November 30, 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
Clemson Online Offices
502 Lebanon Road
Pendleton, South Carolina 29670
Terracon Project No. 86127158 – Task 74

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in the offices of Clemson Online, located at 502 Lebanon Road in Pendleton, South Carolina after a complaint by an employee regarding indoor air quality. 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 the offices of Clemson Online on November 9, 2016. Reportedly, employees there have been experiencing health related issues which they feel may be related to indoor air quality in the offices. The Clemson Online staff moved into the offices in August 2016.

Terracon made measurements of temperature and relative humidity and conducted airborne mold sampling which consisted of collecting spore trap air samples in four 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.

## SAMPLING CRITERIA AND METHODS

### Mold Sampling

Total mold 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), Greenville, SC. 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 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.

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

- The air handler in the lobby was very noisy.
- There were numerous supply registers in Ms. Perkins office leading one to believe that the space was used for something other than an office previously.
- A water leak or intrusion issue in the entrance breezeway was reported by the receptionist, thus the collection of a sample in that area.
- The second floor had scattered water staining on the drop ceiling and reportedly the roof is scheduled to be replaced.

## Mold Air Sampling

On the afternoon of November 9, 2016, Terracon collected four mold spore trap samples inside the offices at Clemson Online and two samples in outdoor locations 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 – November 9, 2016

| Sample # | 502-1 | 502-2 | 502-3 | 502-4 | 502-5 | 502-6 |
|---|---|---|---|---|---|---|
| **Location Description** | **Perkins desk** | **Pelt desk** | **2nd Floor Classroom** | **Entrance Breezeway** | **Outside entrance in parking lot** | **Outside on far side of parking lot** |
| **Spore Type** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** |
| Ascospores | --- | 13 | --- | 52 | 104 | 221 |
| Basidiospores | --- | 156 | 39 | 585 | 624 | 2,260 |
| Bipolaris/Dreschlera | --- | --- | --- | --- | 13 | --- |
| *Cladosporium* | 13 | 13 | 13 | 78 | 1,600 | 2,070 |
| *Epicoccum* | --- | --- | --- | 13 | --- | 26 |
| Nigrospora | --- | --- | --- | 13 | --- | --- |

| Sample # | 502-1 | 502-2 | 502-3 | 502-4 | 502-5 | 502-6 |
|---|---|---|---|---|---|---|
| **Location Description** | **Perkins desk** | **Pelt desk** | **2nd Floor Classroom** | **Entrance Breezeway** | **Outside entrance in parking lot** | **Outside on far side of parking lot** |
| **Spore Type** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** | **Spores/m³** |
| *Penicillium/ Aspergillus* | 39 | --- | 78 | 390 | 156 | 117 |
| Smuts/*Periconia*/ Myxomycetes | --- | 13 | --- | 78 | 65 | 78 |
| *Speggazinia* | --- | --- | --- | --- | 13 | --- |
| **Total** | **52** | **195** | **130** | **1,210** | **2,580** | **4,770** |

There was visual evidence of a previous water leak into the entrance breezeway and the spore count there was at least six times higher than any measured in the offices. The highest indoor office total spore count was approximately 8% of the lowest total spore count outside. The dominant molds indoors were Basidiospores and *Penicillium/Aspergillus*. The dominant mold types outdoors were *Cladosporium* and Basidiospores. The weather on the day we sampled was warm (71ºF) and sunny with a light breeze (winds less than 10 mph).

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

### Temperature and Relative Humidity

The indoor temperature was 73ºF and the relative humidity was 34%. The outdoor temperature was 71ºF and the relative humidity was 23%.

## CONCLUSIONS

The following conclusions are provided based on our assessment:

- Total spore counts inside were lower than outdoor air.
- *Aspergillus/Penicillium* was identified at a slightly higher spore count in the breezeway versus outside indicating there may have been an indoor mold issue in this area at some point, but the data is not absolutely conclusive.
- Temperature and relative humidity were within acceptable ASHRAE and EPA guidelines.
- The offices appeared to be in good condition with no obvious dust accumulations or mold growth.
- The office downstairs (occupied by Katherine Perkins) had multiple HVAC supply and return registers, suggesting it had previously been used for something other than an office.

