July 6, 2018

Clemson University
310 Klugh Avenue
Clemson, South Carolina 29634

Attn: Mr. W. Robert Newberry, IV
E-mail: wnewber@clemson.edu

Re: Limited Mold Investigation Report
Sikes Hall, Room G08-O
Clemson, South Carolina 29634
Terracon Project No. 86187072F

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in Sikes Hall Room G08-O at Clemson University in Clemson, South Carolina. Reportedly, residents of this office have reported "musty" odors that may be related to a reported water leak from the HVAC system. This service was conducted in general accordance with our Master Service Agreement with Clemson University.

PROJECT DESCRIPTION

Scope of Services

At the request of Clemson University, Terracon representative Mr. Benjamin Hestir conducted a limited mold investigation in Room G08-O at Sikes Hall, on Tuesday, July 3, 2018. Sikes Hall was originally constructed in 1904 and was rebuilt after a fire in 1927. Office G08 contains the student financial services office and consists of approximately 2,700 square feet of office space located on the basement level on the south side of the building.

On our July 3rd visit, Terracon made measurements of temperature and relative humidity and conducted airborne mold sampling which consisted of collecting spore trap air samples in three locations inside the offices and the collection of two additional samples outside for comparison.

Standard of Care

This limited mold investigation was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. Terracon did not attempt to identify every potential exposure or hazard present in the subject building. The results, findings, conclusions and recommendations expressed in this report are based on conditions observed during our sampling. Many factors, such as weather conditions, building occupancy, ventilation patterns and seasonal variations in fungal concentrations, can affect the conditions observed. The information contained in this report should not be relied upon to represent conditions that existed prior to or after this sampling. Terracon does not warrant the services of regulatory agencies, laboratories or other third parties supplying information that may have been used in the preparation of this report.

INVESTIGATION CRITERIA AND METHODS

Physical Assessment

The physical assessment was conducted to determine whether building materials in the area of the known HVAC leak were impacted by moisture, and to identify the presence of visible fungal growth. The inspection focused primarily on collecting observational data (i.e., information obtained by physical inspection of the office space and interviews with the facility management staff in the process of conducting repairs). The physical inspection can help to formulate plans for more in-depth investigation.

The physical inspection included:

- an examination of the physical structure and the visible structure above the ceiling and behind the wall in the office where the leak occurred;
- the identification of any discoloration or odor that could indicate fungal growth;
- using a moisture meter to detect moisture impacted materials.

Building materials have different absorptive and moisture retention properties and will come into equilibrium with environmental moisture (as indicated by relative humidity levels) or become wet by contact with water.

A Protimeter® Mini Moisture Meter, Model BLD2000 direct-reading instrument was used to measure the moisture content of the building materials included in this investigation. The moisture meter works via the measurement of electroconductivity through the material being tested via two penetrating probes.

According to Protimeter®, readings above 16% on wood components should generally be considered excess moisture that may indicate moisture intrusion and the early stages of wood-

deteriorating organism growth. Wood Moisture Equivalent (%WME) readings on materials other than wood components (e.g. drywall) above 16% WME would also be considered moisture impacted.

Mold Sampling

Total mold spore trap samples were collected using Allergenco-D™ spore trap cassettes specifically designed for the collection of airborne mold spores. Air samples were collected using a calibrated Zefon Bio-Pump™ at a flow rate of 15 liters per minute (LPM) for 5 minutes at each location.

After collection, the spore trap samples were hand delivered to the Southeastern Environmental Microbiology Lab (SEEML) in Greenville, South Carolina. SEEML is accredited by the AIHA® Laboratory Accreditation Programs, LLC under the Environmental Microbiology Laboratory Accreditation Program (EMLAP), Accreditation #173667. Air samples were analyzed by direct microscopic examination and results are reported in spores per cubic meter of air (spores/m^3).

To help interpret the mold sampling results, we compared indoor air and outdoor air measurements. High variability in airborne fungal spore concentrations can exist in different geographic locations, during different seasons, and weather patterns, and over the course of a given day. As a general rule, indoor air fungal spore concentrations in a heating, ventilation and air-conditioning (HVAC)-supplied building are typically less than, but qualitatively similar to, fungal spore concentrations found in the outside environment.

