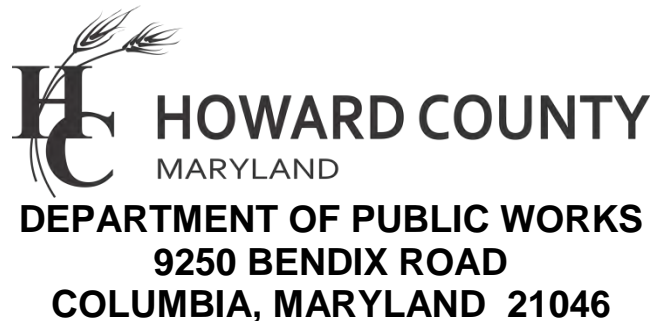


**INDOOR AIR QUALITY ASSESSMENT REPORT
JUNE 9, 2016, EVENT
CENTENNIAL LANE ELEMENTARY SCHOOL
3825 CENTENNIAL LANE
ELLCOTT CITY, MARYLAND 21042**

PREPARED FOR



PREPARED BY



**449 EISENHOWER BOULEVARD, SUITE 300
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AUGUST 1, 2016

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1.0 EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

The Howard County Department of Public Works retained Skelly and Loy, Inc. to conduct an Indoor Air Quality (IAQ) assessment of Centennial Lane Elementary School within Howard County, Maryland. The assessment occurred on June 9, 2016.

The Scope of Work for these assessments included the collection of air samples for subsequent spore trap analysis and measuring various IAQ parameters as follows:

1. Comfort parameters (carbon dioxide [CO₂], temperature, and relative humidity);
2. Carbon monoxide (CO); and
3. Particulates – Total Particulate Matter 10 microns in diameter and smaller (PM₁₀).
4. Total airborne fungi;

Additionally, select accessible portions of the school were to be visually inspected, looking for signs of past or ongoing water damage and mold growth.

Regarding the collection and analysis of airborne spore trap samples, multiple Genera of molds were identified at multiple interior locations at concentrations higher than the corresponding concentrations in the outside/exterior control samples.

Regarding the measurement of CO₂, temperature, relative humidity, CO, and respirable particulates, the upper limit for CO₂ of 700 parts per million (ppm) plus background was exceeded in all five portable classrooms. The temperature in all classrooms was within the acceptable range. The relative humidity levels fell below the lower limit of 30% in three occupied areas. Measured levels of CO above 9 ppm were also identified in all five portable classrooms. Unfortunately, due to a meter malfunction, respirable particulates could not accurately be measured through this assessment effort.

Regarding the visual inspection of assessed portions of the school, it was reported by the teacher of Portable Classroom 149 that water enters in through one of the windows during rain events; however, at the time of the assessment, this area appeared dry with no visible staining, warping, or mold growth. The on-site custodian stated that all stained ceiling tiles in the entire school were replaced over the weekend prior to the June 9 assessment. No signs of past or ongoing water damage or mold growth were observed during the June 9 assessment.

2.0 BACKGROUND

2.0 BACKGROUND

Skelly and Loy, Inc. was retained by the Howard County Department of Public Works to perform IAQ assessments at various elementary, middle, and high schools within the Howard County Public School System. Assessment efforts included the following:

- a visual inspection of accessible portions of the school;
- the measurement and recordation of comfort parameters, including CO₂, temperature, and relative humidity;
- the measurement and recordation of airborne CO and particulates; and
- the collection and analysis of fungal spore trap samples.

Including outdoor/exterior control (or baseline) locations, a total of 20 locations were assessed. This report is for the assessment performed at Centennial Lane Elementary School on June 9, 2016.

Centennial Lane Elementary School is one of 41 elementary schools located in Howard County, Maryland, and serves students in grades Kindergarten through 5. It is located at 3825 Centennial Lane in Ellicott City, Maryland, 21042. Enrollment in school year 2015-2016 is reported to be 728. The school capacity is reported to be 647, but this does not include the additional capacity provided by five portable classrooms. This school first opened in 1973 and had additions in 1987 and 2008. Renovations occurred in 2007.

A copy of the school's floor plans is included in Appendix A.

3.0 OBSERVATIONS AND MEASUREMENTS

3.0 OBSERVATIONS AND MEASUREMENTS

Assessment locations within the school were selected with a number of factors being considered:

- At least one assessment location should occur within each of the buildings' heating, ventilation, and air conditioning (HVAC) zones.
- Assessment locations should be evenly dispersed geographically throughout the school.
- If the school has portable classrooms, all such portable classrooms are to be assessed.

The locations where all 20 assessments occurred are depicted on the floor plans in Appendix A. The locations, dimensions, and orientation of all portable classrooms presented on the floor plans are approximate only. The floor plans depicting the assessment locations (Appendix A) were generated from base floor plans/heating, ventilation, and air conditioning zone plans obtained from Howard County Public Schools. On the floor plans in Appendix A and in Tables 2A, 2B, 3A, and 3B, the various interior sampling and assessment locations that were compared against specific outside/exterior "control" locations are identified by color (on the floor plans in Appendix A) and by grouping (in Tables 2A, 2B, 3A, and 3B).

3.1 VISUAL INSPECTION

During the on-site assessment activities, the industrial hygienist technician looked for signs of past and/or ongoing water infiltration, leaks, and damage to interior building materials, including signs of past or ongoing mold growth. Additionally, where applicable, if any building occupants (teachers and/or custodial staff) offered any information regarding IAQ concerns, water damage, or mold growth, the technician also recorded this information.

Regarding the visual inspection portion of the assessment, no locations within the school were observed to have past or ongoing signs of water leaks or fungal growth, although the on-site custodian stated that stained ceiling tiles located in various portions of the school were replaced on June 4, 2016, and the teacher in Portable Classroom 149 reported that water enters in through one of the windows during rain events.

3.2 COMFORT PARAMETERS, CARBON MONOXIDE, AND PARTICULATES

3.2.1 Assessment Methodology

Measurements of CO₂, air temperature, relative humidity, and CO concentrations were made using a calibrated direct reading hand-held TSI brand Q- Trak Model 7575 (or equivalent) instrument. Measurements of particulate concentrations were made using a TSI Brand Dust Trak II (or equivalent) particulate monitor. These instruments provide quick, accurate information to assess key IAQ parameters. The meters were allowed to equilibrate at each sample location prior to recording the measurements. Copies of the calibration records/certificates for the Q- and Dust Track meters are included in Appendix C.

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) 55-2010, "Thermal Environmental Conditions for Human Occupancy" provides guidance for the desirable ranges of temperature and relative humidity to achieve occupant comfort. That document recommends that indoor air temperatures generally be maintained between 68 degrees Fahrenheit (°F) and 74 °F in the winter and 73 °F and 79 °F in the summer for 80 percent (%) occupant acceptability.¹ These ranges are presented in Table 1.

**TABLE 1
ACCEPTABLE RANGES OF TEMPERATURE AND RELATIVE HUMIDITY
IN SUMMER AND WINTER***

RELATIVE HUMIDIFY	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

* Adapted from ASHRAE Standard 55-2013

There are currently no specific Health and Safety regulations for relative humidity in indoor air. However, ASHRAE Standard 62.1-2010, "Ventilation for Acceptable Indoor Air Quality," recommends that relative humidity levels be maintained below 65% with a relative

humidity of 50% being ideal.² U.S. Environmental Protection Agency (U.S. EPA) Tools for Schools recommends that relative humidity levels be maintained between 30% and 60%.³

ASHRAE Standard 62.1-2010, "Ventilation for Acceptable Indoor Air Quality," specifies fresh air requirements for various types of occupancies. IAQ studies performed by the National Institute for Occupational Safety and Health (NIOSH) have indicated that, by far, the most common contributor to IAQ complaints is inadequate ventilation. CO₂ is often utilized as an indicator of fresh air infusion into buildings. CO₂ is a normal component of the atmosphere and is typically present at concentrations between 300 and 500 ppm in outside air. Because humans produce CO₂, its build-up in an occupied space may be an indicator of inadequate fresh air supply. For occupant comfort, ASHRAE recommends that CO₂ concentration in a space be maintained no greater than 700 ppm above outdoor air levels.²

The U.S. EPA National Ambient Air Quality Primary Standard for CO is 9 ppm for an eight-hour period that is not to be exceeded more than once per year. There is also a 35 ppm level for a one-hour period that is not to be exceeded more than once per year.⁴ CO is formed from incomplete oxidation during combustion of natural gas and other fuels.

Total particulate levels were measured using a direct reading, factory calibrated TSI brand DustTrak II IAQ (or equivalent) instrument. This instrument measures particulates 10 microns and smaller also referred to as PM₁₀.

The U.S. Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for inert airborne particulates (not otherwise regulated) is 15 mg/M³ of air as a total particulate sample or 5 mg/M³ of air as a respirable particulate sample.⁷ In 1987, the U.S. EPA replaced the earlier Total Suspended Particulate (TSP) air quality standard with a PM₁₀ standard. The newer standard focuses on smaller particles that are likely responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract. The PM₁₀ standard includes particles with a diameter of 10 micrometers or less (i.e., 0.0004 inch or one-seventh the width of a human hair). The U.S. EPA's health-based national air quality standard for PM₁₀ is 0.15 mg/M³ (measured as a daily concentration over a 24-hour period).⁷

3.2.2 Assessment Findings

Regarding the measurement of CO₂, temperature, relative humidity, CO, and particulates, the bolded measurements in Table 2A (page 6) and Table 2B (page 7) fell outside of their corresponding acceptable range. The CO₂, temperature, and relative humidity levels that fell

outside their corresponding acceptable range do not pose severe health risks. The CO levels which exceeded the corresponding federal acceptable ppm level could pose health risks if this scenario repeats itself on a routine basis. Although the technician performing the assessment looked for nearby sources of CO, none was identified. Unfortunately, no valid data regarding airborne particulates were generated through this assessment event due to the Dust Trak II particulate monitor malfunctioning.

