December 2, 2015

Clemson University
310 Klugh Avenue
Clemson, South Carolina 29634

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

Re: Limited Mold Investigation Report
Clemson University
Martin Hall – Suite E106/108
Clemson, South Carolina
Terracon Project No. 86127158 – Task 50

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in Suite E106/108 of the Clemson Graduate School on Clemson University's main campus in Clemson, South Carolina. The graduate school is considering relocating an employee into the office and wanted to confirm air quality (related to mold) in the space. The sampling was performed in general accordance with our IDC with Clemson University.

PROJECT DESCRIPTION

Scope of Services

At the request of Clemson University Terracon conducted a limited mold investigation of Suite E106/108 in the Clemson Graduate School offices. Terracon representative Mr. Benjamin Hestir performed this investigation on the morning of November 16, 2015. The investigation included a general observation for visible mold and air sampling for mold spores.

Standard of Care

This 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 investigation. Many factors, such as weather conditions, building occupancy, ventilation patterns, and seasonal variations in fungal/bacterial concentrations or local sources of volatile chemicals, 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 investigation. 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 were impacted by moisture intrusion or condensate formation, and to identify the presence of visible suspected fungal growth. The investigation focused primarily on collecting observational data (i.e., information obtained by physical assessment of the building and interviews with the building management, owners, and occupants). The physical assessment can help to formulate plans for more in-depth investigation. Destructive sampling or testing to inspect interior wall cavity spaces or mechanical enclosures was not within the scope of work for this project.

The physical assessment included:

- the identification of any discoloration or odor that could indicate moisture intrusion, water damage, and/or fungal growth;

Mold Sampling

Total non-viable (non-culturable) fungal spore trap samples were collected using Air-O-Cell™ spore trap cassette 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 air sample collection, the samples were hand delivered to Southeast Environmental Microbiology Laboratories, Inc. (SEEML), accredited by the AIHA® Laboratory Accreditation Programs, LLC under the Environmental Microbiology Laboratory Accreditation Program (EMLAP), Accreditation #173667. The total spore count samples were analyzed by direct microscopic examination and are reported in spores per cubic meter of air (spores/m^3).

There are no state or federal exposure limits established for fungal aerosols. There are currently no regulatory standards or medically based threshold limit or dose-response relationships 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.

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 an HVAC-supplied building are typically less than, but qualitatively similar to, fungal spore concentrations found in the outside environment. In winter months or cooler periods, outdoor mold spore levels may be lower than indoor levels. To help interpret the sampling results, we compared indoor air and outdoor air measurements.

Temperature and Relative Humidity

Indoor air temperature and RH 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 55-2004, 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 performing “office” work and 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 30 and 60%.

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

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

FINDINGS

Physical Assessment

The offices in Suite E106/108 house the Clemson Graduate School Dean and various other employees of the Graduate School in Martin Hall and currently is occupied by approximately 10-12 full time employees. At the time of assessment no musty odors were detected in the rooms sampled and no evidence of active water intrusion or visible mold growth was observed in the rooms sampled.

Mold Air Sampling

On the morning of November 16, 2015, Terracon collected seven (7) non-viable mold spore trap samples; five in Suite E106/108 plus two outdoors for comparison. A media blank sample was also submitted for quality assurance.

At the time of testing the indoor temperatures ranged from 68º F to 73º F and indoor relative humidity ranged from 30% to 38%. Outdoor temperature was 48º F and outdoor relative humidity was 62% with on a clear day with a slight breeze. The results of the total spore count samples are summarized in Table 1 below:

Table 1: Summary of Total Spore Count Results – November 16, 2015

Sample #	MH-1	MH-2	MH-3	MH-4	MH-5	MH-6	MH-7
Location	**JO office Suite E106/108**	**LS office Suite E106/108**	**FF office Suite E106/108**	**LK office Suite E106/108**	**FB office Suite E106/108**	**Outside 1**	**Outside 2**
Spore Type	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**
Ascospores	---	39	---	---	---	---	---
Aspergillus/ Penicillium	624	234	---	195	468	546	---
Basidiospores	78	---	741	39	78	78	702
Cladosporium	78	39	156	78	78	39	39
Curvularia	13	---	---	---	13	---	---
Myxomycetes/ Perconia/Smuts	26	13	39	---	---	26	---
Epiccocum	---	13	---	---	---	---	---
Ulocladium	---	---	13	---	---	---	---
Total	**819**	**338**	**949**	**312**	**637**	**689**	**741**

Two of the five indoor total spore counts were slightly higher than counts from the outdoor samples. *Basidiospores* and *Aspergillus/Penicillium* were dominant in the two outdoor samples, and also in the indoor spore counts. The media blank did not have any spores detected.

The laboratory analytical report is attached.

Conclusions and Recommendations

The following conclusions and recommendations are provided based on our assessment:

- Total spore counts inside versus outside were very similar in both concentrations and in species present. Although indoor mold spore levels were slightly higher at the time of sampling it should be noted that outdoor variability in mold levels exist especially during cooler times of the year. At the time of sampling the outdoor temperature was 48°F. Additionally other sources have referenced indoor mold spore levels less than 1,500 spores/m³ to be acceptable.

- Temperature and relative humidity readings were within normal comfort levels for an office environment.
- Observations and sampling did not identify evidence of indoor fungal amplification.