No state or federal exposure limits have been established for fungal aerosols. Regulatory standards, medically based threshold limit or dose-response relationships have not been established for exposure to airborne or surface concentrations of mold spores. Terracon relies upon experience, professional judgment, current scientific literature, guidelines and recommendations made by professional organizations and experts, and statistical methods in interpreting mold sampling results.

Temperature and Relative Humidity

Indoor air temperature and relative humidity are physical conditions important to the perception of comfort. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has published recommendations regarding thermal comfort. ASHRAE Standard 55-2013, Thermal Environmental Conditions for Human Occupancy, identifies six primary factors that affect comfort: metabolic rate (affected by the activity being performed); clothing insulation; air temperature; radiant temperature; air speed; and humidity.

Although the relationships are complex, a temperature range between 73 and 79 degrees Fahrenheit (°F) with relative humidity between roughly 20 and 60 percent (%) are recommended for persons in a conditioned setting wearing light summer clothing. Higher temperatures require

lower humidity for comfort. For persons in winter clothing, temperatures can range between 68 and 75°F, with relative humidity between 20% and 60%, with preferred conditions falling between 30% and 50% for both winter and summer temperatures.

EPA recommends maintaining indoor humidity below 60%, ideally 30-50%, if possible.

Readings of temperature and relative humidity were collected with an Extech Model 445580 IAQ instrument which was calibrated by the manufacturer.

FINDINGS

General Observations

- At the time of our investigation on July 3, the office space (entire section G08 approximately 2,700 square feet, as shown in Figure 1) was emptied, carpet tiles had been removed and new carpet tiles were in the process of being installed. Our investigation focused on Rooms G08-O where the HVAC leak occurred and adjacent Room G08-P.
- Holes had been cut in the walls and ceiling in the area of the reported HVAC leak in Room G08-O. Based on moisture measurements of the wall and ceiling, the leak appeared to be in the horizontal chase above the window in Room G08-O and extended to the vertical chases on either side of the window. The leak also affected the shared vertical chase in G08-P.
- Small areas (less than 10 square feet) of suspect mold growth were observed at the base of the wall in Room G08-O.
- On July 4, Terracon met with Bill Hurst of Clemson Facilities to show elevated moisture readings. Moisture readings on the south wall of Rooms G08-O and G08-P (drywall and plaster) ranged from 20 – 70 %WME. No other rooms were tested.
- Photographs from the assessment are attached.
- Locations of air samples and moisture readings are found in Figure 1.

Mold Air Sampling

On the afternoon of July 3, 2018, Terracon collected three mold spore trap samples inside the office at G08 Sikes Hall and two samples in outdoor locations for comparison. Please note construction activities were occurring during the sampling and could bias results. The results of the total spore count samples analyses are summarized in Table 1 below:

Table 1: Summary of Total Spore Count Analyses – July 3, 2018

Sample #	G08-1	G08-2	G08-3	G08-4	G08-5
Location Description	**Room G08-O**	**Just inside S entrance**	**NW corner Outside G08-E**	**Outside W entrance**	**Outside on bench at Carillon Garden**
Spore Type	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**
Alternaria	78	78	117	13	---
Ascospores	78	78	117	195	468
Basidiospores	312	351	117	429	1,950
Chaetomium	---	---	39	---	---
Cladosporium	117	468	156	234	390
Curvalaria	---	---	---	---	104
Epicoccum	13	---	---	---	39
Penicillium/ Aspergillus	2,420	14,300	22,000	1,400	195
Rust	---	---	---	---	---
Smuts/*Periconia*/ Myxomycetes	13	13	---	78	169
Pithomyces	---	---	---	---	13
Torula	---	---	---	---	13
Total	**2,950**	**15,200**	**22,400**	**2,350**	**3,340**
Temperature (degrees F.)	70.8	72.1	73.2	93.7	---
Relative Humidity (%)	52.2	49.7	47.1	44	---

The highest indoor total spore count was approximately seven times higher than the highest total spore count outside. The predominant mold genus indoors was *Aspergillis/Penicillium.* The predominant mold genera outdoors were *Basidiospores and Aspergillis/Penicillium*. The weather on the day we sampled was hot (93.7ºF) with a slight breeze. The laboratory analytical report is attached.

Temperature and Relative Humidity

The indoor temperature readings average 72ºF and the relative humidity readings averaged 49.7%. The outdoor temperature was 93.7ºF and the relative humidity was 44%.

