January 15, 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
Institute for Environmental Toxicology – Room L125
Pendleton, South Carolina
Terracon Project No. 86127158 – Task 123

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in Room L125 in the Clemson Institute for Environmental Toxicology (CIET) located in Pendleton, South Carolina. University employees working in this space expressed concern regarding potential water damage and mold in this office space. 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 including the collection of three (3) air samples (spore traps) in Room L125 and the immediate vicinity on January 4, 2018. Room L125 consists of approximately 100 square feet and is currently unoccupied. We were given access to the building by the building maintenance person, Ron Gossett and Jeff Allen, director of the SC Water Resources Center pointed out the room of concern.

The investigation included measurements of temperature and relative humidity; and collection of airborne mold samples. Two samples were additionally collected outside the building 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

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 spore trap 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

- A ceiling tile was removed above the desk and fiberglass insulation with black stains was observed.
- Black plastic was taped over the bookshelf below the missing ceiling tile in an apparent attempt to direct a leak into a trash can.
- There was nothing observed that indicated that the leak was current.
- Accumulations of a black particulate were observed beneath the HVAC supply in Room L125 on filing cabinets and on the items stored on the filing cabinets.
- Rodent droppings were observed on the desk in Room L125.
- The heat was running at the time of our investigation.
- Photographs from the assessment are attached.

Mold Air Sampling Results

The results of the total spore count samples analyses and IAQ measurements are presented in Table 1. The laboratory analytical reports are attached.

Table 1 – Analytical Results and Temperature/Relative Humidity readings – January 4, 2018

Sample #	L125-1	L125-2	L125-3	L125-4	L125-5
Location	On desk in Room L125	On filing cabinet in Room L125	Outside of Room L125 where grad student cubicles were removed	Outside south entrance to bldg.	Outside – in employee parking
Spore Type	Spores/m³	Spores/m³	Spores/m³	Spores/m³	Spores/m³
Ascospores	39	13	---	13	117
Aspergillus/ Penicillium	117	39	156	156	78
Basidiospores	156	39	---	351	234
Cladosporium	13	39	39	195	78
Curvularia	13	---	---	---	---
Epicoccum	---	---	---	13	13
Myxomycetes/ Perconia/Smut	---	---	---	26	52
Total	**338**	**130**	**195**	**754**	**572**
Temperature - degrees F.	71.7	74.3	73.9	32	---
Relative Humidity (%)	8	6.7	6.7	17.5	---

The lowest total spore count outside was approximately 1.7 times higher than the highest spore count inside. The dominant mold genera indoors were *Basidiospores* and *Penicillium/Aspergillus.* The dominant mold spore types outdoors were *Basidiospores* and *Cladosporium*. Conditions outside on the day we sampled were clear, cold, and windy.

Temperature and Relative Humidity

The highest indoor temperature was 74.3ºF and the highest indoor relative humidity was 8%. The outdoor temperature was 32ºF and the relative humidity was 17.5% (See Table 1 above for all readings).

CONCLUSIONS

The following conclusions are provided based on our assessment:

- The results of mold air sampling indicated that total airborne mold spore concentrations inside the building were below the total mold spore levels measured in the two outdoor samples. The dominant mold genera indoors were *Basidiospores* and *Penicillium/Aspergillus.* The dominant mold spore types outdoors were *Basidiospores* and *Cladosporium*. The higher percentage of *Penicillium/Aspergillus* in the indoor samples may indicate past humidity, water intrusion, or general housekeeping.

- Temperature levels measured were within ASHRAE guideline ranges.

- Relative humidity levels measured were below the lower range of 20% recommended by EPA for indoor air.

- Accumulations of a black particulate observed beneath the HVAC supply appear to be granular, not biological, and may have come from above the ceiling tile possibly debris from a past roofing replacement.

RECOMMENDATIONS

The following recommendations are provided based on our assessment:

- Terracon could not conclusively determine the source of the reported leak. Cleaning of particulate accumulations and rodent droppings should be conducted in Room L125. Accumulations of a black particulate observed beneath the HVAC supply appear to be granular, not biological, and may have come from above the ceiling tile. The buildings rodent control program should be evaluated to ensure controls are working.