The comfort parameters associated with Outside/Exterior Sample 1 location are provided in Table 2A, and the comfort parameters associated with Outside/Exterior Sample 2 location are provided in Table 2B.

**TABLE 2A
CENTENNIAL LANE ELEMENTARY SCHOOL
CARBON DIOXIDE, TEMPERATURE, RELATIVE HUMIDITY,
CARBON MONOXIDE, AND PARTICULATES MEASUREMENTS
ASSOCIATED WITH OUTSIDE/EXTERIOR SAMPLE 1 LOCATION
JUNE 9, 2016, SAMPLING EVENT**

SAMPLE/ ASSESSMENT LOCATION	TIME SAMPLED/ ASSESSED	NUMBER OF OCCUPANTS	CO ₂ (ppm)	TEMP (°F)	% RELATIVE HUMIDITY	CO (ppm)	PARTICULATES (mg/M ³)
Outside 1	10:48	0	420	78.4	24.5%	18.2	N/A
Portable 88	10:10	26	1530	76.1	32.5%	26.8	N/A
Portable 90	10:09	15	1693	78.1	30.8%	24.2	N/A
Portable 149	10:46	24	2315	75.5	41.3%	17.7	N/A
Portable 197	10:30	27	2410	76.7	39.1%	23.7	N/A
Portable 198	10:31	25	1335	75.6	35.7%	19.6	N/A

Bolded values indicate the assessed parameter value fell outside of the range deemed acceptable.
 Acceptable CO₂ range is the background CO₂ level plus 700 ppm.
 Acceptable temperature range is 73 °F to 79 °F.
 Acceptable relative humidity range is 30% to 60%.
 Acceptable CO range is 0 to 9 ppm.
 Acceptable particulates range is 0 to 0.15 mg/M³.
 N/A: Not Applicable – An instrument malfunction prevented valid particulate concentration data from being generated.



**TABLE 2B
CENTENNIAL LANE ELEMENTARY SCHOOL
CARBON DIOXIDE, TEMPERATURE, RELATIVE HUMIDITY,
CARBON MONOXIDE, AND PARTICULATES MEASUREMENTS
ASSOCIATED WITH OUTSIDE/EXTERIOR SAMPLE 2 LOCATION
JUNE 9, 2016, SAMPLING EVENT**

SAMPLE/ ASSESSMENT LOCATION	TIME SAMPLED/ ASSESSED	NUMBER OF OCCUPANTS	CO₂ (ppm)	TEMP (°F)	% RELATIVE HUMIDITY	CO (ppm)	PARTICULATES (mg/M³)
Outside 2	13:55	0	415	78.7	26.9%	0	N/A
Classroom 119	12:28	27	740	74.9	31.1%	0	N/A
Classroom 129	12:26	25	910	74.5	33.1%	0	N/A
Classroom 133	12:12	0	475	71.1	33.7%	0	N/A
Classroom 144	11:58	0	575	74.9	31.0%	0	N/A
Classroom 157	11:32	18	650	76.3	30.6%	0	N/A
Classroom 210	12:00	0	601	74.8	31.7%	0	N/A
Activity Room (219)	11:19	0	455	75.2	26.8%	4.9	N/A
Boiler Room (169)	13:07	0	520	80.8	25.4%	0	N/A
Cafeteria (173)	12:52	50+	720	75.9	32.0%	0	N/A
Front Office (100)	12:41	2	700	75.9	32.0%	0	N/A
Gym (163)	11:18	0	435	74.4	29.1%	0.4	N/A
Media Room (113)	11:35	2	489	74.2	28.2%	0	N/A
Music Room (211)	13:22	1	880	75.6	30.5%	0	N/A

Bolded values indicate the assessed parameter value fell outside of the range deemed acceptable.
Acceptable CO₂ range is the background CO₂ level plus 700 ppm.
Acceptable temperature range is 73 °F to 79 °F.
Acceptable relative humidity range is 30% to 60%.
Acceptable CO range is 0 to 9 ppm.
Acceptable particulates range is 0 to 0.15 mg/M³.
N/A: Not Applicable – An instrument malfunction prevented valid particulate concentration data from being generated.

3.3 FUNGI

3.3.1 Assessment Methodology

Fungi are common in and found throughout both the natural and man-made environment. Airborne mold is commonly found in homes, hotels, businesses, and offices, and in insti-

tutional and commercial buildings. It is quite possible that there are higher levels of fungi in one's home than in one's school or work. Many airborne fungi identified in the man-made environment (i.e., inside of buildings) originate outdoors and are brought inside with fresh air and attached to items brought into the buildings, including its occupants.

However, for certain sensitive individuals, increased levels of certain airborne fungi can cause adverse reactions. All individuals react differently to exposure to fungi, and the degree of reaction can change with time. Additionally, the degree of reaction can be affected by other factors, including an individual's overall health, the length and frequency of exposure, and other contaminants to which an individual is exposed. Also, individuals' susceptibility to different mold Genera, or combinations of mold Genera, vary. Because of this, there are no established regulatory or health-based levels of fungi above which could lead to moderate or severe illnesses. For fungi to grow, three criteria must be met: the presence of fungal spores, a food source, and moisture. Any organic matter can serve as the food source, and moisture can be from liquid water or elevated humidity. If any of these three criteria are eliminated, fungal growth will not occur.

Total airborne fungi samples were collected on specialized spore trap cassettes using a calibrated specialty sampling pump flowing at 15 liters of air per minute (lpm) for a total of 10 minutes and a total sample volume of 150 liters. Sampling works on the principle of initial impaction. Presumably particulate-laden air is drawn through the cassette's tapered inlet and accelerates the stream against a small slide coated with a collection media (adhesive). This sampling method is one that is industry-accepted.⁵ The pump pulls air through the spore trap cassette before the air is subsequently pulled through the pump, so there is no need to decontaminate the pump between samples. Following the assessment, the spore trap samples were shipped under proper chain of custody (COC) to Southeast Environmental Microbiology Laboratories in Greenville, South Carolina, for microscopic count and identification (i.e., Genus) of fungi. Copies of the COC and corresponding results are included as Appendix B along with the laboratory's accreditation. All spore trap sample results were reported in fungal spores per cubic meter of air (spores/m³) for the purposes of this assessment. The sampling pump used to collect the spore trap samples was calibrated using a manufacturer-supplied rotometer both before and after the sampling event. A copy of the calibration log is included as Appendix C. Specific areas of the school that were assessed and sampled are identified on the COC (Appendix B) and in Tables 3A and 3B (pages 10 and 11); these can be ascertained by cross-referencing the referenced room numbers to the room numbers on the floor plans (Appendix A).

There are currently no state or federal Health and Safety regulations or universally accepted guidelines for exposure to fungal spores in indoor air. The American Conference of Governmental Industrial Hygienists (ACGIH) has taken the position that the development of exposure guidelines based on the enumeration of viable or total (i.e., both viable and nonviable) fungi in air is not feasible.⁶ It is commonly accepted that a “one size fits all” approach to developing exposure guidelines will not work due to wide variations in how different individuals respond to exposure to airborne fungi. To further complicate the development of exposure guidelines, multiple agencies and organizations have (sometimes widely) varying opinions on how exposure guidelines should be set and what the guidelines should be.

Because there are no “absolute” exposure limits for airborne fungal spores, the assessment protocol called for the comparison of indoor results from the interior areas with results from the outdoor air. In an ideal situation, indoor results should show lower fungi counts than outdoor samples and contain similar biodiversity. The results of the visual inspection and the building’s history related to moisture and ventilation must also be considered when interpreting fungal air sample results. For the June 9 event, Outside/Exterior Sample 1 is being compared to Portable Classrooms 88, 90, 149, 197, and 198. Outside/Exterior Sample 2 is being compared to results from all other (traditional) classrooms and internal areas.

The locations for the baseline (i.e., Outside/Exterior) assessments were selected based on one outside/exterior sample located in close proximity to the portable classrooms being compared to the results of the portable classroom samples and a second outside/exterior sample being compared against all remaining sample results.

3.3.2 Assessment Findings

Regarding the sampling and analysis for airborne fungal spores, some locations had one or more mold Genera identified at a concentration in excess of its corresponding outside/exterior concentration. When viewing Tables 3A and 3B, bolded values represent such occurrences. Values in Tables 3A and 3B that are **bolded black** indicate that an interior mold source is likely, although airborne concentrations appear to be marginal. Values that are **bolded red** also indicate that an interior mold source is likely and that airborne concentrations appear to be higher than expected for a healthy indoor environment.⁵

When determining airborne fungi values that are marginal versus values that are higher than expected based on industry accepted practice, it must be noted that some limitations exist.

The 1.5 multiplier was selected based on its reasonableness in helping identify those molds identified inside at a concentration higher than outside, while leaving some leeway for an occasional outlying value that was not considerably higher. Relatively low concentrations could still be bolded red if the corresponding exterior baseline concentrations were 1.5 times less or zero. It should be kept in mind that when calculating the airborne mold spore concentration, the laboratory uses a factor of 7 when multiplying the actual raw spore count (i.e., the actual number of a particular mold spore seen with a microscope by the analyst) to derive the concentration in spores per cubic meter of air. Therefore many bolded red values of low concentration may still be higher than ideal but are not necessarily uncommon or of concern.

