

**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
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DECEMBER 28, 2015

150876

**SPORE TRAP SAMPLING REPORT
FOR GLENWOOD MIDDLE SCHOOL
DECEMBER 16, 2015**

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**SPORE TRAP SAMPLING REPORT
FOR GLENWOOD MIDDLE SCHOOL
DECEMBER 16, 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 16, 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 16, 2015.

**Spore Trap Sampling Report
For Glenwood Middle School
December 16, 2015**

I. BACKGROUND

Representatives from Aria Environmental, Inc. (AE) visited Glenwood Middle School on December 16, 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, 11, 19, 20, 29, 30, Band Room 36, Music Room 37 and portable classrooms 70 and 71. Outdoor air samples were also collected for comparison purposes in one courtyard and outside near portable classroom 70. 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. Monitoring was performed after school with no students in the rooms. Weather on the day of monitoring was cool with a light breeze.

II. OBSERVATIONS AND MEASUREMENTS

A. Observations and Measurements on December 16, 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 3:32 PM and 4:39 PM ranged from 65.4 to 73.1° F with an average of 71° F. The indoor relative humidity ranged from 32.2 to 45.0 percent. The temperature measurements are considered acceptable for winter thermal comfort in all rooms except Portable Classroom 71. Relative humidity measurements were all within the comfort ranges. 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 4:48 PM was 50.2° F and the outdoor relative humidity was 58.8% outside near Portable Classroom 70, and the outside temperature at 4:50 PM was 49.4° F and the relative humidity was 64.4% in the courtyard outside Classroom 19. 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^a**

Relative Humidity	Winter Temperature	Summer Temperature
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

^aadapted 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 with the rooms unoccupied during sampling. Carbon dioxide concentrations ranged from 446 to 1,106 ppm indoors. The concentration of concern for

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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 473 to 480 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 0.1 to 0.4 ppm indoors and the outdoor concentration was 0.4 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 PM 10 concentrations for portable classrooms 70 (199 $\mu\text{g}/\text{m}^3$) and 71 (130 $\mu\text{g}/\text{m}^3$). It is not known if there were any afterschool activities or if the teachers stayed late to do something that may have increased particle counts in these rooms. These rooms were not occupied during the sampling and the custodians had not cleaned them prior to sampling.

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For Glenwood Middle School
December 16, 2015**

**Table 2: Particle, Temperature, Relative Humidity, Carbon Dioxide and Carbon Monoxide
Measurements Collected on December 16, 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 ₂ (ppm)
CR 03	3:32 PM	0	0	2	2	2	73.0	34.4	0.4	496
CR 11	3:36 PM	0	0	1	9	29	73.1	34.8	0.3	554
CR 19	3:50 PM	0	0	1	1	2	71.3	34.1	0.3	458
CR 20	3:52 PM	0	0	0	1	5	71.7	34.5	0.2	459
CR 29	4:03 PM	0	0	0	0	0	70.9	35.4	0.4	496
CR 30	4:06 PM	0	0	0	0	1	71.4	36.3	0.2	514
CR 36	4:17 PM	0	0	4	6	12	72.8	32.2	0.2	456
CR 37	4:21 PM	0	0	1	3	8	72.5	32.3	0.3	446
PCR 70	4:33 PM	0	6	110	199	255	70.1	45.0	0.2	1,106
PCR 71	4:39 PM	0	5	88	130	160	65.4	41.8	0.1	549
Out 1	4:48 PM	0	0	2	2	4	50.2	58.8	0.4	473
Out 2 CY	4:50 PM	0	1	3	3	4	49.4	64.4	0.4	480

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 16, 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, 11, 19, 20, 29, 30, Band Room 36, Music Room 37 and two portable classrooms (70 and 71) 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 m³) 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 16, 2015.

Indoor spore counts ranged from 33 to 1,320 total spores per cubic meter of air (m³) in the main school building and from 240 to 533 in the portable classrooms on December 16, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 5,920 to 11,995 spores per m³. All individual spore types detected indoors had counts lower than the outdoor sample counts except for *Chaetomium* spores found in the Portable Classrooms 70 and 71 samples at 107 and 7 spores/m³, respectively and not found in the outdoor samples, and clear brown spores found in the Portable Classroom 70 sample at 7 spores/m³. *Pithomyces* spores were found in the Classroom 37 sample at 7 spores/m³ but not found in the outdoor sample. A spore count of 7 spores/m³ is equivalent to 1 spore counted in the sample. Windows were not open during sampling. Particle PM 10 concentrations were slightly elevated above the guidelines in the two portable classrooms on the day of monitoring.

