November 10, 2017

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
Center for Applied Technology – Room C3
Pendleton, South Carolina
Terracon Project No. 86127158 – Task 116

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in Room C3 in the Center for Applied Technology (CAT Building), Pendleton, South Carolina. Reports of musty odors have been reported from the occupant of Room C3. 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 air samples (spore traps) in Room C3 on October 31, 2017. Room C3 consists of 2,783 square feet and is occupied by Ansell, a glove manufacturer. The space includes a conference room and meeting room, a sewing research area and material and file storage.

The investigation included measurements of temperature and relative humidity in the areas where the air samples were collected. Also, two (2) spore trap samples were 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 slight musty odor was present when the room was first unlocked for our sampling event.
- The room had multiple functional spaces including two meeting areas, a break area with coffee makers, a research sewing area and an area which contained material and file storage shelving units.
- Site staff reported condensation issues which began after a recent roof replacement.
- Some ceiling tiles were noted to be curled, which may suggest high humidity.
- Bill Hurst of Clemson Facilities reported that there is one air handler serving the front office area that is not functioning and believes it could be contributing to the slight odor we observed.
- 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. Sample locations are shown on the attached Figure 1.

Table 1 – Analytical Results and Temperature/Relative Humidity readings

Sample #	C3-1	C3-2	C3-3	C3-4	C3-5	C3-6
Location	Coffee/Reception Area	Reception near the flat screen	Near sewing area	SE corner of storage area	Outside – picnic table	Outside in SW parking
Spore Type	Spores/m³	Spores/m³	Spores/m³	Spores/m³	Spores/m³	Spores/m³
Ascospores	¾	¾	¾	¾	78	39
Aspergillus/ Penicillium	273	78	¾	195	273	234
Basidiospores	39	117	78	¾	741	507
Bipolaris/Dreschlerea	---	---	---	---	13	
Cladosporium	13	13	13	13	273	1,790
Epicoccum	¾	¾	¾	¾	---	13
Myxomycetes/ Perconia/Smut	¾	13	¾	¾	91	39
Nigrospora	¾	¾	¾	¾	¾	13
Spegazzinia	¾	¾	¾	¾	¾	13
Torula	¾	¾	¾	¾	13	¾
Zygomycetes	¾	¾	¾	¾	¾	52
Total	**325**	**221**	**91**	**208**	**1,480**	**2,700**
Temperature - degrees F.	69.6	70.7	71	70.8	74.8	¾
Relative Humidity (%)	46.3	45.4	44.9	45.2	35.6	¾

The lowest total spore count outside was approximately 4.5 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 warm and sunny.

The laboratory analytical report is attached.

Temperature and Relative Humidity

The highest indoor temperature was 71ºF and the highest indoor relative humidity was 46.3%. The outdoor temperature was 74.8ºF and the relative humidity was 35.6% (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 and mold genera detected indoors were detected at lower levels than outdoors. This is considered a favorable condition.
- Currently, condensation issues reported by site staff do not appear to impact indoor air quality. Ceiling tile "curling" may be a symptom of moisture levels above the ceiling grid.
- Temperature and relative humidity levels measured were within EPA/ASHRAE guideline ranges.

RECOMMENDATIONS

The following recommendations are provided based on our assessment:

- Resolution of the reported condensation issue associated with the roof replacement should be confirmed with Clemson Facilities. Terracon did not access above the ceilings to measure relative humidity, if humidity levels are elevated (>60%) above the ceiling or indoor condensation exists the potential for mold growth may occur. Ceiling tile "curling" may be a symptom of moisture levels above the ceiling grid. The space should be monitored for mold until corrective actions are conducted.
- The HVAC unit not functioning should be corrected.