**TABLE 3A
CENTENNIAL LANE ELEMENTARY SCHOOL
SUMMARY OF SPORE TRAP SAMPLE ANALYTICAL RESULTS
ASSOCIATED WITH OUTSIDE/EXTERIOR SAMPLE 1 LOCATION
JUNE 9, 2016, SAMPLING EVENT**

LOCATION	ALTERNARIA	ASCOSPORES	BASIDIOSPORES	BIPOLARIS/ DRECHSLERA	CHAETOMIUM	CLADOSPORIUM	CURVULARIA	EPICOCCUM	NIGROSPORA	PENICILLIUM/ ASPERGILLUS	POLYTHRINCIUM	RUSTS	SMUTS/PERICONIA/ MYXOMY	STACHYBOTRYS	OIDIUM	PITHOMYCES
	(spores/m ³)															
Outside 1		567	798			462	7	119	7	84	105	35	77			
Portable 88		21	294	7		189	7			777	7		7			7
Portable 90			294			210	7	7		1220			56			7
Portable 149	7		189		7	399	7	14		924	14	7	21	7		
Portable 197			210			63	7	7		462			35			28
Portable 198	7	63	210			210	7	7		735	7		21			

Bold Black values are indicative of a mold source within the building and levels appear to be marginal. There are no established state or federal guidelines for determining levels that pose a health risk to the general population.

Bold Red values are indicative of a mold source within the building and levels appear to be higher than expected based on industry-accepted practices. Nonetheless, there are no established state or federal guidelines for determining levels that pose a health risk to the general population.



**TABLE 3B
CENTENNIAL LANE ELEMENTARY SCHOOL
SUMMARY OF SPORE TRAP SAMPLE ANALYTICAL RESULTS
ASSOCIATED WITH OUTSIDE/EXTERIOR SAMPLE 2 LOCATION
JUNE 9, 2016, SAMPLING EVENT**

LOCATION	ALTERNARIA	ASCOSPORES	BASIDIOSPORES	BIPOLARIS/ DRECHSLERA	CHAETOMIUM	CLADOSPORIUM	CURVULARIA	EPICOCCUM	NIGROSPORA	PENICILLIUM/ ASPERGILLUS	POLYTHRINCUM	RUSTS	SMUTS/PERICONIA/ MYXOMY	STACHYBOTRYS	OIDIUM	PITHOMYCES	
	(spores/m ³)																
Outside 2	7	105	378			399		21		147	14		42				7
Classroom 119	28	525	987			924		84		546	7		98			21	7
Classroom 129	14	21	252	7		231		21		1130			14				
Classroom 133	7		210			63		7		357			14				
Classroom 144	7		63			21		14		210							
Classroom 157	28	42	231			168	14	7		567			21				
Classroom 210	7	84	189			84		21		567			35				
Activity Room (219)						7				63			28				7
Boiler Room (169)	70	273	693	7		504	14	28		1600	7		56				
Cafeteria (173)	7	21	273			147	7	14		1090		7	28				
Front Office (100)		63	273	7		105	7			588			28				
Gym (163)			21			7				42							
Media Room (113)		21	273			231		14		462			7				
Music Room (211)			210			189				294			14				

Bold Black values are indicative of a mold source within the building and levels appear to be marginal. There are no established state or federal guidelines for determining levels that pose a health risk to the general population.

Bold Red values are indicative of a mold source within the building and levels appear to be higher than expected based on industry-accepted practices. Nonetheless, there are no established state or federal guidelines for determining levels that pose a health risk to the general population.



4.0 REFERENCES

4.0 REFERENCES

1. American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Standard 55-2010, "Thermal Environmental Conditions for Human Occupancy," ASHRAE, Atlanta, Georgia, 2010.
2. American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), Standard 62.1-2010, "Ventilation for Acceptable Indoor Air Quality," ASHRAE, Atlanta, Georgia, 2010.
3. United States Environmental Protection Agency (U.S. EPA), Tools for Schools, U.S. EPA 402/K-07/008, January 2009.
4. United States Environmental Protection Agency (U.S. EPA), Clean Air Act – National Ambient Air Quality Standard, 40 CFR Part 50, 1990.
5. Jensen, Paul A., Ph.D., P.E., CIH; and Schafer, Millie P., Ph.D.; NIOSH/DPSE "Sampling and Characterization of Bioaerosols," NIOSH Manual of Analytical Methods, Chapter J, January 15, 1998
6. ACGIH, 2015 Threshold Limit Values and Biological Exposure Indices
7. National Institute for Occupational Safety and Health/Centers for Disease Control, Pocket Guide to Chemical Hazards 2015, Cincinnati, Ohio, 2015.



5.0 LIMITATIONS AND USER RELIANCE

5.0 LIMITATIONS AND USER RELIANCE

The scope of this report is limited to the matters expressly covered. In preparing this report, Skelly and Loy has relied, in part, on information derived from secondary sources and interviews. Except as set forth in this report, Skelly and Loy has made no independent investigation as to the accuracy or completeness of the information derived from the secondary sources and interviews and has assumed that such information was accurate and correct. The floor plans depicting the assessment locations (Appendix A) were generated from base floor plans/heating, ventilation, and air conditioning zone plans obtained from Howard County Public Schools. Dimensions, orientation, and locations of any portable classrooms depicted are approximate only.

Skelly and Loy's findings are based on and have been developed in accordance with generally accepted standards of indoor air quality assessments, scientific principles, and professional judgment with resultant subjective interpretations. Professional judgments expressed herein are based on the facts currently available within the limits of existing data, Scope of Work, budget, and schedule. The findings are relevant for the dates of our site visit and should not be relied on to represent conditions at a later date.

This report was completed in accordance with the Scope of Work and contractual agreement between Skelly and Loy and the Howard County Department of Public Works. This report has been prepared for and is intended for the exclusive use of Howard County Department of Public Works, the client, and those parties authorized by the client. The information may not be relied on by any other person or entity without the written authorization of Skelly and Loy or the client.



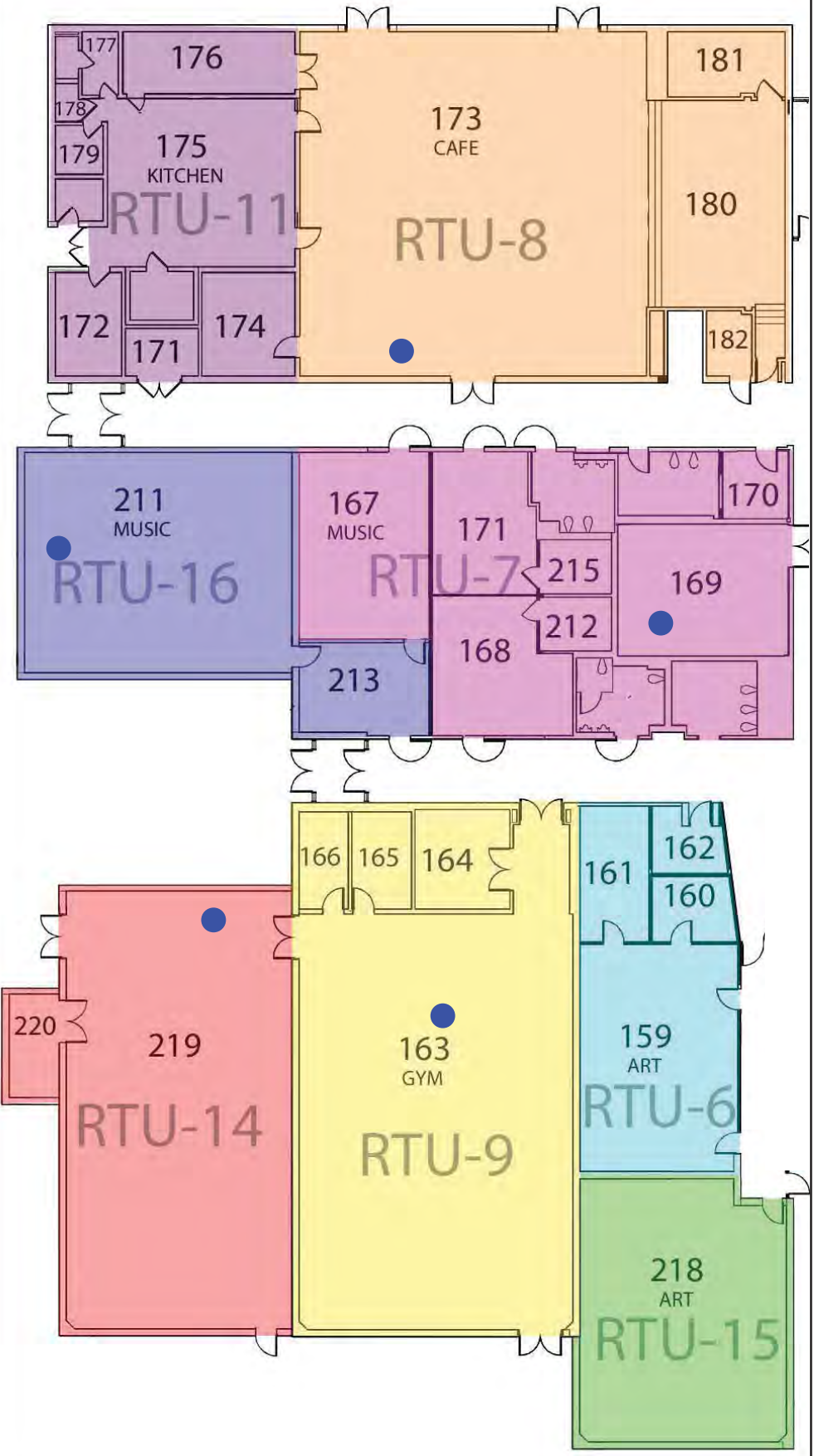
APPENDICES

**APPENDIX A -
BUILDING FLOOR PLANS**

IAQ Assessment Legend
Centennial Lane Elementary School - June 9, 2016, Event

- X** Outside/Exterior Sample 2 Location
- Spore Trap Sampling IAQ and Parameters Assessment Locations Associated with Outside/Exterior Samples

