March 10, 2016

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
Long Hall Room 113A & 113B
Clemson, South Carolina
Terracon Project No. 86127158 – Task 56

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation at Long Hall in Rooms 113A & 113B which have recently been renovated into a single office space for the Office of International Services on the Clemson University campus in Clemson, South Carolina. 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 Long Hall Rooms 113A & 113B on March 7, 2016. Specifically, our efforts focused on the air quality in the office and the immediate vicinity based on concerns expressed to the University facilities staff regarding a musty odor in the newly renovated space.

Long Hall was originally constructed in 1937 for the College of Agriculture. It currently houses the Biology department among others. Terracon conducted airborne mold sampling which consisted of collecting air samples in four locations inside the office space and adjacent kitchen and the collection of two additional samples outside for comparison. Temperature and relative humidity measurements were also collected.

Standard of Care

This sampling 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/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 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.

SAMPLING 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 fungal growth. The assessment focused primarily on collecting observational data (i.e., information obtained by physical assessment of the building and interviews with the building management and maintenance staff). The physical assessment can help to formulate plans for more in-depth investigation.

The physical assessment included:

- an examination in the area of concern of the physical structure and potential indoor and outdoor sources of moisture intrusion in the area of concern; and,
- 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 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 air sample collection, the samples were hand delivered to Southeast Environmental Microbiology Laboratories, Inc. (SEEML), accredited by the American Industrial Hygiene Association (AIHA®) Laboratory Accreditation Programs, LLC under the Environmental Microbiology Laboratory Accreditation Program (EMLAP), Accreditation #173667. Air samples were analyzed by direct microscopic examination and are reported in spores per cubic meter of air (spores/m^3).

To help interpret the 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 an HVAC-supplied building are typically less than, but qualitatively similar to, fungal spore concentrations found in the outside environment.

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.

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 55-2004, 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 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

Physical Assessment

Long Hall is a 4-story building originally constructed in 1937 and has a brick and masonry exterior with interior finishes including metal and plaster walls and vinyl flooring. The renovated office space in Rooms 113A & 113B include new carpeting, new cubicles and a newly installed drop ceiling. Evidence of water intrusion or mold growth was not observed during a cursory visual inspection. The newly renovated space has cubicles for four employees, two of which are still vacant. The one employee present (Mr. Ibrahim) did not report issues with indoor air quality when questioned, but had only been occupying in the space for approximately one week.

Mold Air Sampling

On the afternoon of March 7, 2016 Terracon collected four (4) non-viable mold spore trap samples in Long Hall and in two (2) outdoor locations for comparison.

The four indoor samples were collected at the following locations:

- two within cubicles in Room 113A & 113B;
- one from the top of the air handler in Room 113A & 113B;
- one from the kitchen space near the 113A entrance; and,
- two from outside the building for comparison.

The results of the total spore count samples analyses are summarized in Table 1 below:

Table 1: Summary of Total Spore Count Analyses – March 7, 2016

Sample #	113-1	113-2	113-3	113-4	113-5	113-6
Location Description	**Top of air handler**	**Kitchen area**	**Occupied cubicle – 113B side**	**Vacant cubicle – 113A side**	**Outside SE corner**	**Outside SW corner**
Spore Type	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**
Ascospores	---	---	---	---	39	---
Basidiospores	182	---	78	234	78	273
Cladosporium	13	13	13	78	13	13
Curvalaria	---	---	---	---	---	13
Aspergillis / Penicillium	429	273	663	897	---	195
Smuts/Periconia/ Myxomy	---	---	13	---	---	---
Total	**624**	**286**	**767**	**1,210**	**130**	**494**

Three of the four indoor total spore counts were higher than the results from the two outdoor samples. The dominant genera indoors and outdoors were *Basidiospores* and *Aspergillus / Penicillium*. The weather on the day we sampled was clear and sunny, warm (70.3º F) with a light breeze (winds less than 10 mph).

The laboratory analytical report is attached. Photos from the sampling event are attached.

Temperature and Relative Humidity

Indoor temperatures ranged from 74.6º F to 77.3º F and indoor relative humidity ranged from 24% to 27%. The outdoor temperatures was 70.3º F and outdoor relative humidity was 23% on a clear, warm day.

Indoor temperatures were within recommended comfort ranges but relative humidity was below than the recommended range of 30%-60%.

