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



**Spore Sampling Report  
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December 3, 2015**

**Table 4: Results of Spore Trap Sampling in Portable Classrooms  
at Glenwood Middle School on December 3, 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>
Alternaria	7	27	-	-
Ascospores	693	427	13	7
Basidiospores	4,000	2,133	40	133
Cercospora	-	7	-	-
Cladosporium	1,280	2,027	27	87
Colorless	7	-	-	-
Epicoccum	20	13	-	-
Hyphal Elements	120	140	27	-
Penicillium/ Aspergillus	7	207	20	7
Pithomyces	13	-	-	-
Rusts	-	7	-	-
<b>Smuts, Periconia, myxomycetes</b>	53	327	20	-
Unknown	7	27	-	-
<b>Total Fungi</b>	6,207	5,340	147	233

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

**Spore Sampling Report  
For Glenwood Middle School  
December 3, 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 December 3, 2015.

Thermal comfort parameters of temperature and humidity were measured. Temperature measurements were within the comfort ranges established by ASHRAE and relative humidity measurements were slightly low which is expected during the heating season. Carbon dioxide, carbon monoxide and particulate matter measurements were within acceptable ranges for good indoor air quality in all areas except for the PM10 particulate concentration in Classroom 3 (170 µg/m<sup>3</sup>). Classroom 3 had 25 students in it approximately 5 minutes prior to sampling because of after-school activities. Particulate concentrations would be expected to be elevated from student movement, clothing and use of pencils, erasers and other activities that generate dust.

Indoor spore counts ranged from 100 to 4,900 total spores per cubic meter of air (m<sup>3</sup>) in the main school building classrooms and from 147 to 233 in the portable classrooms on December 3, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 5,340 to 6,207 spores/ m<sup>3</sup>. All individual spore types detected indoors had counts lower than the outdoor sample counts except for Penicillium/Aspergillus group spores found in the Classroom 3 sample (4,373 spores/m<sup>3</sup>). This sample was 21 times higher than the outdoor sample due to student after-school activities in this room five minutes prior to sampling. Indoor hyphal elements were detected in four out of ten of the indoor samples at 7 to 33 elements/m<sup>3</sup>, and the counts were lower than the outdoor samples, ranging from 120 to 140 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
October 27, 2015	87 to 680	8,827 to 9,427
November 4, 2015	73 to 780	26,592 to 27,484
November 11, 2015	133 to 6,427	23,808 to 28,018
November 18, 2015	40 to 673	3,080 to 3,553

**Spore Sampling Report  
For Glenwood Middle School  
December 3, 2015**

Date	Indoor Spore Count Range Spores per m <sup>3</sup>	Outdoor Spore Count Range Spores per m <sup>3</sup>
November 25, 2015	53 to 333	4,827 to 5,747
December 3, 2015	100 to 4,900	5,340 to 6,207

Spore measurements collected in classrooms were generally acceptable compared to outdoor samples with outdoor total spore counts over 8 times higher on average than the indoor counts. Indoor sample total spore counts and individual spore counts were all lower than the outdoor sample counts with exceptions described above. Follow up air sampling is scheduled for December 9, 2015 and will be performed regularly in order to monitor changes in conditions affected by seasonal variations and the new HVAC system. Classroom 3 will be added to the next air sampling event following this report in order to follow up on spore counts sooner than the routine rotation of sampling locations.