Skelly and Loy Project R10-0163.019, Task 4



Match Line

X



Floor Plan prepared by
 Howard County Public School System

The Howard County Public School System
 10910 Route 108 Ellicott City, Maryland 21042-6198 (410)313-6600



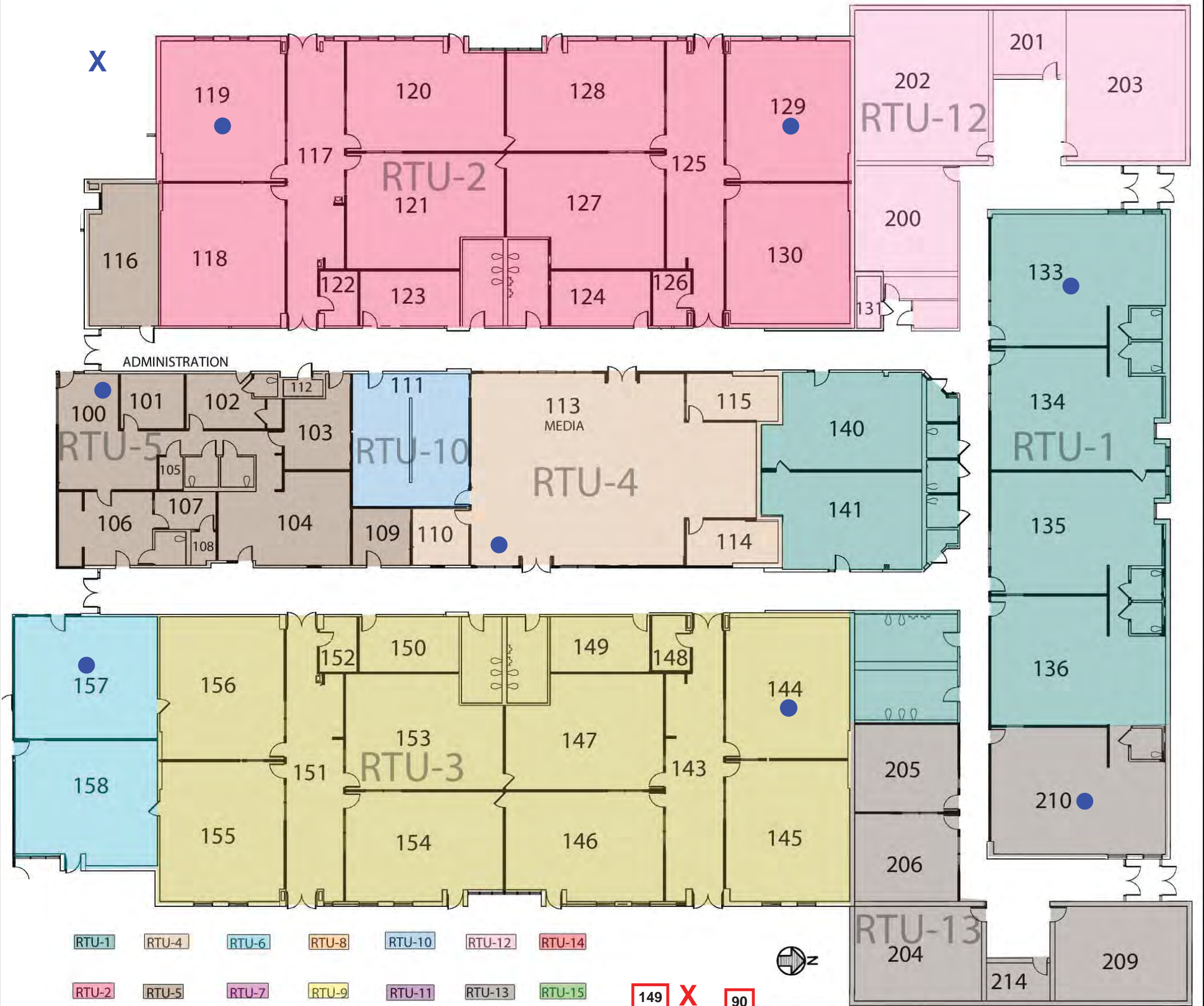
CENTENNIAL LANE ELEMENTARY FLOOR PLAN

MODIFIED - 7/12/11

IAQ Assessment Legend
Centennial Lane Elementary School - June 9, 2016, Event

- X Outside/Exterior Sample 1 Location
- X Outside/Exterior Sample 2 Location
- Spore Trap Sampling IAQ and Parameters Assessment Locations Associated with Outside/Exterior Samples
- Portable Classrooms Associated with Outside/Exterior Samples

Skelly and Loy Project R10-0163.019, Task 4



Match Line →

The Howard County Public School System
 10910 Route 108 Ellicott City, Maryland 21042-6198 (410)313-6600



Floor Plan prepared by
 Howard County Public School System

149 X 90
 198 197 88



CENTENNIAL LANE ELEMENTARY FLOOR PLAN

MODIFIED - 7/12/11

**APPENDIX B -
SPORE TRAP SAMPLE ANALYTICAL REPORT,
CHAIN OF CUSTODY, AND
LABORATORY ACCREDITATION**



SEEML Reference Number:
160613006

Southeast Environmental Microbiology Laboratories

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Greenville, SC 29607
Phone: (864) 233-3770
FAX: (864) 233-6589

The information and data for **Skelly and Loy, Inc.** has been checked for thoroughness and accuracy. The following reports are contained within this document:

- Direct Exam Report
- Spore Trap Report
- Andersen Fungal Report
- Quantitative Direct Exam Report
- Quantitative Fungal Report

Lab Manager Review:

Rafael Berrios

Date: 06/13/16

Thank you for using SEEML laboratories. We strive to provide superior quality and service. SEEML laboratories are AIHA (American Industrial Hygiene Association) Environmental Microbiology Accredited laboratory for only fungal analysis Air-Direct Examination (EMLAP # 173667).

The data within this report is reliable to three significant figures. The third significant figure is technically unjustified. In this instance, the third figure is reported as an estimate to facilitate the interpretation by the customer.

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Guidelines for Interpretation:

No accepted quantitative regulatory standards currently exist by which to assess the health risks related to mold and bacterial exposure. Molds and bacteria have been associated with a variety of health effects and sensitivity varies from person to person.

Several organizations, including: the American Conference of Government Industrial Hygienists (ACGIH); the American Industrial Hygiene Association (AIHA); the Indoor Air Quality Association (IAQA); the United States Environmental Protection Agency (USEPA); the Centers for Disease Control (CDC), as well as the California Department of Health Services (CADHS), have all published guidelines for assessment and interpretation of mold resulting from water intrusion in buildings.

Interpretation of the data and information within this document is left to the company, consultant, and/or persons who conducted the fieldwork.

Spore Trap Report

	Date Sampled: 06/09/16
Attn: Rob Rowley	Date Received: 06/13/16
Skelly and Loy, Inc	Date Analyzed: 06/13/16
449 Eisenhower Blvd.	Date Reported: 06/13/16
Harrisburg, PA 17111	Date Revised:
	Project Name: Centennial Lane Elementary
	Project Address: 3825 Centennial Lane
	Project City, State, ZIP: Ellicott City, MD.21042
	SEEML Reference #: 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Portable 90			Portable 88			Portable 197		
Location	Back of Classroom			Back of Classroom			Back of Classroom		
Lab Sample ID	160613006-012			160613006-013			160613006-014		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments	7	49		3	21		7	49	
Pollen	2	14					6	42	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria									
Ascospores				3	21	2			
Basidiospores	42	294	16	42	294	22	30	210	26
Bipolaris/Drechslera				1	7	<1			
Chaetomium									
Cladosporium	30	210	12	27	189	14	9	63	8
Curvularia	1	7	<1	1	7	<1	1	7	<1
Epicoccum	1	7	<1				1	7	<1
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	174	1220	68	111	777	59	66	462	57
Polythrincium				1	7	<1			
Rusts									
Smuts/Periconia/Myxomy	8	56	3	1	7	<1	5	35	4
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces	1	7	<1	1	7	<1	4	28	3
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	257	1800		188	1320		116	812	

Comments: Condition of the sample(s) upon receipt: Acceptable.

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The reporting limit is 1 Spore/sample.

Disclaimer: This report relates only to the samples tested

Respectfully submitted, SEEML

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AIHA-LAP, LLC EMLAP # 173667

Rafael Berrios

Rafael Berrios, Approved Laboratory Signatory

Spore Trap Report

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Harrisburg, PA 17111	Date Revised:
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	Project Address: 3825 Centennial Lane
	Project City, State, ZIP: Ellicott City, MD.21042
	SEEML Reference #: 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Portable 198			Portable 149			Outside 1		
Location	Back of Classroom			Back of Classroom			Outside of Portables		
Lab Sample ID	160613006-015			160613006-016			160613006-017		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments	1	7		7	49		12	84	
Pollen	1	7					6	42	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria	1	7	<1	1	7	<1			
Ascospores	9	63	5				81	567	25
Basidiospores	30	210	17	27	189	12	114	798	35
Bipolaris/Drechslera									
Chaetomium				1	7	<1			
Cladosporium	30	210	17	57	399	25	66	462	20
Curvularia	1	7	<1	1	7	<1	1	7	<1
Epicoccum	1	7	<1	2	14	<1	17	119	5
Cercospora									
Fusarium									
Memnoniella									
Nigrospora							1	7	<1
Penicillium/Aspergillus	105	735	58	132	924	58	12	84	4
Polythrincium	1	7	<1	2	14	<1	15	105	5
Rusts				1	7	<1	5	35	2
Smuts/Periconia/Myxomy	3	21	2	3	21	1	11	77	3
Spegazzinia									
Stachybotrys				1	7	<1			
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	181	1270		228	1600		323	2260	

Comments: Condition of the sample(s) upon receipt: Acceptable.