- Staff members reported scattered roof leaks (stains were observed) occurring periodically and stated that a roof replacement was forthcoming based on discussions with Clemson Facilities.

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** View of Clemson Online offices facing south

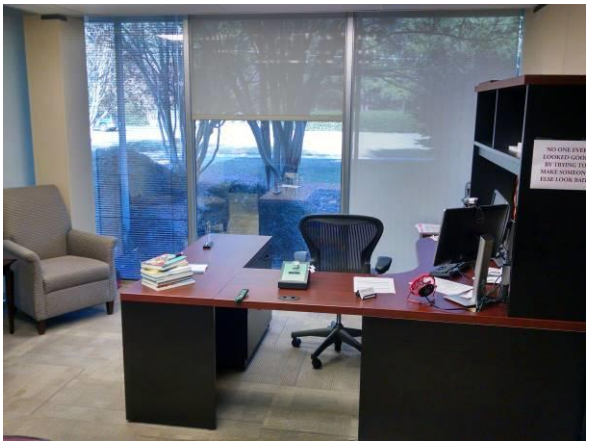


**Photo #2** Office of Katherine Perkins – northeast corner of ground floor



**Photo #3** Some of the supply ducts in Ms. Perkins office.



**Photo #4** Office of April Pelt – on interior of 2nd floor offices



**Photo #5** Evidence of water leaks in 2nd floor classroom

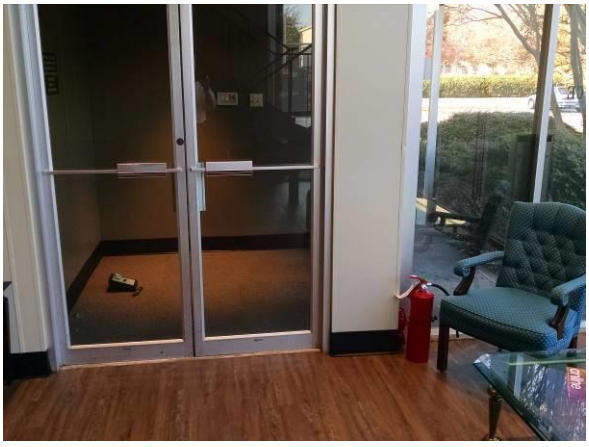


**Photo #6** Entrance breezeway



**Photo #7** Location of outdoor sample 502-5 near entrance



**Photo #8** Location of outdoor sample 502-6 north end of parking lot

# Laboratory Results

SEEML Reference Number:
161110046

**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: 11/10/16

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: 11/09/16 |
| Terracon | Date Received: 11/10/16 |
| 72 Pointe Circle | Date Analyzed: 11/10/16 |
| Greenville, SC 29615 | Date Reported: 11/10/16 |
| | Date Revised: |
| | Project Name: Clemson Online |
| | Project Address: 86127158 Task 74 |
| | Project City, State, ZIP: |
| | SEEML Reference # : 161110046 |

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

| Client Sample ID | 502-1 | | | 502-2 | | | 502-3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | Perkins Office | | | Pelt Office | | | 2nd Floor Classroom | | |
| Lab Sample ID | 161110046-148 | | | 161110046-149 | | | 161110046-150 | | |
| Detection Limit (spores/$m^3$) | 13 | | | 13 | | | 13 | | |
| Hyphal Fragments | | | | | | | | | |
| 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 | 7 | | | |
| Basidiospores | | | | 12 | 156 | 80 | 3 | 39 | 30 |
| Bipolaris/Drechslera | | | | | | | | | |
| Chaetomium | | | | | | | | | |
| Cladosporium | 1 | 13 | 25 | 1 | 13 | 7 | 1 | 13 | 10 |
| Curvularia | | | | | | | | | |
| Epicoccum | | | | | | | | | |
| Cercospora | | | | | | | | | |
| Fusarium | | | | | | | | | |
| Memnoniella | | | | | | | | | |
| Nigrospora | | | | | | | | | |
| Penicillium/Aspergillus | 3 | 39 | 75 | | | | 6 | 78 | 60 |
| Polythrincium | | | | | | | | | |
| Rusts | | | | | | | | | |
| Smuts/Periconia/Myxomy | | | | 1 | 13 | 7 | | | |
| Spegazzinia | | | | | | | | | |
| Stachybotrys | | | | | | | | | |
| Stemphylium | | | | | | | | | |
| Tetraploa | | | | | | | | | |
| Torula | | | | | | | | | |
| Ulocladium | | | | | | | | | |
| Colorless/Other Brown 2 | | | | | | | | | |
| Oidium | | | | | | | | | |
| Zygomycetes | | | | | | | | | |
| Pithomyces | | | | | | | | | |
| Background debris (1-5)3 | 1 | | | 2 | | | 3 | | |
| Sample Volume(liters) | 75 | | | 75 | | | 75 | | |
| **TOTAL SPORES/$M^3$** | 4 | **52** | | 15 | **195** | | 10 | **130** | |