CONCLUSIONS

The following conclusions are provided based on our assessment:

- During the testing period for mold spores the entire office section was in the process of renovation and the spore result may be biased high because of the carpet removal/replacement and disturbance to the wall cavities where leaks were identified. The results of total spore count air sampling indicated that total airborne mold spore concentrations inside the building were higher the total mold spore levels measured in the highest outdoor sample.
- Moisture readings in the wall (both drywall and plaster materials) in Rooms G08-O and G08-P ranged from 20 – 70 %WME, indicating elevated moisture in building materials.
- Temperature and relative humidity levels inside the office space were within ASHRAE and EPA guideline ranges.

It is our understanding Clemson Facilities is currently working on the removal and replacement of wet building materials, including the limited mold impacted areas. HVAC repairs have already been made above the office ceiling. A final cleaning of the space via wet wiping and HEPA vacuuming should be conducted along with temporary HEPA air filtration units to reduce airborne spore levels from the construction activities. A second round of air sampling should be conducted to confirm the successful removal of the elevated spore levels.

Terracon appreciates the opportunity to provide this service to Clemson University. If you have any questions regarding this limited mold investigation report, please contact the undersigned at 864-292-2901.

Sincerely,
Terracon Consultants, Inc.

Benjamin Hestir, P.E.
Project Industrial Hygienist

Jeffrey A. Gurrie
Senior Industrial Hygienist

Attachments: Figure 1 – Sample Locations
Photographs
Laboratory Results

Figure 1 – Sample Locations

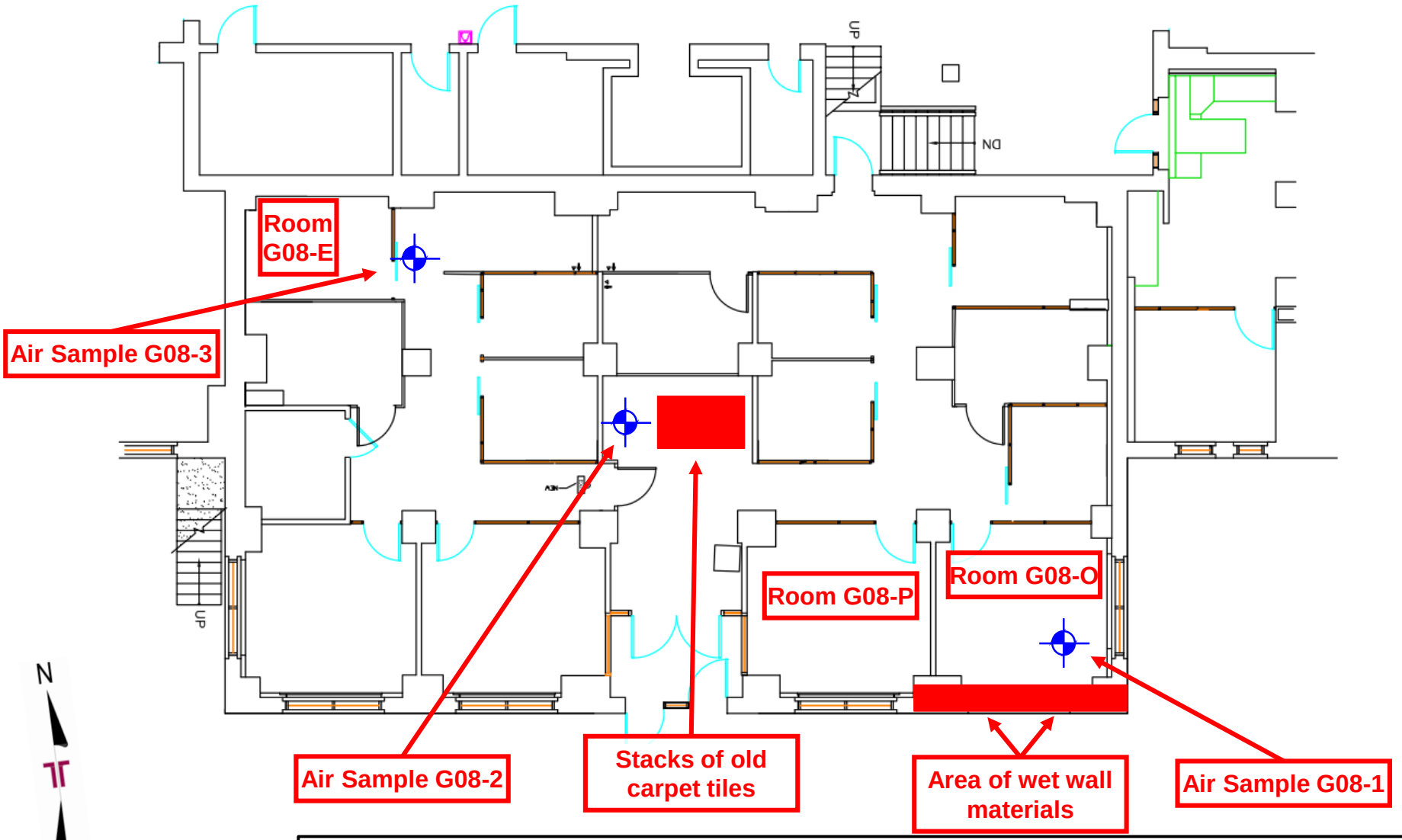


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES. FIGURE BASE LAYOUT PROVIDED BY CLEMSON UNIVERSITY

Project Manager:	BDH
Drawn by:	BDH
Checked by:	JAG
Approved by:	JAG

Project No.	86187072F
Scale:	N.T.S.
File Name:	Figure 1
Date:	7/6/2018

Terracon
Consulting Engineers & Scientists
72 Pointe Circle Greenville, South Carolina 29615
PH. (864) 292-2901 FAX. (864) 292-6301

SAMPLE LOCATION DIAGRAM

Sikes Hall – Office G08
Clemson University – Main Campus
Clemson, South Carolina

Figure 1

Photographs



Photo #1 South wall in Room G08O within G08 office space – area of HVAC leak and wet wall materials



Photo #2 View of Office G08 from south entrance hall facing east



Photo #3 Location of air sample G08-2 just inside south entrance to office G08



Photo #4 View of SE column in Room G08P which also contained wet materials