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Harrisburg, PA 17111	Date Revised:
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	Project Address: 3825 Centennial Lane
	Project City, State, ZIP: Ellicott City, MD.21042
	SEEML Reference #: 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Gym			Activity Room			Media Room		
Location	Center of Room			Center of Room			Front Left Corner of Room		
Lab Sample ID	160613006-018			160613006-019			160613006-020		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments				1	7				
Pollen							1	7	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria									
Ascospores							3	21	2
Basidiospores	3	21	30				39	273	27
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	1	7	10	1	7	7	33	231	23
Curvularia									
Epicoccum							2	14	1
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	6	42	60	9	63	60	66	462	46
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy				4	28	27	1	7	<1
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces				1	7	7			
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	10	70		15	105		144	1010	

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449 Eisenhower Blvd.	Date Reported: 06/13/16
Harrisburg, PA 17111	Date Revised:
	Project Name: Centennial Lane Elementary
	Project Address: 3825 Centennial Lane
	Project City, State, ZIP: Ellicott City, MD.21042
	SEEML Reference # : 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Cafeteria			Front Office			Boiler Room		
Location	Rear on Top of Refrigerator			Near Secretary Desk			Near Steps to Roof Access		
Lab Sample ID	160613006-021			160613006-022			160613006-023		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments	8	56		1	7		8	56	
Pollen	2	14		5	35		148	1036	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria	1	7	<1				10	70	2
Ascospores	3	21	1	9	63	6	39	273	8
Basidiospores	39	273	17	39	273	26	99	693	21
Bipolaris/Drechslera				1	7	<1	1	7	<1
Chaetomium									
Cladosporium	21	147	9	15	105	10	72	504	16
Curvularia	1	7	<1	1	7	<1	2	14	<1
Epicoccum	2	14	<1				4	28	<1
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	156	1090	69	84	588	55	228	1600	49
Polythrincium							1	7	<1
Rusts	1	7	<1						
Smuts/Periconia/Myxomy	4	28	2	4	28	3	8	56	2
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	228	1590		153	1070		464	3250	

Comments: Condition of the sample(s) upon receipt: Acceptable.

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	Project Address: 3825 Centennial Lane
	Project City, State, ZIP: Ellicott City, MD.21042
	SEEML Reference #: 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Classroom 157			Classroom 144			Classroom 210		
Location	Back of Room			Side of Room			Front of Room		
Lab Sample ID	160613006-024			160613006-025			160613006-026		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments	1	7		2	14		4	28	
Pollen	1	7							
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria	4	28	3	1	7	2	1	7	<1
Ascospores	6	42	4				12	84	9
Basidiospores	33	231	21	9	63	20	27	189	19
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	24	168	16	3	21	7	12	84	9
Curvularia	2	14	1						
Epicoccum	1	7	<1	2	14	4	3	21	2
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	81	567	53	30	210	67	81	567	57
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	3	21	2				5	35	4
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	154	1080		45	315		141	987	

Comments: Condition of the sample(s) upon receipt: Acceptable.

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	SEEML Reference #: 160613006

TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Classroom 133			Classroom 129			Classroom 119		
Location	Front of Room			Front of Room			Side of Room		
Lab Sample ID	160613006-027			160613006-028			160613006-029		
Detection Limit (spores/m ³)	7			7			7		
Hyphal Fragments	2	14		2	14		6	42	
Pollen	1	7					8	56	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%
Alternaria	1	7	1	2	14	<1	4	28	<1
Ascospores				3	21	1	75	525	16
Basidiospores	30	210	32	36	252	15	141	987	31
Bipolaris/Drechslera				1	7	<1			
Chaetomium									
Cladosporium	9	63	10	33	231	14	132	924	29
Curvularia									
Epicoccum	1	7	1	3	21	1	12	84	3
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	51	357	54	162	1130	67	78	546	17
Polythrincium							1	7	<1
Rusts									
Smuts/Periconia/Myxomy	2	14	2	2	14	<1	14	98	3
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium							3	21	<1
Zygomycetes									
Pithomyces							1	7	<1
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	150			150			150		
TOTAL SPORES/M³	94	658		242	1690		461	3230	

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TEST METHOD: DIRECT MICROSCOPY EXAMINATION AT 400X (100% OF TRACE ANALYZED) SEEML SOP 7

Client Sample ID	Classroom 211			Outside 2					
Location	Back of Room			By Front Doors					
Lab Sample ID	160613006-030			160613006-031					
Detection Limit (spores/m ³)	7			7					
Hyphal Fragments				3	21				
Pollen				1	7				
Spore Trap Used	AOC			AOC					
	raw ct.	spores/m ³	%	raw ct.	spores/m ³	%			
Alternaria				1	7	<1			
Ascospores				15	105	9			
Basidiospores	30	210	30	54	378	34			
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	27	189	27	57	399	36			
Curvularia									
Epicoccum				3	21	2			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	42	294	42	21	147	13			
Polythrincium				2	14	1			
Rusts									
Smuts/Periconia/Myxomy	2	14	2	6	42	4			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces				1	7	<1			
Background debris (1-5)3	3			3					
Sample Volume(liters)	150			150					
TOTAL SPORES/M³	101	707		160	1120				

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Fungal Descriptions

Alternaria sp.

Aw - 0.89. Conidia dimensions: 18-83 x 7-18 microns. A very common allergen with an IgE mediated response. It is often found in carpets, textiles and on horizontal surfaces in building interiors. Often found on window frames. Outdoors it may be isolated from samples of soil, seeds and plants. It is commonly found in outdoor samples. The large spore size, 20 - 200 microns in length and 7 - 18 microns in sizes, suggests that the spores from these fungi will be deposited in the nose, mouth and upper respiratory tract. It may be related to bakers' asthma. It has been associated with hypersensitivity pneumonitis. The species *Alternaria alternata* is capable of producing tenuazonic acid and other toxic metabolites that may be associated with disease in humans or animals. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Ascospore

A spore borne in a special cell called an ascus. Spores of this type are reported to be allergenic. All ascomycetes, members of a group of fungi called Ascomycotina, have this type of spore. The minute black dots on rotting wood and leaves or the little cups on lichens are examples of ascomycetes; another is the "truffle" mushroom.

Aspergillus/Penicillium

These are two of the most commonly found allergenic fungi in problem buildings. *Aspergillus* comes in many varieties (species). Many of the varieties produce toxic substances. It may be associated with symptoms such as sinusitis, allergic bronchiopulmonary aspergillosis, and other allergic symptoms. *Penicillium* is a variety of mold that is very common indoors and is found in increased numbers in problem buildings. It also has many varieties, some of which produce toxic substances. The symptoms are allergic reactions, mucous membrane irritation, headaches, vomiting, and diarrhea. Because the spores of *Aspergillus* and *Penicillium* are very similar, they are not differentiated by microscopic analysis and are reported together.

Aspergillus sp.

Aw 0.75 - 0.82. Reported to be allergenic. Members of this genus are reported to cause ear infections. Many species produce mycotoxins that may be associated with disease in humans and other animals. Toxin production is dependent on the species or a strain within a species and on the food source for the fungus. Some of these toxins have been found to be carcinogenic in animal species. Several toxins are considered potential human carcinogens. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema; may also be associated with sinusitis, allergic bronchiopulmonary aspergillosis, and other allergic symptoms.

Basidiospore

Spore from basidiomycetes. Many varieties are reported to be allergenic.

Bipolaris sp.

A fungus with large spores that could be expected to be deposited in the upper respiratory tract. This fungus can produce the mycotoxin - sterigmatocystin, which has been shown to produce liver and kidney damage when ingested by laboratory animals.

Botrytis sp.

Aw 0.93. Conidia dimensions: 7-14 x 5-9 microns. It is parasitic on plants and soft fruits. Found in soil and on house plants and vegetables, it is also known as "gray mold". It causes leaf rot on grapes, strawberries, lettuce, etc. It is a well-known allergen, producing asthma type symptoms in greenhouse workers and "wine grower's lung".

Cercaspora

Common outdoors in agricultural areas, especially during harvest. Parasite of higher plants, causing leaf spot. Commonly found as parasites on higher plants.

Chaetomium sp.

large ascomycetous fungus producing perithecia. It is found on a variety of substrates containing cellulose, including paper and plant compost. It has been found on paper in sheetrock. It can produce an *Acremonium*-like state on fungal media. Varieties are considered allergenic and have been associated with peritonitis, cutaneous lesions, and system mycosis.

Cladosporium sp.

Aw 0.88; Aw 0.84. Most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter. The numbers are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is a common allergen. Indoor *Cladosporium* sp. may be different than the species identified outdoors. It is commonly found on the surface of fiberglass duct liners in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint, and textiles. Produces greater than 10 antigens. Antigens in commercial extracts are of variable quality and may degrade within weeks of preparation. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include skin lesions, eye ulceration, mycosis (including onychomycosis, an infection of the nails of the feet or hands) edema and bronchospasms; chronic cases may develop pulmonary emphysema.

Curvularia sp.

