June 15, 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
Redfern Health Center
Basement Level Offices
Clemson, South Carolina
Terracon Project No. 86127158 – Task 61

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in two basement level offices within the Redfern Health Center 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 performed limited indoor air quality (IAQ) testing in the basement level offices of Angee Pearson and Cary Williford on June 3, 2016. Specifically, our efforts focused on identifying levels of mold spores in the offices and measuring temperature and relative humidity.

Redfern Health Center provides medical services to the students at Clemson University. The building was constructed in 1969 and consists of approximately 40,000 square feet on two floors. Terracon conducted airborne mold sampling which consisted of collecting air samples in three locations in two lower level offices and the library and 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.

Mold Sampling

Total (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 in a conditioned setting wearing light summer clothing. Higher temperatures require lower humidity for comfort.

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

Mold Air Sampling

On the afternoon of Friday, June 3, 2016, Terracon collected three (3) mold spore trap samples on the lower level of Redfern Health Center and two (2) outdoor samples for comparison. Evidence of water intrusion was not observed during a cursory visual inspection. Sample locations and total spore count samples analyses are summarized in Table 1 below.

Table 1: Summary of Total Spore Count Analyses – June 3, 2016

Sample #	RHC-1	RHC-2	RHC-3	RHC-4	RHC-5
Location Description	**Office of Angee Pearson**	**Office of Cary Williford**	**Library – Room G12B**	**Outside front entrance**	**Outside in parking lot**
Spore Type	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**	**Spores/m^3**
Alternaria	13	---	---	26	13
Ascospores	---	---	---	624	273
Basidiospores	13	---	---	195	351
Bipolaris/Drechslera	---	---	---	---	---
Cladosporium	195	13	13	1,500	1,130
Curvalaria	---	---	---	---	13
Epiccocum	39	---	---	---	26
Aspergillus / Penicillium	195	39	39	---	---
Smuts/Periconia/ Myoxmycetes	---	---	---	26	26
Tetraploa	---	---	---	---	13
Torula	---	---	---	52	---
Total	**455**	**52**	**52**	**2,420**	**1,850**

The highest total spore count inside was approximately one-quarter of the lowest outside total spore count. The dominant indoor genera were *Aspergillus/Penicillium and Cladosporium.* The dominant genus outdoors was *Cladosporium.* The laboratory analytical report is attached.

Temperature and Relative Humidity

The indoor temperature in Angee Pearson's office was 72.6º F and the relative humidity was 57.7%. The indoor temperature in Cary Williford's office was 72.8º F and the relative humidity was 59.0%. The outdoor temperature was 93.0º F and the relative humidity was 87.0% on a sunny, hot day.

Indoor temperatures and humidity levels were within recommended comfort ranges, although ideally the relative humidity would be closer to 50%.

CONCLUSIONS AND RECOMMENDATIONS

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

- Indoor fungal spore counts were not elevated as compared to outside air.
- Temperature and relative humidity measurements were within acceptable ranges for indoor workspaces at this time of year; however this is a spot measurement. Terracon recommends adjusting the air handler for the lower level to reduce the relative humidity closer to 50% if possible.
- No water intrusion or visible mold growth was observed. Angee Pearson and Cary Williford both spoke of health issues that they believed may be connected to indoor air quality.

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

Scott D. Rohlf, CIH
Senior Staff Industrial Hygienist

Attachments: Laboratory Results

Laboratory Results

SEEML Reference Number:
160606022

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: 06/06/16

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: 6/3/2016
Terracon	Date Received: 6/6/2016
72 Pointe Circle	Date Analyzed: 6/6/2016
Greenville, SC 29615	Date Reported: 6/6/2016
	Date Revised:
	Project Name: Red Fern Health Center
	Project Address: 86127158- Task 61
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 160606022

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

Client Sample ID	RHC-1			RHC-2			RHC-3		
Location	Office Of Angee Pearson			Office Of Cary Willford			Library Room 612b		
Lab Sample ID	160606022-058			160606022-059			160606022-060		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments	1	13		2	26				
Pollen									
Spore Trap Used	AOC			AOC			AOC		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores	1	13	3						
Basidiospores	1	13	3						
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	15	195	43	1	13	25	1	13	25
Curvularia									
Epicoccum	3	39	9						
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	15	195	43	3	39	75	3	39	75
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy									
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			2			2		
Sample Volume(liters)	75			75			75		
TOTAL SPORES/M^3	35	**455**		4	**52**		4	**52**	

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: 6/3/2016
Terracon	Date Received: 6/6/2016
72 Pointe Circle	Date Analyzed: 6/6/2016
Greenville, SC 29615	Date Reported: 6/6/2016
	Date Revised:
	Project Name: Red Fern Health Center
	Project Address: 86127158- Task 61
	Project City, State, ZIP: Clemson, SC
	SEEML Reference # : 160606022

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

Client Sample ID	RHC-4			RHC-5					
Location	Outside RHF Entrance			Outside Parking lot					
Lab Sample ID	160606022-061			160606022-062					
Detection Limit (spores/m^3)	13			13					
Hyphal Fragments									
Pollen	4	52		1	13				
Spore Trap Used	AOC			AOC					
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%			
Alternaria	2	26	1	1	13	<1			
Ascospores	48	624	26	21	273	15			
Basidiospores	15	195	8	27	351	19			
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	115	1500	62	87	1130	61			
Curvularia				1	13	<1			
Epicoccum				2	26	1			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus									
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	2	26	1	2	26	1			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa				1	13	<1			
Torula	4	52	2						
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3					
Sample Volume(liters)	75			75					
TOTAL SPORES/M^3	186	**2420**		142	**1850**				

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

Southeast Environmental Microbiology Laboratories
Chain of Custody

506 Laurens Rd, 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 #: 1606060022	Lab ID: 056 - 062

Company Information		Client Information		Environmental Conditions	
(Project Manager)	Ben Hestir	Date Sampled:	6/3/16	Precipitation in last 16hrs:	
(Company Name)	Terracon	Project Name:	Redfern Health Center	Relative Humidity I/O:	/
(Address)	72 Ponte Circle	Project Address:	86127158-Task 61	Temperature I/O:	/
(City, State, Zip)	Greenville, SC 29615	City, State, Zip:	Clemson, SC	Wind Conditions	
(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
RHC-1	Office of Angee Pearson	AOC	1		75	
RHC-2	Office of Cary Williford	"	"		"	
RHC-3	Library - Room 612B	"	"		"	
RHC-4	Outside - RHC entrance	"	"		"	
RHC-5	Outside - Parking Lot	"	"		"	

Reliquished By:	Date/Time	Recieved By:	Date/Time
Ben Hestir	6/6/16 0915		6-6-16

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