**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 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.

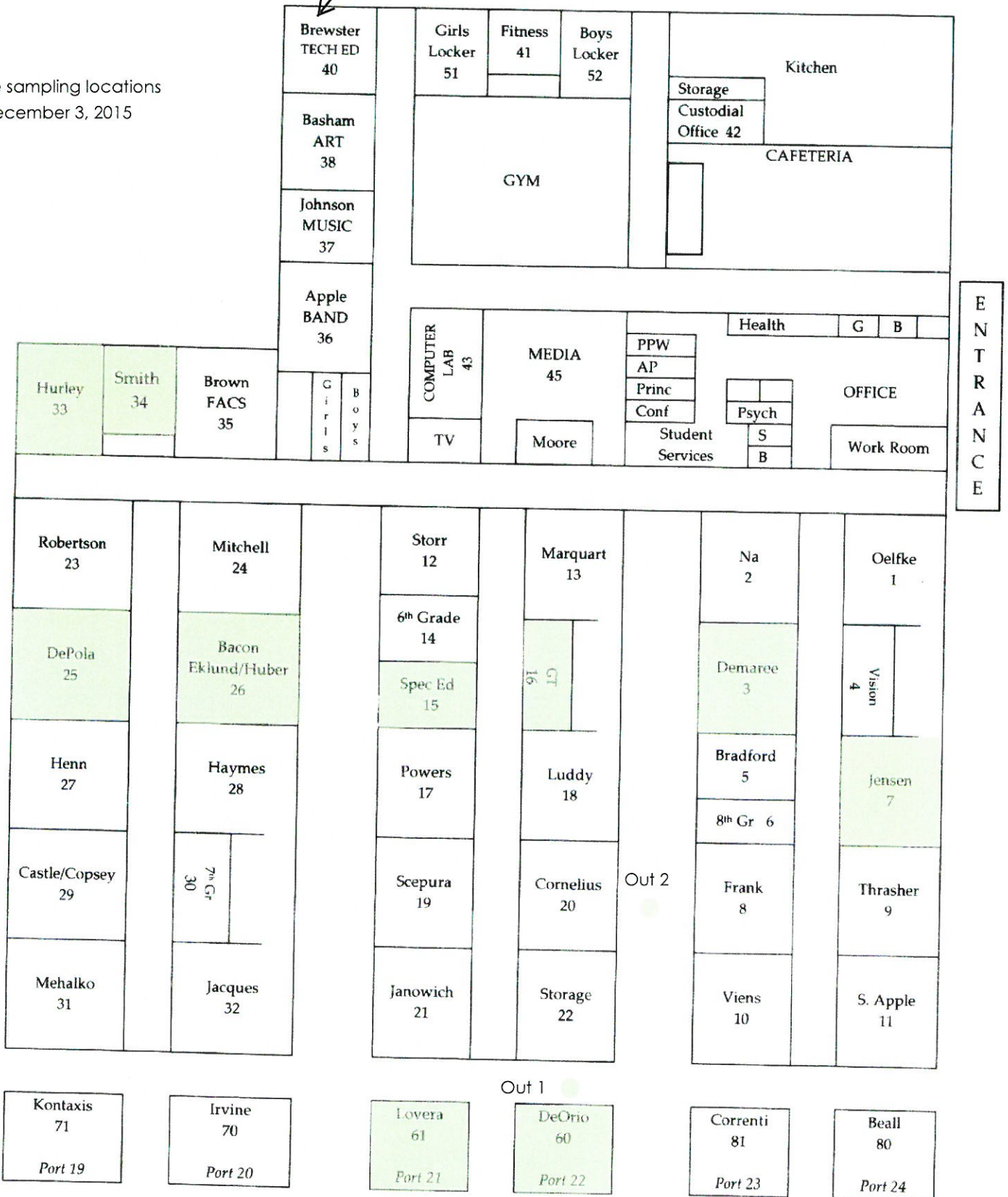
By virtue of providing the services described in this report, the preparer does not assume the responsibility of the person(s) in charge of the site, or otherwise undertake responsibility for reporting to any local, state, or federal public agencies any conditions at the site that may present a potential 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 December 3, 2015**

TECH ED LAB and CLASSROOM (40A and 40B)

Spore sampling locations  
for December 3, 2015



As of 8/02/13

Glenwood Middle School Floor Plan



**Attachment B:**

**Report of Analysis and Chain of Custody Forms  
December 3, 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: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
Date Reported: 12/10/2015  
Project ID: 15031904  
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1054 Spore Trap Analysis: SOP 3.8

Client Sample Number	<b>GM-03</b>				<b>Out 2 CY</b>			
Sample Location	<b>Classroom 3</b>				<b>Outside Courtyard</b>			
Sample Volume (L)	<b>150</b>				<b>150</b>			
Lab Sample Number	<b>15031904-001</b>				<b>15031904-012</b>			
<b>Spore Identification</b>	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	1	7	<1	1/64	8	427	8	-
basidiospores	4	427	9	1/5	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	4	27	1	1/76	38	2027	38	-
Epicoccum	1	7	<1	1/2	2	13	<1	-
hyphal elements	5	33	1	1/4	21	140	3	-
Penicillium/Aspergillus group	41	4373	89	21/1	31	207	4	-
Pithomyces	1	7	<1	-	-	-	-	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	3	20	<1	1/16	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>4</b>				Debris Rating <b>2</b>			
Analytical Sensitivity	Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>				Analytical Sensitivity: <b>7 spr/m<sup>3</sup></b>			
Comments	Large amount of particulate seen.							
Total *See Footnotes	60	4900	~100%	1/1	199	5340	~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: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
Date Reported: 12/10/2015  
Project ID: 15031904  
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Client Sample Number	GM-07				Out 2 CY			
Sample Location	Classroom 07				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-002				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	-	-	-	-	8	427	8	-
basidiospores	8	213	73	1/10	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	5	33	11	1/61	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	5	33	11	1/6	31	207	4	-
Rusts	1	7	2	1/1	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	2	1/49	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>2</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	20	293	~100%	1/18	199	5340	~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: 12/03/2015  
 Date Received: 12/07/2015  
 Date Analyzed: 12/08/2015  
 Date Reported: 12/10/2015  
 Project ID: 15031904  
 Page 3 of 12