Reported to be allergenic and has been associated with allergic fungal sinusitis. It may cause corneal infections, mycetoma, and infections in immune compromised hosts.

Dreschlera sp.

Conidia dimensions: 40-120 x 17-28 microns. Found on grasses, grains and decaying food. It can occasionally cause a corneal infection of the eye.

Epicoccum sp.

Conidia dimensions: 15-25 microns. A common allergen. It is found in plants, soil, grains, textiles and paper products.

Fusarium sp.

Aw 0.90. A common soil fungus. It is found on a wide range of plants. It is often found in humidifiers. Several species in this genus can produce potent trichothecene toxins. The trichothecene (scirpene) toxin targets the following systems: circulatory, alimentary, skin, and nervous. Produces vomitoxin on grains during unusually damp growing conditions. Symptoms may occur either through ingestion of contaminated grains or possibly inhalation of spores. The genera can produce hemorrhagic syndrome in humans (alimentary toxic aleukia). This is characterized by nausea, vomiting, diarrhea, dermatitis, and extensive internal bleeding. Reported to be allergenic. Frequently involved in eye, skin, and nail infections.

Myxomycetes

Members of a group of fungi that is included in the category of "slime molds". They're occasionally found indoors, but mainly reside in forested regions on decaying logs, stumps, and dead leaves. Myxomycetes display characteristics of fungi *and* protozoans. In favorable (wet) conditions they exhibit motile, amoeba-like cells, usually bounded only by a plasma membrane, that are variable in size and form. During dry spells, they form a resting body (sclerotium) with dry, airborne spores. These fungi are not known to produce toxins, but can cause hay fever and asthma.

Memnoniella

Contaminant, found most often with *Stachybotrys* on wet cellulose. Forms in chains, but it are very similar to *Stachybotrys* and sometimes is considered to be in the *Stachybotrys* family. Certain species do produce toxins very similar to the ones produced by *Stachybotrys chartarum* and many consider the IAQ importance of *Memnoniella* to be on par with *Stachybotrys*. Allergenic and infectious properties are not well studied.

Nigrospora sp.

Commonly found in warm climates, this mold may be responsible for allergic reactions such as hay fever and asthma. It is found on decaying plant material and in the soil. It is not often found indoors.

Oidium sp.

The asexual phase of *Erysiphe* sp. It is a plant pathogen causing powdery mildews. It is very common on the leaves stems, and flowers of plants. The health effects and allergenicity have not been studied. It does not grow on non-living surfaces such as wood or drywall.

Penicillium sp.

Aw 0.78 - 0.88. A wide number of organisms have been placed in this genus. Identification to species is difficult. Often found in aerosol samples. Commonly found in soil, food, cellulose and grains. It is also found in paint and compost piles. It may cause hypersensitivity pneumonitis, allergic alveolitis in susceptible individuals. It is reported to be allergenic (skin). It is commonly found in carpet, wallpaper, and in interior fiberglass duct insulation. Some species can produce mycotoxins. Common cause of extrinsic asthma (immediate-type hypersensitivity: type I). Acute symptoms include edema and bronchospasms; chronic cases may develop pulmonary emphysema. It may also cause headaches, vomiting, and diarrhea.

Periconia sp.

found in soil, blackened and dead herbaceous stems leaf spots, grasses, rushes, and sedges. Almost always associated with other fungi. Rarely found growing indoors. Reportedly associated with a rare case of mycotic keratitis.

Pithomyces sp.

A common mold found on dead leaves, plants, soil and especially grasses. Causes facial eczema in ruminants. It exhibits distinctive multi-celled brown conidia. It is not known to be a human allergen or pathogen. It is rarely found indoors, although it can grow on paper.

Polythrincium sp.

Polythrincium species comprise a very small proportion of the fungal biota. This genus is somewhat related to Ramularia. No information is available regarding health effects, or toxicity. Allergenicity has not been studied. Our laboratory has never seen this organism growing on environmental surfaces. May be identified in air on spore trap samples (spores have distinctive morphology). Also, spores may be seen in dust as part of the normal influx of outdoor microbial particles. Natural habitat is on leaves.

Rusts/Smuts

These fungi are associated with plant diseases. In the classification scheme of the fungi, the smuts have much in common with the rusts, and they are frequently discussed together. Both groups produce wind-borne, resistant teliospores that serve as the basis for their classification and their means of spread. Rusts usually attack vegetative regions (i.e., leaves and stems) of plants; smuts usually are associated with the reproductive structures (seeds). They can cause hay fever and asthma.

Spegazzinia

Spegazzinia species comprise a very small proportion of the fungal biota. This genus is somewhat related to other lobed or ornamented genera such as *Candelabrum*. No information is available regarding health effects or toxicity. Allergenicity has not been studied. Usually identified on spore trap samples where it is seen every few weeks. (Spores have very distinctive morphology.) May also be found in air by culturable (Andersen) samples if a long enough incubation period is provided so that sporulation occurs. Our laboratory has never found this organism growing on indoor environmental surfaces. Natural habitat includes soil and many kinds of trees and plants.

Stachybotrys sp.

Aw - 0.94 , optimum Aw \rightarrow 0.98. Several strains of this fungus (*S. atra*, *S. chartarum* and *S. alternans* are synonymous) may produce a trichothecene mycotoxin- Satratoxin H - which is poisonous by inhalation. The toxins are present on the fungal spores. This is a slow growing fungus on media. It does not compete well with other rapidly growing fungi. The dark colored fungus grows on building material with high cellulose content and low nitrogen content. Areas with a relative humidity above 55%, and are subject to temperature fluctuations, are ideal for toxin production.

Individuals with chronic exposure to the toxin produced by this fungus reported cold and flu symptoms, sore throats, diarrhea, headaches, fatigue, dermatitis, intermittent local hair loss and generalized malaise. Other symptoms include coughs, rhinitis, nosebleed, a burning sensation in the nasal passages, throat, and lungs, and fever. The toxins produced by this fungus will suppress the immune system affecting the lymphoid tissue and the bone marrow. Animals injected with the toxin from this fungus exhibited the following symptoms: necrosis and hemorrhage within the brain, thymus, spleen, intestine, lung, heart, lymph node, liver, and kidney. Affects by absorption of the toxin in the human lung are known as pneumomycosis.

This organism is rarely found in outdoor samples. It is usually difficult to find in indoor air samples unless it is physically disturbed (or possibly -this is speculation- a drop in the relative humidity). The spores are in a gelatinous mass. Appropriate media for the growth of this organism will have high cellulose content and low nitrogen content. The spores will die readily after release. The dead spores are still allergenic and toxigenic. Percutaneous absorption has caused mild symptoms.

Stemphylium sp.

Reported to be allergenic. Isolated from dead plants and cellulose materials.

Taeniocella sp.

contaminant primarily grows on wood. It was isolated from human cutaneous and subcutaneous lesions.

Torula sp.

Found outdoors in air, soil, on dead vegetation, wood, and grasses. Also found indoors on cellulose materials. Reported to be allergenic and may cause hay fever and asthma.

Tetraploa

Tetraploa species comprise a very small proportion of the fungal biota. This genus is somewhat related to Triposporium and Diplocladiella. The only reported human infections are two cases of keratitis (1970, 1980) and one case of subcutaneous infection of the knee (1990). No information is available regarding other health effects or toxicity. Allergenicity has not been studied. Usually identified on spore trap samples where it is seen every few weeks. (Spores have very distinctive morphology.) Our laboratory has never found this organism growing on indoor environmental surfaces. Natural habitat includes leaf bases and stems just above the soil on many kinds of plants and trees.

Ulocladium sp.

Aw 0.89. Isolated from dead plants and cellulose materials. Found on textiles.

Zygomycetes

Zygomycetes are one of the four major groups of fungi, the others being the Oomycetes, the Ascomycetes, and the Basidiomycetes. Zygomycetes are common, fast growing, and often overgrow and/or inhibit other fungi nearby. Rhizopus and Mucor are two of the most common Zygomycetes seen in the indoor environment. However, others are seen as well, including Syncephalastrum, Circinella, Mortierella, Mycotypha, Cunninghamella, and Choanephora. For further information, please see descriptions of these individual genera.

The following table lists mycotoxins that are produced by certain types of fungi:

Fungi	Mycotoxin
Acremonium crocinigenum	Crocin
Aspergillus favus	Alfatoxin B, cyclopiazonic acid
Aspergillus fumigatus	Fumagilin, gliotoxin
Aspergillus carneus	Citrinin
Aspergillus clavatus	Cytochalasin, patulin
Aspergillus Parasiticus	Alfatoxin B
Aspergillus nomius	Alfatoxin B
Aspergillus niger	Ochratoxin A, malformin, oxalic acid
Acremonium crocinigenum	Crocin
Aspergillus nidulans	Sterigmatocystin
Aspergillus ochraceus	Ochratoxin A, penicillic acid
Aspergillus versicolor	Sterigmatocystin, 5 ethoxysterigmatocystin
Aspergillus ustus	Ausdiol, austamide, austocystin, brevianamide
Aspergillus terreus	Citreoviridin
Alternaria	Alternariol, altertoxin, altenuene, altenusin, tenuazonic acid
Arthrinium	Nitropropionic acid
Bioploaris	Cytochalasin, sporidesmin, sterigmatocystin
Chaetomium	Chaetoglobosin A,B,C. Sterigmatocystin
Cladosporium	Cladosporic acid
Clavipes purpurea	Ergotism
Cylindrocopon	Trichothecene
Diplodia	Diplodiatoxin
Fusarium	Trichothecene, zearalenone
Fusarium moniliforme	Fumonisin
Emericella nidulans	Sterigmatocystin
Gliocladium	Gliotoxin
Memnoniella	Griseofulvin, dechlorogriseofulvin, epi-dechlorogriseofulvin, trichodermin, trichodermol
Myrothecium	Trichothecene
Paecilomyces	Patulin, viriditoxin
Penicillium aurantiocandidum	Penicillic acid
Penicillium aurantiogriseum	Penicillic acid
Penicillium brasilanum	Penicillic acid
Penicillium brevicompactum	Mycophenolic acid
Penicillium camemberti	Cyclopiazonic acid
Penicillium carneum	Mycophenolic acid, Roquefortine C
Penicillium crateriforme	Rubratoxin