- Discolored fiberglass insulation above the ceiling grid and ceiling tile should be replaced. Any debris above the ceiling tile should also be cleaned.

- Sustained low humidity levels below 20% may cause additional complaints with building occupants in office spaces. Terracon recommends to periodically monitor the space for relative humidity to verify if this low humidity is an outlier due to the weather.

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: Photographs
Laboratory Results

Photographs



Photo #1 Room assessed at Clemson Institute for Environmental Toxicology



Photo #2 View of black plastic over bookshelf and missing ceiling tile



Photo #3 View of insulation above drop ceiling



Photo #4 View of discolored office chair in Room L125



Photo #5 View of black particulate beneath HVAC supply in Room L125



Photo #6 View of rodent droppings on desk in Room L125



Photo #7 View of supply and return ducts in Room L125



Photo #8 View of CIET building looking west from employee parking lot

Laboratory Results

SEEML Reference Number:
180104042

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: 01/04/18

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: 01/04/18
Terracon	Date Received: 01/04/18
72 Pointe Circle	Date Analyzed: 01/04/18
Greenville, SC 29615	Date Reported: 01/04/18
	Date Revised:
	Project Name: Clemson Entox L125
	Project Numner: 86127158 Task-108
	Project City, State, ZIP:
	SEEML Reference # : 180104042

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

Client Sample ID	L125-1			L125-2			L125-3		
Location	On Desk			On Filing Cabinet			In Adjacent Room		
Lab Sample ID	180104042-142			180104042-143			180104042-144		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments									
Pollen									
Spore Trap Used	Allergenco			Allergenco			Allergenco		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores	3	39	12	1	13	10			
Basidiospores	12	156	46	3	39	30			
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	1	13	4	3	39	30	3	39	20
Curvularia	1	13	4						
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	9	117	35	3	39	30	12	156	80
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	26	**338**		10	**130**		15	**195**	

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: 01/04/18
Terracon	Date Received: 01/04/18
72 Pointe Circle	Date Analyzed: 01/04/18
Greenville, SC 29615	Date Reported: 01/04/18
	Date Revised:
	Project Name: Clemson Entox L125
	Project Numner: 86127158 Task-108
	Project City, State, ZIP:
	SEEML Reference # : 180104042

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

Client Sample ID	L125-4			L125-5					
Location	Outside- Front			Outside- Employee Parking					
Lab Sample ID	180104042-145			180104042-146					
Detection Limit (spores/m^3)	13			13					
Hyphal Fragments	1	13		2	26				
Pollen									
Spore Trap Used	Allergenco			Allergenco					
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%			
Alternaria									
Ascospores	1	13	2	9	117	20			
Basidiospores	27	351	47	18	234	41			
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	15	195	26	6	78	14			
Curvularia									
Epicoccum	1	13	2	1	13	2			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	12	156	21	6	78	14			
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy	2	26	3	4	52	9			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3					
Sample Volume(liters)	75			75					
TOTAL SPORES/M^3	58	**754**		44	**572**				

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

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Southeast Environmental Microbiology Laboratories
Chain of Custody

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For Lab Use Only			
Condition of samples is acceptable	☒ YES ☐ NO	SEEML Ref #: 180104042	Lab ID: 142 - 146

Company Information		Client Information		Environmental Conditions	
(Project Manager)	Ben Hesfir	Date Sampled:	1/4/18	Precipitation in last 16hrs:	
(Company Name)	Terracon	Project Name:	Clemson Entox L125	Relative Humidity I/O:	6.7% / 17.5%
(Address)	72 Pointe Circle	Project Address:	86127158 Task-	Temperature I/O:	73.9° / 32°
(City, State, Zip)	Greenville, SC 29615	City, State, Zip:		Wind Conditions	steady breeze
(Phone)	864-293-7348				
(Email)	ben.hesfir@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
L125-1	On desk	A	1		75	
L125-2	On filing cabinet	"	"		"	
L125-3	In adjacent room	"	"		"	
L125-4	Outside - front	"	"		"	
L125-5	Outside - employee parking	"	"		"	

Reliquished By: Ben Hesfir Date/Time 1/4/18 11:45 am

Recieved By: Date/Time 1/4/18

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