Client Sample Number	GM-15				Out 2 CY			
Sample Location	Classroom 15				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-003				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	-	-	-	-	8	427	8	-
basidiospores	9	60	41	1/36	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	6	40	27	1/51	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	6	40	27	1/5	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	5	1/49	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>3</b>				Debris Rating <b>2</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	22	147	~100%	1/36	199	5340	~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: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
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Project ID: 15031904  
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Client Sample Number	GM-16				Out 2 CY			
Sample Location	Classroom 16				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-004				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	1	7	3	1/64	8	427	8	-
basidiospores	5	133	67	1/16	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	1	7	3	1/304	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	2	13	7	1/11	21	140	3	-
Penicillium/Aspergillus group	4	27	13	1/8	31	207	4	-
Pithomyces	1	7	3	-	-	-	-	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	3	1/49	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>3</b>				Debris Rating <b>2</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	15	200	~100%	1/27	199	5340	~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: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
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Client Sample Number	GM-25				Out 2 CY			
Sample Location	Classroom 25				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-005				15031904-012			
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	3	1/4	4	27	<1	-
ascospores	-	-	-	-	8	427	8	-
basidiospores	8	213	89	1/10	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	-	-	-	-	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	3	20	8	1/10	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>3</b>				Debris Rating <b>2</b>			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	12	240	~100%	1/22	199	5340	~100%	-

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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/03/2015  
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Client Sample Number	GM-26				Out 2 CY			
Sample Location	Classroom 26				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-006				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	-	-	-	-	8	427	8	-
basidiospores	8	213	80	1/10	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	3	20	8	1/101	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	4	27	10	1/8	31	207	4	-
Pithomyces	1	7	2	-	-	-	-	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>3</b>				Debris Rating <b>2</b>			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	16	267	~100%	1/20	199	5340	~100%	-

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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/03/2015  
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Client Sample Number	GM-33				Out 2 CY			
Sample Location	Classroom 33				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-007				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	2	13	12	1/32	8	427	8	-
basidiospores	7	47	41	1/46	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	2	13	12	1/152	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	6	40	35	1/5	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>2</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	17	113	~100%	1/47	199	5340	~100%	-

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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/03/2015  
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Client Sample Number	<b>GM-34</b>				<b>Out 2 CY</b>			
Sample Location	<b>Classroom 34</b>				<b>Outside Coutryard</b>			
Sample Volume (L)	<b>150</b>				<b>150</b>			
Lab Sample Number	<b>15031904-008</b>				<b>15031904-012</b>			
<b>Spore Identification</b>	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	2	13	13	1/32	8	427	8	-
basidiospores	6	40	40	1/53	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	4	27	27	1/76	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	1	7	7	1/21	21	140	3	-
Penicillium/Aspergillus group	1	7	7	1/31	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	7	1/49	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	<b>Debris Rating 2</b>				<b>Debris Rating 2</b>			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m <sup>3</sup>				Analytical Sensitivity: 7 spr/m <sup>3</sup>			
Comments								
Total *See Footnotes	15	100	~100%	1/53	199	5340	~100%	-

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

Date Collected: 12/03/2015  
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Date Analyzed: 12/08/2015  
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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	15031904-009				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	2	13	9	1/32	8	427	8	-
basidiospores	6	40	27	1/53	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	4	27	18	1/76	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	4	27	18	1/5	21	140	3	-
Penicillium/Aspergillus group	3	20	14	1/10	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	3	20	14	1/16	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>2</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	22	147	~100%	1/36	199	5340	~100%	-

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

Date Collected: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
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Client Sample Number	GM-61				Out 2 CY			
Sample Location	Portable Classroom 61				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15031904-010				15031904-012			
Spore Identification	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out	Raw Ct	spr/m <sup>3</sup>	% Ttl	In/Out
Alternaria	-	-	-	-	4	27	<1	-
ascospores	1	7	3	1/64	8	427	8	-
basidiospores	20	133	57	1/16	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	13	87	37	1/23	38	2027	38	-
Epicoccum	-	-	-	-	2	13	<1	-
hyphal elements	-	-	-	-	21	140	3	-
Penicillium/Aspergillus group	1	7	3	1/31	31	207	4	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	49	327	6	-
Unknown	-	-	-	-	4	27	<1	-
	Debris Rating <b>1</b>				Debris Rating <b>2</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	35	233	~100%	1/23	199	5340	~100%	-