Photo #5 Location of air sample G08-4 – outside West entrance to Sikes Hall



Photo #6 Location of air sample G08-5 – outside entrance to Carillon Garden just west of Sikes Hall

Laboratory Results

SEEML Reference Number:
180705028

Southeast Environmental Microbiology Laboratories
102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233-3770
FAX: (864) 233-6589

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

- ☐ Surface/Bulk Report
- ☒ Spore Trap Report
- ☐ Andersen Fungal Report
- ☐ Quantitative Fungal Report

Lab Manager Review: Rafael Berrios Date: 07/05/18

Thank you for using SEEML laboratories. We strive to provide superior quality and service.
SEEML laboratories are accredited through AIHA-LAP, LLC (EMLAP # 173667) for the analysis of Spore Traps and Surface/Bulk Samples.

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.

Confidentiality Notice:
The document(s) contained herein are confidential and privileged information, intended for the exclusive use of the individual or entity named above. If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering it to the intended recipient, you are hereby notified that any dissemination, distribution or copying of the document(s) is strictly prohibited. If you have received this document in error, please immediately notify us by telephone to arrange for its return. Thank you.

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: 07/03/18
Terracon	Date Received: 07/05/18
72 Pointe Circle	Date Analyzed: 07/05/18
Greenville, SC 29615	Date Reported: 07/05/18
	Date Revised:
	Project Name: Sikes Hall
	Project Address: 86187072F
	Project City, State, ZIP:
	SEEML Reference # : 180705028

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

Client Sample ID	608-1			608-2			608-3		
Location	SE Corner - RM G080			Just Inside S. Entrance			NW Corner- Outside G08E		
Lab Sample ID	180705028-070			180705028-071			180705028-072		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	2	26		2	26		4	52	
Pollen				1	13				
Spore Trap Used	Allergenco			Allergenco			Allergenco		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores	6	78	3	6	78	<1	9	117	<1
Basidiospores	24	312	11	27	351	2	9	117	<1
Bipolaris/Drechslera									
Chaetomium							3	39	<1
Cladosporium	9	117	4	36	468	3	12	156	<1
Curvularia									
Epicoccum	1	13	<1						
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	186	2420	82	1101	14300	94	1691	22000	98
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	1	13	<1	1	13	<1			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	75			75			75		
TOTAL SPORES/M^3	227	**2950**		1171	**15200**		1724	**22400**	

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

1=Total % may not equal 100 due to rounding.