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 Gurrie
Senior Project Industrial Hygienist

Attachments: Photographs
Laboratory Results

Photographs



Photo #1 Graduate School Office signage



Photo #2 Calibration of Zefon BioPump



Photo #3 Location of Sample MH-1 in Office of Jason Osborne



Photo #4 View of temperature and relative humidity at Sample MH-1



Photo #5 Location of Sample MH-2 on the counter above desk of Lavonne Sloop



Photo #6 View of temperature and relative humidity at Sample MH-2



Photo #7 Location of Sample MH-3 on round table in office of Dr. Frankie Felder



Photo #8 View of temperature and relative humidity readings at Sample MH-3



Photo #9 Location of Sample MH-4 on round table in office of Laura Kinard



Photo #10 View of temperature and relative humidity readings at Sample MH-4



Photo #11 Location of Sample MH-5 on round table in office of Frank Ballentine



Photo #12 View of temperature and relative humidity readings at Sample MH-5



Photo #13 Location of Sample MH-6 outside Martin Hall – north side



Photo #14 Location of Sample MH-7 outside Martin Hall – further north towards Sikes Hall



Photo #15 View of temperature and relative humidity readings outside on morning of November 16, 2015

Laboratory Results

SEEML Reference Number:
151116052-DX

Southeast Environmental Microbiology Laboratories
506 Laurens Rd
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:

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

Lab Manager Review: Rafael Berrios Date: 11/16/15

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.

Confidentiality Notice:
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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

Attention: Ben Hestir	Date Sampled: 11/16/15
Terracon	Date Received: 11/16/15
3534 Rutherford Road	Date Analyzed: 11/16/15
Taylors, SC 29687	Date Reported: 11/16/15
	Date Revised:
	Project Name: CU Martin E106/108
	Project Address: 86127158-Task 50
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 151116052

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

Client Sample ID	MH-1			MH-2			MH-3		
Location	Office of Jason Osborne			Desk of Lavonne Sloop			Office of Frankie Felder		
Lab Sample ID	151116052-184			151116052-185			151116052-186		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	1	13		1	13		1	13	
Pollen									
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores				3	39	12			
Basidiospores	6	78	10				57	741	78
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	6	78	10	3	39	12	12	156	16
Curvularia	1	13	2						
Epicoccum				1	13	4			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	48	624	76	18	234	69			
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	2	26	3	1	13	4	3	39	4
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium							1	13	1
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	63	**819**		26	**338**		73	**949**	

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

506 Laurens Road
Greenville, SC 29607
Phone: (864) 233- 3770
Fax: (864) 233-6589
AIHA-LAP, LLC EMLAP # 173667

Spore Trap Report

Attention: Ben Hestir	Date Sampled: 11/16/15
Terracon	Date Received: 11/16/15
3534 Rutherford Road	Date Analyzed: 11/16/15
Taylors, SC 29687	Date Reported: 11/16/15
	Date Revised:
	Project Name: CU Martin E106/108
	Project Address: 86127158-Task 50
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 151116052

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

Client Sample ID	MH-4			MH-5			MH-6		
Location	Desk of Laura Kinard			Office of Frank Ballentine			Outside 1		
Lab Sample ID	151116052-187			151116052-188			151116052-189		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	1	13							
Pollen							1	13	
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores									
Basidiospores	3	39	13	6	78	12	6	78	11
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	6	78	25	6	78	12	3	39	6
Curvularia				1	13	2			
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	15	195	63	36	468	73	42	546	79
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy							2	26	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)	75			75			75		
TOTAL SPORES/M^3	24	**312**		49	**637**		53	**689**	

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

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

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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

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Greenville, SC 29607
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AIHA-LAP, LLC EMLAP # 173667

Spore Trap Report

Attention: Ben Hestir	Date Sampled: 11/16/15
Terracon	Date Received: 11/16/15
3534 Rutherford Road	Date Analyzed: 11/16/15
Taylors, SC 29687	Date Reported: 11/16/15
	Date Revised:
	Project Name: CU Martin E106/108
	Project Address: 86127158-Task 50
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 151116052

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

Client Sample ID	MH-7			MH-8					
Location	Outside 2			Blank					
Lab Sample ID	151116052-190			151116052-191					
Detection Limit (spores/m^3)	13			13					
Hyphal Fragments									
Pollen									
Spore Trap Used	AOC			AOC					
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%			
Alternaria									
Ascospores									
Basidiospores	54	702	95						
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	3	39	5	No					
Curvularia				Trace					
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus									
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy									
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			0					
Sample Volume(liters)	75			75					
TOTAL SPORES/M^3	57	**741**							

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

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Southeast Environmental Microbiology Laboratories
Chain of Custody

506-A Laurens Rd, Greenville, SC 29607

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

For Lab Use Only			
Condition of samples is acceptable	☒ YES ☐ NO	SEEML Ref #: 151116052	Lab ID: 184 - 191

Company Information	Client Information		Environmental Conditions	
Ben Hestir	Date Sampled:	11/16/15	Precipitation in last 16hrs:	No
Terracon	Project Name:	CU Martin E106/108	Relative Humidity I/O:	32% / 62.5%
3534 Rutherford Rd	Project Address:	86127158 - Task 50	Temperature I/O:	73° / 48°
Taylors, SC 29687	City, State, Zip:	Clemson, SC	Wind Conditions	light breeze
ben.hestir@terracon.com				
864-293-7348				

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
MH-1	Office of Jason Osborne	AOC	1		75	
MH-2	Desk of Lavonne Sloop	"	"		"	
MH-3	Office of Frankie Felder	"	"		"	
MH-4	Desk of Laura Kinard	"	"		"	
MH-5	Office of Frank Ballentine	"	"		"	
MH-6	Outside 1	"	"		"	
MH-7	Outside 2	"	"		"	
MH-8	Blank	"	"		"	

Reliquished By:	Date/Time	Recieved By:	Date/Time
[signature]	11/16/15 10:38 am	[signature]	11/16/15

* Area is only required for culturable surface samples.

** Volume = Pump setting (L/min) x minutes