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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/03/2015  
Date Received: 12/07/2015  
Date Analyzed: 12/08/2015  
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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	15031904-011				15031904-012			
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	1/4	4	27	<1	-
ascospores	13	693	11	2/1	8	427	8	-
basidiospores	75	4000	64	2/1	40	2133	40	-
Cercospora	-	-	-	-	1	7	<1	-
Cladosporium	24	1280	21	1/2	38	2027	38	-
Colorless	1	7	<1	-	-	-	-	-
Epicoccum	3	20	<1	2/1	2	13	<1	-
hyphal elements	18	120	2	1/1	21	140	3	-
Penicillium/Aspergillus group	1	7	<1	1/31	31	207	4	-
Pithomyces	2	13	<1	-	-	-	-	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	8	53	1	1/6	49	327	6	-
Unknown	1	7	<1	1/4	4	27	<1	-
	Debris Rating <b>2</b>				Debris Rating <b>2</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	147	6207	~100%	1/1	199	5340	~100%	-

Aria Environmental  
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Condition of Sample(s) Upon Receipt: Acceptable

Date Collected: 12/03/2015  
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Date Analyzed: 12/08/2015  
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## Footnotes and Additional Report Information

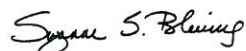
### Debris Rating Table

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.**



Suzanne S. Blevins, B.S., SM (ASCP)  
Laboratory Director

15 031904  
 15031904



NVLAP Lab Code 200860-0 (CO)  
 NVLAP Lab Code 200829-0 (VA)  
 NVLAP Lab Code 500097-0 (AZ)



LAB #192583 (CO)  
 LAB #102977 (GA)  
 LAB #163063 (VA)  
 LAB #210229 (AZ)

<b>Aerobiology Client</b> Aria Environmental, Inc.		<b>Collected By/Date:</b> 12/03/15		<b>Relinquished By/Date:</b> 12/04/15	
<b>Field Contact</b>	Julie Barth	<b>Relinquished By/Date:</b> 12/04/15		<b>Received By/Date:</b> 12/17/15	
<b>Reporting Address</b>	PO Box 286, Woodbine, MD 21797	<b>Sampler Type</b>	Andersen SAS	<b>Sample Aire</b>	Other
<b>Billing Address</b>	SAME	<b>PO#/Job#:</b>	J15-876 GMS		
<b>Phone/Fax</b>	410-549-5774/410-549-4488	<b>Project Name:</b>	Glenwood MS		
<b>Reporting Email (s)</b>	jbarth@ariaenviro.com	<b>Routine</b>	<input checked="" type="radio"/> 24 Hour <input type="radio"/> Same Day <input type="radio"/> 4 Hour <input type="radio"/> 2 Hour <input type="radio"/> 5 Day (Aerobios Only)		
<b>SAMPLING LOCATION ZIP CODE</b>	21738	<b>Notes:</b>			
<b>CC Info:</b>					

Sample No.	Test Code	Sample Location	Total Volume/Area
1	GM-03	Classroom 03	150 L
2	GM-07	Classroom 07	150 L
3	GM-15	Classroom 15	150 L
4	GM-16	Classroom 16	150 L
5	GM-25	Classroom 25	150 L
6	GM-26	Classroom 26	150 L
7	GM-33	Classroom 33	150 L
8	GM-34	Classroom 34	150 L
9	GM-60	Portable Classroom 60	150 L
10	GM-61	Portable Classroom 61	150 L
11	Out 1	Outside near PCR 60	150 L
12	Out 2 CY	Outside Courtyard	150 L
13			
14			

1054	Direct, Non-viable Spore Trap	1015	Culture - WATER Legionella
1051	Direct, Qualitative - Swab/Tape	1017	Culture - SWAB Legionella
1050	Direct, Qualitative - Bulk	1010	WATER - Potable - E. coli/total coliforms
1005	AIR Culture - Bacterial Count w/ ID's	1012	SWAB - E. coli/total coliforms
1030	AIR Culture - Fungal Count w/ ID's	1028	Sewage Screen (E. coli/Enterococcus/fecal coliforms)
1006	SWAB Culture - Bacterial Count w/ ID's	2056	Heterotrophic Plate Count
1031	SWAB Culture - Fungal Count w/ ID's	3001	ASBESTOS - Point count
1008	BULK Culture - Bacterial Count w/ ID's	3002	ASBESTOS - PLM Analysis
1033	BULK Culture - Fungal Count w/ ID's	3003	ASBESTOS - Particle characterization
1007	WATER Culture - Bacterial Count w/ID's	3004	ASBESTOS - PCM Analysis

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 2228 West Northern Avenue, Suite B110, Phoenix, AZ 85021 - (855) 738-5619 Fax (602) 441-2818 - email: phoenix@aerobiology.net