Penicillium citrinum	Citrinin
Penicillium commune	Cyclopiazonic acid
Penicillium crustosum	Roquefortine C
Penicillium chrysogenum	Roquefortine C
Penicillium discolor	Chaetoglobosin C
Penicillium expansum	Citrinin, Roquefortine C
Penicillium griseofulvum	Roquefortine C, cyclopiazonic acid, griseofulvin
Penicillium hirsutum	Roquefortine C
Penicillium hordei	Roquefortine C
Penicillium nordicum	Ochratoxin A
Penicillium paneum	Roquefortine C
Penicillium palitans	Cyclopiazonic acid
Penicillium polonicum	Penicillic acid
Penicillium roqueforti	Roquefortine C, Mycophenolic acid
Penicillium veridicatum	Penicillic acid
Penicillium verrucosum	Citrinin, ochratoxin A
Penicillium/ Aspergillus	Patulin
Penicillium/ Aspergillus/Alternaria	Glitoxin
Phomopsis	Macrocyclic trichothecenes
Phoma	Brefeldin, cytochalasin, secalonic acid, tenuazonic acid
Pithomyces	Sporidesmin
Rhizoctonia	Slaframine
Rhizopus	Rhizonin
Sclerotinia	Furanocoumarins
Stachybotrys chartarum	Iso-satratoxin F, roridin E, L-2, satratoxin G & H, trichodermin, trichodermol, trichothecene
Torula	Cytotoxins
Trichoderma	Trichodermin, trichodermol, gliotoxin
Trichothecium	Trichothecene
Wallemia	Walleminol
Zygosporium	Cytochalasin

General terms

Allergen

An allergen is a substance that elicits an IgE antibody response and is responsible for producing allergic reactions. Chemicals are released when IgE on certain cells come into contact with an allergen. These chemicals can cause injury to surrounding tissue - the visible signs of an allergy. Only a few fungal allergens have been characterized but all fungi are thought to be potentially allergenic. Fungal allergens are proteins found in either the mycelium or spores

"Black mold"

The poorly defined term? Black mold? Or? Toxic black mold? Has usually been associated with the mold *Stachybotrys chartarum*. While there are only a few molds that are truly black, there are many that can appear black. Not all molds that appear to be black are *Stachybotrys*.

Fungi

Fungi are neither animals nor plants and are classified in a kingdom of their own? The Kingdom of Fungi. Fungi include a very large group of organisms, including molds, yeasts, mushrooms and puffballs. There are >100,000 accepted fungal species but current estimates range to 1.5 million species. Mycologists (people who study fungi) have grouped fungi into four large groups according to their method of reproduction.

Hidden mold

This refers to visible mold growth on building structures that is not easily seen, including the areas above drop ceilings, within a wall cavity (the space between the inner and outer structure of a wall), inside air handlers, or within the ducting of a heating/ventilation system.

Microbial Volatile Organic Compounds (MVOCs)

Fungi produce chemicals as a result of their metabolism. Some of these chemicals, MVOCs, are responsible for the characteristic moldy, musty, or earthy smell of fungi, whether mushrooms or molds. Some MVOCs are considered offensive or annoying. Specific MVOCs are thought to be characteristic of wood rot and mold growth on building materials. The human nose is very sensitive to mold odors and sometimes more so than current analytical instruments.

Mold

Molds are a group of organisms that belong to the Kingdom of Fungi (see Fungi). Even though the terms mold and fungi had been commonly referred to interchangeably, all molds are fungi, but not all fungi are molds.

Mycotoxin

Mycotoxins are compounds produced by some fungi that are toxic to humans or animals. By convention, the term? Mycotoxin? Excludes mushroom toxins. Fungi that produce mycotoxins are called "toxigenic fungi.

Spore

General Term for a reproductive structure in fungi, bacteria and some plants. In fungi, the spore is the structure which may be used for dissemination and may be resistant to adverse environmental conditions.

Toxic mold

The term? Toxic mold" has no scientific meaning since the mold itself is not toxic. The metabolic byproducts of some molds may be toxic (see mycotoxin).

Hypha (plural, hyphae)

An individual fungal thread or filament of connected cells; the thread that represents the individual parts of the fungal body.



Southeast Environmental Microbiology Laboratories

Chain of Custody

506 Laurens Rd, Greenville, SC 29607

Phone : 864-233-3770, Fax: 864-233-3779, www.seeml.com, AIHA-LAP, LLC. (EMLAP) #173667

Page 1 of 2

For Lab Use Only

Condition of samples is acceptable	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	SEEML Ref #: <u>160613006</u>	Lab ID: <u>012-031</u>
------------------------------------	---------------------------------------------------------------------	-------------------------------	------------------------

Company Information	Client Information	Environmental Conditions
(Project Manager) <u>Rob Rowley</u>	Date Sampled: <u>6-9-16</u>	Precipitation in last 16hrs:
(Company Name) <u>Skelly & Loy</u>	Project Name: <u>Centennial Lane Elem</u>	Relative Humidity I/O: <u>/</u>
(Address) <u>949 Eisenhower Blvd.</u>	Project Address: <u>3825 Centennial Lane</u>	Temperature I/O: <u>/</u>
(City, State, Zip) <u>Harrisburg, PA 17111</u>	City, State, Zip: <u>Ellicott City, MD 21043</u>	Wind Conditions:
(Phone) <u>717-232-0593</u>		
(Email) <u>rrowley@skellyloy.com</u>		

Sample Type Abbreviations:
 A- Allergenco S-Swab AP-Andersen Plate
 AOC- Air O Cell T-Tape W- Water
 M5- Micro 5 B- Bulk D- Dust

Analysis Type: Invoice to: RID-0163-019.04.DIR
 1. SporeTrap, Air Sample Analysis-Same Day
 2. Direct Exam Surface Sample Analysis -Same Day
 3. Culturable Air / Surface Samples -7-10 days

Sample ID	Sample Location	Sample Type	Analysis Type	*Area	**Volume (L)	Notes
Portable 90	Back of classroom	AOC	1		150	
Portable 88	↓					
Portable 197						
Portable 198						
Portable 149						
outside 1	outside of portables					
Gym	center of room					
Activity room	↓					
media room	front left corner of room					
cafeteria	rear on top of refrigerator					

Relinquished By: Jaime Willey Date/Time: 6/10/16 @ 0900

Received By: Caenen Bi Date/Time: 6-13-16

* Area is only required for culturable surface samples.
 ** Volume = Pump setting (L/min) x minutes



Southeast Environmental Microbiology Laboratories

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For Lab Use Only

Condition of samples is acceptable	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	SEEML Ref #: <u>160613006</u>	Lab ID: <u>012-031</u>
------------------------------------	---------------------------------------------------------------------	-------------------------------	------------------------

Company Information	Client Information	Environmental Conditions
(Project Manager) <u>Edo Rowley</u>	Date Sampled: <u>6-9-14</u>	Precipitation in last 16hrs:
(Company Name) <u>Skelly + Loy</u>	Project Name: <u>Centennial Lane Elem</u>	Relative Humidity I/O: <u>/</u>
(Address) <u>449 Eisenhower Blvd</u>	Project Address: <u>3825 Centennial Lane</u>	Temperature I/O: <u>/</u>
(City, State, Zip) <u>Harrisburg, PA 17111</u>	City, State, Zip: <u>Ellicott City, MD 21042</u>	Wind Conditions:

(Phone) 717-232-0593
 (Email) Rowley@SkellyLoy.com

Sample Type Abbreviations:
 A- Allergenco S-Swab AP-Andersen Plate
 AOC- Air O Cell T-Tape W- Water
 M5- Micro 5 B- Bulk D- Dust

Analysis Type: * Invoice to: RID-0163.019.04.DIR
 1. SporeTrap, Air Sample Analysis-Same Day
 2. Direct Exam Surface Sample Analysis-Same Day
 3. Culturable Air / Surface Samples -7-10 days

Sample ID	Sample Location	Sample Type	Analysis Type	*Area	**Volume (L)	Notes
Front office	near secretarys desk	AOC	1		15D	
boiler room	near steps to roof access					
Classroom 157	Back of room					
Classroom 144	Side of room					
Classroom 210	front of room					
Classroom 133	↓					
Classroom 129	↓					
Classroom 119	side of room					
Classroom 211	back of room					
outside 2	by front doors					

Relinquished By: Lauren Tully Date/Time: 6/10/14 @ 0900

Received By: Lauren B... Date/Time: 6-13-14

* Area is only required for culturable surface samples.
 ** Volume = Pump setting (L/min) x minutes



AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Southeast Environmental Microbiology Laboratories

506-A Laurens Road, Greenville, SC 29607

Laboratory ID: 173667

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

- | | |
|----------------------------------------------------------------|-----------------------------------|
| <input type="checkbox"/> INDUSTRIAL HYGIENE | Accreditation Expires: |
| <input type="checkbox"/> ENVIRONMENTAL LEAD | Accreditation Expires: |
| <input checked="" type="checkbox"/> ENVIRONMENTAL MICROBIOLOGY | Accreditation Expires: 11/01/2017 |
| <input type="checkbox"/> FOOD | Accreditation Expires: |
| <input type="checkbox"/> UNIQUE SCOPES | Accreditation Expires: |