CONCLUSIONS AND RECOMMENDATIONS

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

- No visual evidence of water intrusion or mold growth was observed in Rooms 113A & 113B.
- Three of the four indoor total spore counts were higher than the spore counts from the two outdoor samples. In winter months outdoor mold spores levels are generally lower and indoor levels may exceed outdoor levels. This is generally not of concern unless indoor levels are substantially higher (i.e. 10 times) than outdoor levels.
- Based on the indoor sample spore counts there is the possibility of an indoor source of Aspergillis/Penicillium, which was identified in one of the two outdoor samples but at a lower level. Terracon recommends inspection and cleaning of the air handler system present in the office, with emphasis on the drain pans and the coils.
- Temperature readings were within normal comfort levels for an office environment in winter. Relative humidity (24% - 27%) was below the EPA recommended range of 30%-60%. Humidity below this range is not necessarily a problem; however, lower humidly levels may cause symptoms of dryness with building occupants.

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
Sr. Project Industrial Hygienist

Attachments: Photographs
Laboratory Results

Photographs



Photo #1 Entry into one side of 113A & 113B office suite – Long Hall



Photo #2 Hallway outside of office suite 113A & 113B in Long Hall



Photo #3 View of Long Hall exterior detail



Photo #4 View of newly renovated office suite 113A & 113B Long Hall



Photo #5 View of adjoining kitchen space in office suite 113A & 113B Long Hall



Photo #6 View of air handler and free standing air filtration unit in office suite 113A & 113B Long Hall

Laboratory Results

SEEML Reference Number:
160308058

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: 03/08/16

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.

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

Attention: Ben Hestir	Date Sampled: 03/07/16
Terracon	Date Received: 03/08/16
72 Pointe Circle	Date Analyzed:
Greenville, SC 29615	Date Reported:
	Date Revised:
	Project Name: CU Long Hall 113A-B
	Project Address: 86127158-Task 56
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 160308058

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

Client Sample ID	113-1			113-2			113-3		
Location	Top of Air Handler			Kitchen Area			Occupied Cubicle 113B		
Lab Sample ID	160308058-194			160308058-195			160308058-196		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	1	13					3	39	
Pollen									
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores									
Basidiospores	14	182	29				6	78	10
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	1	13	2	1	13	5	1	13	2
Curvularia									
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	33	429	69	21	273	95	51	663	86
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy							1	13	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)	75			75			75		
TOTAL SPORES/M^3	48	**624**		22	**286**		59	**767**	

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: 03/07/16
Terracon	Date Received: 03/08/16
72 Pointe Circle	Date Analyzed:
Greenville, SC 29615	Date Reported:
	Date Revised:
	Project Name: CU Long Hall 113A-B
	Project Address: 86127158-Task 56
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 160308058

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

Client Sample ID	113-4			113-5			113-6		
Location	Vacant Cubicle 113A			Outside Long Hall SE Corner			Outside Long Hall SW Corner		
Lab Sample ID	160308058-197			160308058-198			160308058-199		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	3	39					1	13	
Pollen				3	39		2	26	
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	30			
Basidiospores	18	234	19	6	78	60	21	273	55
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	6	78	6	1	13	10	1	13	3
Curvularia							1	13	3
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	69	897	74				15	195	39
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy									
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	93	**1210**		10	**130**		38	**494**	

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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AIHA-LAP, LLC EMLAP # 173667

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

For Lab Use Only			
Condition of samples is acceptable	☒ YES ☐ NO	SEEML Ref #: 160308058	Lab ID: 194 - 199

Company Information		Client Information		Environmental Conditions	
(Project Manager)	Ben Hestir	Date Sampled:	3/7/2016	Precipitation in last 16hrs:	None
(Company Name)	Terracon	Project Name:	86127158 - Task 56	Relative Humidity I/O:	24.8% / 26.8%
(Address)	72 Pointe Circle	Project Address:	CU Long Hall 113A-B	Temperature I/O:	75.5°F / 68° F
(City, State, Zip)	Greenville, SC 29615	City, State, Zip:	Clemson, SC	Wind Conditions	light breeze
(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
113-1	Top of Air Handler	AOC	1		75	
113-2	Kitchen Area	"	"		"	
113-3	Occupied cubicle 113B	"	"		"	
113-4	Vacant cubicle 113A	"	"		"	
113-5	Outside Long Hall SE corner	"	"		"	
113-6	Outside Long Hall SW corner	"	"		"	

Reliquished By:	Date/Time	Recieved By:	Date/Time
Ben Hestir	10:38am 3/8/16		3-08-16

* Area is only required for culturable surface samples.

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