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: Figure 1 – Air Sample Locations
Photographs
Laboratory Results

Figure 1 – Air Sample Locations

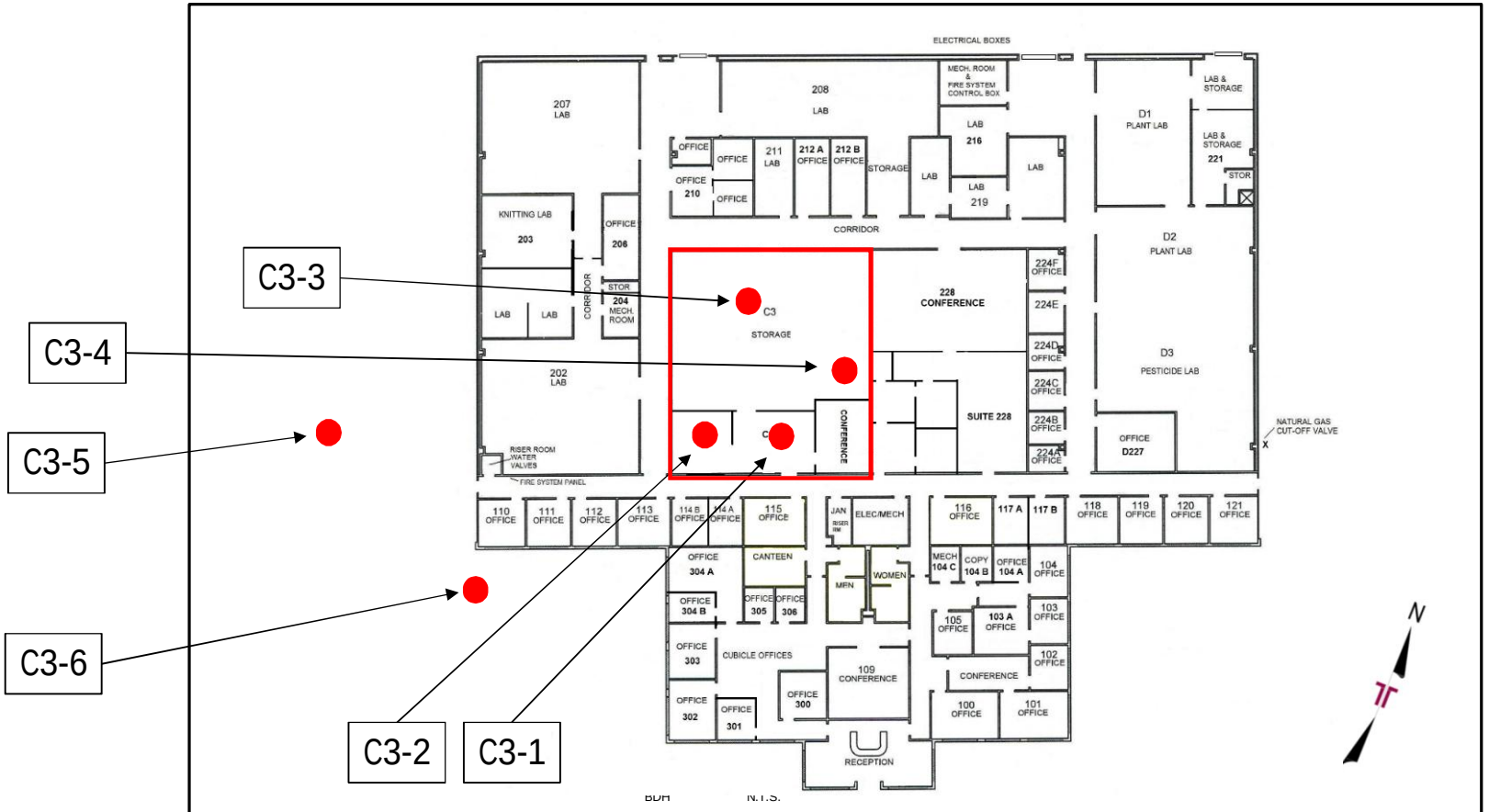


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	BDH
Drawn by:	BDH
Checked by:	JAG
Approved by:	JAG
Project No.	86127158 – Task 116
Scale:	N.T.S.
File Name:	Figure 1.ppt
Date:	11/9/2017