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: 11/09/16 |
| Terracon | Date Received: 11/10/16 |
| 72 Pointe Circle | Date Analyzed: 11/10/16 |
| Greenville, SC 29615 | Date Reported: 11/10/16 |
| | Date Revised: |
| | Project Name: Clemson Online |
| | Project Address: 86127158 Task 74 |
| | Project City, State, ZIP: |
| | SEEML Reference # : 161110046 |

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

| Client Sample ID | 502-4 | | | 502-5 | | | 502-6 | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | Entrance Breezeway | | | Outside- Entrance | | | Outside- Parking | | |
| Lab Sample ID | 161110046-151 | | | 161110046-152 | | | 161110046-153 | | |
| Detection Limit (spores/$m^3$) | 13 | | | 13 | | | 13 | | |
| Hyphal Fragments | | | | | | | | | |
| 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 | 4 | 52 | 4 | 8 | 104 | 4 | 17 | 221 | 5 |
| Basidiospores | 45 | 585 | 48 | 48 | 624 | 24 | 174 | 2260 | 47 |
| Bipolaris/Drechslera | | | | 1 | 13 | <1 | | | |
| Chaetomium | | | | | | | | | |
| Cladosporium | 6 | 78 | 6 | 123 | 1600 | 62 | 159 | 2070 | 43 |
| Curvularia | | | | | | | | | |
| Epicoccum | 1 | 13 | 1 | | | | 2 | 26 | <1 |
| Cercospora | | | | | | | | | |
| Fusarium | | | | | | | | | |
| Memnoniella | | | | | | | | | |
| Nigrospora | 1 | 13 | 1 | | | | | | |
| Penicillium/Aspergillus | 30 | 390 | 32 | 12 | 156 | 6 | 9 | 117 | 2 |
| Polythrincium | | | | | | | | | |
| Rusts | | | | | | | | | |
| Smuts/Periconia/Myxomy | 6 | 78 | 6 | 5 | 65 | 3 | 6 | 78 | 2 |
| Spegazzinia | | | | 1 | 13 | <1 | | | |
| 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** | | 198 | **2580** | | 367 | **4770** | |

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



| For Lab Use Only | | | |
|---|---|---|---|
| Condition of samples is acceptable | ☑ YES ☐ NO | SEEML Ref #: 161110046 | Lab ID: 148 - 153 |

| Company Information | | Client Information | | Environmental Conditions | |
|---|---|---|---|---|---|
| (Project Manager) | Ben Hestir | Date Sampled: | 11-9-16 | Precipitation in last 16hrs: | None |
| (Company Name) | Terracon | Project Name: | Clemson Online | Relative Humidity I/O: | 33% / 20% |
| (Address) | 72 Pointe Circle | Project Address: | 86127158 Task 74 | Temperature I/O: | 73°F / 73°F |
| (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 |
|---|---|---|---|---|---|---|
| 502-1 | Perkins office | AOC | 1 | | 75 | |
| 502-2 | Polt office | " | " | | " | |
| 502-3 | 2nd floor classroom | " | " | | " | |
| 502-4 | Entrance breezeway | " | " | | " | |
| 502-5 | Outside - entrance | " | " | | " | |
| 502-6 | Outside - parking | " | " | | " | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Relinquished By: | Date/Time | Recieved By: | Date/Time |
|---|---|---|---|
| Ben Hestir | 11/10/16 1315 | | 11-10-16 |

* Area is only required for culturable surface samples.

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