No secondary colonizers including *Chaetomium* or *Stachybotrys* were detected in the indoor air samples except for the *Chaetomium* spores found in the Portable Classroom 70 sample described above. Hyphal elements were detected in six of the ten indoor samples at 7 to 340 hyphal elements per m³, and three of the detected indoor hyphal elements were lower than the outdoor sample hyphal element count of 27 elements per m³. Hyphal element counts in the portable classroom samples and the Classroom 11 sample were higher than the outdoor sample counts. 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 December 16, 2015

Location	Outside near PCR 70 (Out 1)	Outside in Courtyard (Out 2)	Room 03 (GM 03)	Room 11 (GM 11)	Room 19 (GM 19)	Room 20 (GM 20)	Room 29 (GM 29)	Room 30 (GM 30)	Room 36 (GM 36)	Room 37 (GM 37)
Spore Type	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³
Ascospores	40	53	-	-	-	-	-	-	-	-
Basidiospores	5,440	11,289	307	1,173	613	747	167	140	7	13
Botrytis	7	-	-	-	-	-	-	-	-	-
Chaetomium	-	-	-	-	-	-	-	-	-	-
Cladosporium	207	153	-	13	-	-	-	7	-	7
Clear brown	-	-	-	-	-	-	-	-	-	-
Epicoccum	7	20	-	7	-	-	-	-	13	-
Hyphal Elements	-	27	-	47	13	7	-	-	-	7
Oidium	-	7	-	-	-	-	-	-	-	-
Penicillium/ Aspergillus	167	133	27	20	-	-	7	7	7	13
Pestalotiopsis	-	7	-	-	-	-	-	-	-	-
Pithomyces	-	-	-	-	-	-	-	-	-	7
Rusts	-	7	-	7	-	-	-	-	7	-
Smuts, Periconia, myxomycetes	53	300	-	53	-	-	-	7	-	-
Total Fungi	5,920	11,995	333	1,320	627	753	173	160	33	47

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 December 16, 2015**

Location	Outside near Room 70 (Out 1)	Outside in Courtyard (Out 2)	Room 70 (GM 70)	Room 71 (GM 71)
Spore Type	Spores/ m ³	Spores/ m ³	Spores/ m ³	Spores/ m ³
Ascospores	40	53	-	-
Basidiospores	5,440	11,289	20	7
Botrytis	7	-	-	-
Chaetomium	-	-	107	7
Cladosporium	207	153	20	-
Clear brown	-	-	7	-
Epicoccum	7	20	-	-
Hyphal Elements	-	27	340	200
Oidium	-	7	-	-
Penicillium/ Aspergillus	167	133	7	20
Pestalotiopsis	-	7	-	-
Pithomyces	-	-	-	-
Rusts	-	7	-	-
Smuts, Periconia, myxomycetes	53	300	33	7
Total Fungi	5,920	11,995	533	240

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

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December 16, 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 16, 2015.

Thermal comfort parameters of temperature and humidity were measured. Temperature and relative humidity measurements were within the comfort ranges established by ASHRAE except for temperature measurements in Portable Classroom 71. Carbon dioxide, carbon monoxide and particulate matter measurements were within acceptable ranges for good indoor air quality in all areas except for particle PM 10 measurements in portable classrooms 70 and 71. It is not known whether there were after school activities in these classrooms prior to air sampling.

Indoor spore counts ranged from 33 to 1,320 total spores per cubic meter of air (m³) in the main school building classrooms and from 240 to 533 in the portable classrooms on December 16, 2015. All indoor samples had total spore counts lower than the outdoor samples which ranged from 5,920 to 11,995 spores/ m³. All individual spore types detected indoors had counts lower than the outdoor sample counts except for Chaetomium spores found in the Portable Classrooms 70 and 71 samples at 107 and 7 spores/m³, respectively and not found in the outdoor samples, and clear brown spores found in the Portable Classroom 70 sample at 7 spores/m³. Pithomyces spores were found in the Classroom 37 sample at 7 spores/m³ but not found in the outdoor sample. Particle PM 10 concentrations were slightly elevated above the guidelines in the two portable classrooms on the day of monitoring. Indoor hyphal elements were detected in six of ten indoor samples ranging from 7 to 340 elements/m³. Hyphal element counts were higher than the outdoor counts in the Classroom 11 and Portable Classroom 70 and 71 samples. Hyphal elements were detected in one of the two outdoor samples at 27 elements per m³. 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

Date	Indoor Spore Count Range Spores per m³	Outdoor Spore Count Range Spores per m³
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