2 = Colorless,other Brown are spores without a distinctive morphology on spore traps and non-viable surface samples.

3 = Background debris is the amount of particulate matter present on the slide and is graded from 1-5 with 1 = very light, 2= Light, 3 = Medium, 4 = Heavy, 5 = Very Heavy. The higher the rating the more likelihood spores may be underestimated. A rating of 5 should be interpreted as minimal counts and may actually be higher than reported.

The reporting limit is 1 Spore/sample.

Disclaimer: This report relates only to the samples tested

Respectfully submitted, SEEML

Rafael Berrios

Rafael Berrios, Approved Laboratory Signatory

102 Edinburgh Court
Greenville, SC 29607
Phone: (864) 233- 3770
Fax: (864) 233-6589
AIHA-LAP, LLC EMLAP # 173667

Spore Trap Report

	Date Sampled: 07/03/18
Terracon	Date Received: 07/05/18
72 Pointe Circle	Date Analyzed: 07/05/18
Greenville, SC 29615	Date Reported: 07/05/18
	Date Revised:
	Project Name: Sikes Hall
	Project Address: 86187072F
	Project City, State, ZIP:
	SEEML Reference # : 180705028

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

Client Sample ID	608-4			608-5					
Location	Outside W Entrance			Outside Carrilon Gaiden					
Lab Sample ID	180705028-073			180705028-074					
Detection Limit (spores/m^3)	13			13					
Hyphal Fragments	5	65		3	39				
Pollen	2	26							
Spore Trap Used	Allergenco			Allergenco					
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%			
Alternaria	1	13	<1						
Ascospores	15	195	8	36	468	14			
Basidiospores	33	429	18	150	1950	58			
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	18	234	10	30	390	12			
Curvularia				8	104	3			
Epicoccum				3	39	1			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	108	1400	60	15	195	6			
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	6	78	3	13	169	5			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula				1	13	<1			
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces				1	13	<1			
Background debris (1-5)3	3			3					
Sample Volume(liters)	75			75					
TOTAL SPORES/M^3	181	**2350**		257	**3340**				

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

1=Total % may not equal 100 due to rounding.

2 = Colorless,other Brown are spores without a distinctive morphology on spore traps and non-viable surface samples.

3 = Background debris is the amount of particulate matter present on the slide and is graded from 1-5 with 1 = very light, 2= Light, 3 = Medium, 4 = Heavy, 5 = Very Heavy. The higher the rating the more likelihood spores may be underestimated. A rating of 5 should be interpreted as minimal counts and may actually be higher than reported.

The reporting limit is 1 Spore/sample.

Disclaimer: This report relates only to the samples tested

Respectfully submitted, SEEML

Rafael Berrios

Rafael Berrios, Approved Laboratory Signatory

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Southeast Environmental Microbiology Laboratories
Chain of Custody

SEEML Labs
Analytical Solutions For a Healthy Indoor Environment
102 Edinburgh Court, Greenville, SC 29607
Phone : 864-233-3770, Fax: 864-233-6589, www.seeml.com, AIHA-LAP, LLC. (EMLAP) #173667

For Lab Use Only			
Condition of samples is acceptable	☑ YES ☐ NO	SEEML Ref #: 180705028	Lab ID: 070 - 074

Company Information		Client Information		Environmental Conditions	
(Project Manager)	Ben Hestir	Date Sampled:	7/3/18	Precipitation in last 16hrs:	Yes
(Company Name)	Terracon	Project Name:	Sikes Hall	Relative Humidity I/O:	49 / 44
(Address)	72 Pointe Circle	Project Address:	86187072F	Temperature I/O:	72 / 93
(City, State, Zip)	Greenville, SC 29615	City, State, Zip:		Wind Conditions	calm
(Phone)	864-293-7348				
(Email)	ben.hestir@terracon.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:
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
608-1	SE corner - Rm 6080	A	1		75	
608-2	Just inside S entrance	"	"		"	
608-3	NW corner - outside 608E	"	"		"	
608-4	Outside W entrance	"	"		"	
608-5	Outside Carrilon Garden	"	"		"	

Reliquished By:	Date/Time	Recieved By:	Date/Time
Ben Hestir	7/5/18 0916		7.5.18

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