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Gerald R. Schultz

Gerald Schultz, CIH
Chairperson, Analytical Accreditation Board

Cheryl O. Morton

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 14: 03/26/2014

Date Issued: 09/30/2015

**APPENDIX C -
INSTRUMENT CALIBRATION LOGS**

CALIBRATION LOG

Instrument Name: Zefon Biopump
Serial Number: ~~1595~~ 1595
Model Number: ZBD-200
Date Calibrated: 6.9.16

Calibrated by: Lauren Tilley
Signature: Lauren Tilley

S&L job number: R10-0163.019.04
S&L job name: Centennial Lane

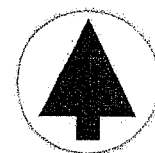
Pre calibration: 15 LPM w/ flow meter air-o-cell rotometer
Time: 7:30am
Post Calibration: 15 LPM w/ flow meter air-o-cell rotometer
Time: 5:00pm

Instrument Name: Zefon Biopump
Serial Number: ~~3401~~ 3401
Model Number: ZBD-~~100~~ 100
Date Calibrated: 6.9.16

Calibrated by: Lauren Tilley
Signature: Lauren Tilley

S&L job number: R10-0163.019.04
S&L job name: Centennial Lane

Pre calibration: 15 LPM w/ flow meter air-o-cell rotometer
Time: 7:30am
Post Calibration: 15 LPM w/ flow meter air-o-cell rotometer
Time: 5:00pm



INSTRUMENT CALIBRATION REPORT

Pine Environmental Services, LLC.

1016 West Eighth Ave
King of Prussia, PA 19406

Pine Environmental Services, Inc.

Instrument ID 16518
Description TSI 982 Probe
Calibrated 6/7/2016 1:16:38PM

Manufacturer Tsi	State Certified
Model Number Probe	Status Pass
Serial Number/ Lot Number 11100014	Temp °C 22
Location Philly	Humidity % 57
Department	

Calibration Specifications

Group # 1	Range Acc % 0.0000
Group Name CO2	Reading Acc % 3.0000
Stated Accy Pct of Reading	Plus/Minus 0.00

<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
1000.00 / 1000.00	PPM	1000.00	PPM	1,000.00	1,000.00	0.00%	Pass

Group # 2	Range Acc % 0.0000
Group Name CO	Reading Acc % 3.0000
Stated Accy Pct of Reading	Plus/Minus 0.00

<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
100.00 / 100.00	PPM	100.00	PPM	100.00	100.00	0.00%	Pass

Test Instruments Used During the Calibration

<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>(As Of Cal Entry Date)</u>	
					<u>Last Cal Date/ Opened Date</u>	<u>Next Cal Date / Expiration Date</u>
KOP CO100/CO2100 0 PPM FAO-375-1	CO100 PPM CO2 1000 OOM	American Gas Group	GP10733	FAO-375-1		5/19/2018

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Allie Gibat

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services, LLC.

1016 West Eighth Ave
King of Prussia, PA 19406

Pine Environmental Services, Inc.

Instrument ID 16518

Description TSI 982 Probe

Calibrated 6/7/2016 1:16:38PM

All instruments are calibrated by Pine Environmental Services, LLC. according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

**Notify Pine Environmental Services, LLC. of any defect within 24 hours of receipt of equipment
Please call 866-960-7463 for Technical Assistance**



CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITION			MODEL	9555-P
TEMPERATURE	73.6 (23.1)	°F (°C)	SERIAL NUMBER	9555P0744004
RELATIVE HUMIDITY	53	%RH		
BAROMETRIC PRESSURE	28.84 (976.6)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

- CALIBRATION VERIFICATION RESULTS -

THERMO COUPLE			SYSTEM PRESSURE01-02			Unit: °F (°C)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	71.4 (21.9)	71.6 (22.0)	69.4~73.4 (20.8~23.0)				

DIFFERENTIAL PRESSURE			SYSTEM PRESSURE01-02			Unit: inH ₂ O (Pa)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	-3.718 (-925.8)	-3.730 (-928.8)	-3.759~-3.677 (-936.0~-915.6)	3	7.957 (1981.3)	7.958 (1981.5)	7.873~8.041 (1960.4~2002.2)
2	1.810 (450.7)	1.811 (450.9)	1.788~1.832 (445.2~456.2)	4	13.944 (3472.1)	13.951 (3473.8)	13.801~14.087 (3436.4~3507.7)

BAROMETRIC PRESSURE			SYSTEM PRESSURE01-02			Unit: inHg (hPa)	
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	20.24 (685.4)	20.23 (685.1)	19.84~20.64 (671.9~699.0)	3	35.15 (1190.3)	35.14 (1190.0)	34.45~35.85 (1166.6~1214.0)
2	28.91 (979.0)	28.91 (979.0)	28.33~29.49 (959.4~998.6)				

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2008.

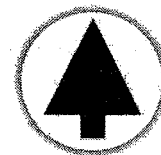
Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E004626	10-30-14	10-30-15	Pressure	E005254	10-20-14	10-20-15
Pressure	E003982	02-27-15	08-27-15	DC Voltage	E003493	01-06-15	01-06-16

CALIBRATED

July 28, 2015

DATE

Doc. ID. CERT_GEN_WCC



INSTRUMENT CALIBRATION REPORT

Pine Environmental Services, LLC.

92 North Main St, Building 20
Windsor, NJ 08561
Toll-free: (800) 301-9663

Pine Environmental Services, Inc.

Instrument ID 16518
Description TSI 982 Probe
Calibrated 5/27/2016 4:33:18PM

Manufacturer Tsi	State Certified
Model Number Probe	Status Pass
Serial Number/ Lot 11100014	Temp °C 26.6
Number	
Location New Jersey	Humidity % 45
Department	

Calibration Specifications

Calibration Specifications							
Group # 1				Range Acc %	0.0000		
Group Name CO2				Reading Acc %	3.0000		
Stated Accy Pct of Reading				Plus/Minus	0.00		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
1000.00 / 1000.00	PPM	1000.00	PPM	984.00	999.00	-0.10%	Pass
Group # 2				Range Acc %	0.0000		
Group Name CO				Reading Acc %	3.0000		
Stated Accy Pct of Reading				Plus/Minus	0.00		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
100.00 / 100.00	PPM	100.00	PPM	98.90	100.30	0.30%	Pass

Test Instruments Used During the Calibration

Test Instruments Used During the Calibration					(As Of Cal Entry Date)	
<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>Last Cal Date/ Opened Date</u>	<u>Next Cal Date/ Expiration Date</u>
NJ CO / CO2 - DAP-375-1	NJ 100 CO/1000 CO2 34 Liters	American Gas Group	GP10733	DAP-375-1		3/9/2019
NJ NITROGEN - KAO-114-5	Nitrogen 99.999% 34 liters	American Gas Group	GP12307	KAO-114-5		10/28/2018

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Dave German

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services, LLC.

92 North Main St, Building 20
Windsor, NJ 08561
Toll-free: (800) 301-9663

Pine Environmental Services, Inc.

Instrument ID 16518
Description TSI 982 Probe
Calibrated 5/27/2016 4:33:18PM

All instruments are calibrated by Pine Environmental Services, LLC. according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

**Notify Pine Environmental Services, LLC. of any defect within 24 hours of receipt of equipment
Please call 866-960-7463 for Technical Assistance**

INSTRUMENT CALIBRATION REPORT



Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 25453
Description TSI 8530 DustTrak II
Calibrated 1/19/2016

Manufacturer TSI
Model Number 8530
Serial Number 8530141304
Location New Jersey
Temp 74

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 23

Calibration Specifications

Group # 1
Group Name Arizona Road Dust
Test Performed: Yes As Found Result: Fail As Left Result: Pass

Test Instruments Used During the Calibration

Test Instrument ID	Description	Manufacturer	Serial Number	(As Of Cal Entry Date)	
				Last Cal Date	Next Cal Date
DUST TRAK DRX MASTER 8533151105	TSI Dust Trak DRX Aerosol Monitor	TSI	8533151105	3/16/2015	3/16/2016
FLUKE 114	Fluke 114 NIST Traceable Multimeter	Fluke	15310288	4/25/2015	4/25/2016

Notes about this calibration

photometric calibration ratio: 0.85

Calibration Result Calibration Successful
Who Calibrated Kevin Cole

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

INSTRUMENT QC/ PACKING LIST

Description	Zefon Bio-Pump plus
Instrument ID	R18911
Date Calibrated	3-31-16



Standard Items	Prepared	QC check	Received by customer	Returned to Pine
Bio-Pump plus w/ case	/	/	_____	_____
Manual	/	/	_____	_____
Charger: 15V, 1.67 A output	/	/	_____	_____
Air-O-Cell flow indicator	/	/	_____	_____
Supporting Items				
Via-Cell/ Air-O-Cell CSI flow indicator	_____	_____	_____	_____
Air-O-Cell cassettes, quantity _____	_____	_____	_____	_____
Via-Cell cassettes, quantity _____	_____	_____	_____	_____
Air-O-Cell CSI cassettes, quantity _____	_____	_____	_____	_____

Prepared by: MH
QC checked by: Q
Date: 3-31-16

This packing list is to ensure that every item needed to operate the unit was sent and received. Upon receiving a shipment, please fill out the "Received by customer" column. Call Pine within 24 hours of receiving the equipment if any pieces are missing, damaged, or malfunctioning. Thank you for choosing Pine Environmental Services LLC