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For Glenwood Middle School
December 16, 2015**

Date	Indoor Spore Count Range Spores per m³	Outdoor Spore Count Range Spores per m³
November 25, 2015	53 to 333	4,827 to 5,747
December 3, 2015	100 to 4,900	5,340 to 6,207
December 9, 2015	40 to 187	10,940 to 11,087
December 16, 2015	33 to 1,320	5,920 to 11,995

Spore measurements collected in classrooms were generally acceptable compared to outdoor samples with outdoor total spore counts over 37 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 a few exceptions described above. Follow up air sampling is scheduled for December 21, 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 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 16, 2015

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

Spore sampling locations
for December 16, 2015



As of 8/02/13

Glenwood Middle School Floor Plan



Attachment B:

**Report of Analysis and Chain of Custody Forms
December 16, 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: 12/16/2015
Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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1054 Spore Trap Analysis: SOP 3.8

Client Sample Number	GM-03				Out 2 CY			
Sample Location	Classroom 03				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-001				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	46	307	92	1/37	53	11289	94	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	-	-	-	-	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	4	27	8	1/5	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m³				Analytical Sensitivity: 7 spr/m³			
Comments								
Total *See Footnotes	50	333	~100%	1/36	159	11995	~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: 12/16/2015
Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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Client Sample Number	GM-11				Out 2 CY			
Sample Location	Classroom 11				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-002				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	22	1173	89	1/10	53	11289	94	-
Cladosporium	2	13	1	1/12	23	153	1	-
Epicoccum	1	7	1	1/3	3	20	<1	-
hyphal elements	7	47	4	2/1	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	3	20	2	1/7	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	1	7	1	1/1	1	7	<1	-
Smuts,Periconia,Myxomycetes	8	53	4	1/6	45	300	3	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	44	1320	~100%	1/9	159	11995	~100%	-

Client Sample Number	GM-19				Out 2 CY			
Sample Location	Classroom 19				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-003				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	23	613	98	1/18	53	11289	94	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	2	13	2	1/2	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	-	-	-	-	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	25	627	~100%	1/19	159	11995	~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: 12/16/2015
Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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Client Sample Number	GM-20				Out 2 CY			
Sample Location	Classroom 20				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-004				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	14	747	99	1/15	53	11289	94	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	1	7	1	1/4	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	-	-	-	-	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m³				Analytical Sensitivity: 7 spr/m³			
Comments								
Total *See Footnotes	15	753	~100%	1/16	159	11995	~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: 12/16/2015
Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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Client Sample Number	GM-29				Out 2 CY			
Sample Location	Classroom 29				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-005				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	25	167	96	1/68	53	11289	94	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	-	-	-	-	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	1	7	4	1/20	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	26	173	~100%	1/69	159	11995	~100%	-

Client Sample Number	GM-30				Out 2 CY			
Sample Location	Classroom 30				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-006				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	21	140	88	1/81	53	11289	94	-
Cladosporium	1	7	4	1/23	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	-	-	-	-	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	1	7	4	1/20	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	4	1/45	45	300	3	-
	Debris Rating 2				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	24	160	~100%	1/75	159	11995	~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: 12/16/2015
Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562
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Client Sample Number	GM-36				Out 2 CY			
Sample Location	Classroom 36				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-007				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	1	7	20	1/1693	53	11289	94	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	2	13	40	1/2	3	20	<1	-
hyphal elements	-	-	-	-	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	1	7	20	1/20	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	1	7	20	1/1	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m³				Analytical Sensitivity: 7 spr/m³			
Comments								
Total *See Footnotes	5	33	~100%	1/360	159	11995	~100%	-

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Condition of Sample(s) Upon Receipt: Acceptable

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Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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Client Sample Number	GM-37				Out 2 CY			
Sample Location	Classroom 37				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-008				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	2	13	29	1/847	53	11289	94	-
Cladosporium	1	7	14	1/23	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	1	7	14	1/4	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	2	13	29	1/10	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Pithomyces	1	7	14	-	-	-	-	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	-	-	-	-	45	300	3	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	7	47	~100%	1/257	159	11995	~100%	-

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

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Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562

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Client Sample Number	GM-70				Out 2 CY			
Sample Location	Portable Classroom 70				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-009				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	3	20	4	1/564	53	11289	94	-
Chaetomium	16	107	20	-	-	-	-	-
Cladosporium	3	20	4	1/8	23	153	1	-
Clear brown	1	7	1	-	-	-	-	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	51	340	64	13/1	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	1	7	1	1/20	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	5	33	6	1/9	45	300	3	-
	Debris Rating 4				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments	Spore count may be underestimated due to heavy particulate.							
Total *See Footnotes	80	533	~100%	1/22	159	11995	~100%	-