Terracon
Consulting Engineers & Scientists
72 Pointe Circle Greenville, South Carolina 29615
PH. (864) 292-2901 FAX. (864) 292-6301

SAMPLE LOCATION DIAGRAM

Center for Applied Technology Building
Pendleton, South Carolina

Figure 1

● = air sample location ▭ = area assessed

Photographs



Photo #1 Entrance to Room C3



Photo #2 Reception/Coffee area in Room C3



Photo #3 Sewing area in Room C3



Photo #4 Material/File storage shelving units



Photo #5 Location of outside samples on SW corner of building



Photo #6 Ceiling grid in reception area with slightly curled tiles

Laboratory Results

SEEML Reference Number:
171101023

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
- ☐ Andersen Fungal Report
- ☐ Quantitative Direct Exam Report
- ☐ Quantitative Fungal Report

Lab Manager Review: Rafael Berrios Date: 11/01/17

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

	Date Sampled: 10/31/17
Terracon	Date Received: 11/01/17
72 Pointe Circle	Date Analyzed: 11/01/17
Greenville, SC 29615	Date Reported: 11/01/17
	Date Revised:
	Project Name: CAT Room C3
	Project Address: 86127158- Task 116
	Project City, State, ZIP:
	SEEML Reference # : 171101023

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

Client Sample ID	C3-1			C3-2			C3-3		
Location	Rm C3- Coffee/ Reception Area			Rm C3- Near Flat Screen			Rm C3- N End of Sewing Area		
Lab Sample ID	171101023-062			171101023-063			171101023-064		
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									
Basidiospores	3	39	12	9	117	53	6	78	86
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	1	13	4	1	13	6	1	13	14
Curvularia									
Epicoccum									
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	21	273	84	6	78	35			
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy				1	13	6			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			2		
Sample Volume(liters)	75			75			75		
TOTAL SPORES/M^3	25	**325**		17	**221**		7	**91**	

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

	Date Sampled: 10/31/17
Terracon	Date Received: 11/01/17
72 Pointe Circle	Date Analyzed: 11/01/17
Greenville, SC 29615	Date Reported: 11/01/17
	Date Revised:
	Project Name: CAT Room C3
	Project Address: 86127158- Task 116
	Project City, State, ZIP:
	SEEML Reference # : 171101023

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

Client Sample ID	C3-4			C3-5			C3-6		
Location	Rm C3- SE Corner of Storage Area			Outside- Picnic Table			Outside in SW Parking Area		
Lab Sample ID	171101023-065			171101023-066			171101023-067		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments									
Pollen				1	13				
Spore Trap Used	Allergenco			Allergenco			Allergenco		
	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%	raw ct.	spores/m^3	%
Alternaria									
Ascospores				6	78	5	3	39	1
Basidiospores				57	741	50	39	507	19
Bipolaris/Drechslera				1	13	<1			
Chaetomium									
Cladosporium	1	13	6	21	273	18	138	1790	66
Curvularia									
Epicoccum							1	13	<1
Cercospora									
Fusarium									
Memnoniella									
Nigrospora							1	13	<1
Penicillium/Aspergillus	15	195	94	21	273	18	18	234	9
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy				7	91	6	3	39	1
Spegazzinia							1	13	<1
Stachybotrys									
Stemphylium									
Tetraploa									
Torula				1	13	<1			
Ulocladium									
Colorless/Other Brown 2									
Oidium									
Zygomycetes							4	52	2
Pithomyces									
Background debris (1-5)3	2			3			3		
Sample Volume(liters)	75			75			75		
TOTAL SPORES/M^3	16	**208**		114	**1480**		208	**2700**	

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

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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.

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