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

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Date Received: 12/21/2015
Date Analyzed: 12/23/2015
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Project ID: 15033562

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Client Sample Number	GM-71				Out 2 CY			
Sample Location	Portable Classroom 71				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-010				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	-	-	-	-	8	53	<1	-
basidiospores	1	7	3	1/1693	53	11289	94	-
Chaetomium	1	7	3	-	-	-	-	-
Cladosporium	-	-	-	-	23	153	1	-
Epicoccum	-	-	-	-	3	20	<1	-
hyphal elements	30	200	83	8/1	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	3	20	8	1/7	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	1	7	3	1/45	45	300	3	-
	Debris Rating 4				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m³				Analytical Sensitivity: 7 spr/m³			
Comments	Large amount of particulate seen.							
Total *See Footnotes	36	240	~100%	1/50	159	11995	~100%	-

Aria Environmental
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Date Received: 12/21/2015
Date Analyzed: 12/23/2015
Date Reported: 12/24/2015
Project ID: 15033562
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Client Sample Number	Out 1				Out 2 CY			
Sample Location	Outside Near PCR 70				Outside Courtyard			
Sample Volume (L)	150				150			
Lab Sample Number	15033562-011				15033562-012			
Spore Identification	Raw Ct	spr/m ³	% Ttl	In/Out	Raw Ct	spr/m ³	% Ttl	In/Out
ascospores	6	40	1	1/1	8	53	<1	-
basidiospores	51	5440	92	1/2	53	11289	94	-
Botrytis	1	7	<1	-	-	-	-	-
Cladosporium	31	207	3	1/1	23	153	1	-
Epicoccum	1	7	<1	1/3	3	20	<1	-
hyphal elements	-	-	-	-	4	27	<1	-
Oidium	-	-	-	-	1	7	<1	-
Penicillium/Aspergillus group	25	167	3	1/1	20	133	1	-
Pestalotiopsis	-	-	-	-	1	7	<1	-
Rusts	-	-	-	-	1	7	<1	-
Smuts,Periconia,Myxomycetes	8	53	1	1/6	45	300	3	-
	Debris Rating 3				Debris Rating 3			
Analytical Sensitivity	Analytical Sensitivity: 7 spr/m ³				Analytical Sensitivity: 7 spr/m ³			
Comments								
Total *See Footnotes	123	5920	~100%	1/2	159	11995	~100%	-

Aria Environmental
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Date Received: 12/21/2015
Date Analyzed: 12/23/2015
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Project ID: 15033562
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Footnotes and Additional Report Information

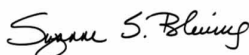
Debris Rating Table

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/m³ 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/m³.
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

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AZ, CO, GA, VA, NJ



NVLAP Lab Code 200850-0 (CO)
NVLAP Lab Code 200829-0 (VA)
NVLAP Lab Code 500097-0 (AZ)



LAB #192683 (CO)
LAB #102977 (GA)
LAB #163063 (VA)
LAB #210229 (AZ)

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Aerobiology Client		Aria Environmental, Inc.	
Field Contact	Julie Barth	Collected By/Date:	12/16/15
Reporting Address	PO Box 286, Woodbine, MD 21797	Relinquished By/Date:	12/17/15
Billing Address	SAME	Sampler Type	Andersen SAS
Phone/Fax	410-549-5774/410-549-4488	PO#/Job#:	J15-876 GMS
Reporting Email (s)	jbarth@ariaenviro.com	Project Name:	Glenwood MS
Routine	<input checked="" type="radio"/> 24 Hour <input type="radio"/> Same Day <input type="radio"/> 4 Hour <input type="radio"/> 2 Hour	5 Day (Asbestos Only)	Notes:
SAMPLING LOCATION ZIP CODE		21738	
CC Info:			

Sample No.	Test Code	Sample Location	Total Volume/Area
1	GM-03	Classroom 03	150 L
2	GM-11	Classroom 11	150 L
3	GM-19	Classroom 19	150 L
4	GM-20	Classroom 20	150 L
5	GM-29	Classroom 29	150 L
6	GM-30	Classroom 30	150 L
7	GM-36	Classroom 36	150 L
8	GM-37	Classroom 37	150 L
9	GM-70	Portable Classroom 70	150 L
10	GM-71	Portable Classroom 71	150 L
11	Out 1	Outside near PCR 70	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