May 2, 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
104A Eaton Circle – Thornhill Village
Clemson, South Carolina
Terracon Project No. 86127158 – Task 59

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in the residential unit at 104A Eaton Circle in Thornhill Village 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 the residential housing unit at 104A Eaton Circle on April 21, 2016. Specifically, our efforts focused on the air quality in the residence based on concerns expressed by the residents regarding a musty odor in their closet and health issues they had reportedly recently experienced. The residents were Briana Firth and Jessie Bynum.

Thornhill Village was originally constructed in the early 1960's as undergraduate residential housing. The buildings within Thornhill are duplexes and 104A Eaton Circle is a 2-bedroom, 1-bathroom unit which includes a living room, storage closet and kitchen. Terracon conducted airborne mold sampling which consisted of collecting air samples in five locations inside the residence 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.

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 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 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

The duplex at 104 Eaton Circle is a 1-story building is believed to have been constructed in the early 1960's and has a brick exterior with CMU walls on a concrete slab. Evidence of water intrusion or mold growth was not observed during a cursory visual inspection. A strong sewage-like odor was observed in the interior storage closet in the residence located on the right side of the living room as you enter the front door.

At the time of our assessment, Ms. Firth was in the process of moving out to another residence which she stated was due to her ongoing respiratory irritation associated with asthma and living in 104A. She and her roommate, Ms. Jessie Bynum, reported that there had been a humidity problem that occurred in November 2015 which caused mold growth on their personal belongings. Terracon doesn't know if there was any specialized cleaning of the residence after the reported issue in November 2015. The occupants also stated they were reimbursed for several of their personal belongings. It is unclear on whether they disposed of the old belongings affected by mold.

General photographs from the assessment are attached.

Mold Air Sampling

On the afternoon of April 21, 2016, Terracon collected five (5) non-viable mold spore trap samples inside the residence at 104A Eaton Circle and two (2) outdoor samples for comparison. Sample locations and total spore count samples analyses are summarized in Table 1 below.

Table 1: Summary of Total Spore Count Analyses – April 21, 2016

Sample #	**104A-1**	**104A-2**	**104A-3**	**104A-4**	**104A-5**	**104A-6**	**104A-7**
Location Description	**Living Room**	**Storage Closet**	**Kitchen**	**Left Bedroom**	**Right Bedroom**	**Outside Front**	**Outside Back**
Spore Type	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**	**Spores/m³**
Ascospores	---	---	---	---	---	39	39
Basidiospores	312	78	117	195	156	312	429
Bipolaris	---	---	---	---	13	---	---
Cladosporium	39	39	39	273	156	117	156
Curvalaria	---	---	---	---	26	---	---
Epiccocum	---	13	---	13	13	13	26
Aspergillis / Penicillium	702	975	546	1,010	3,200	---	---
Rusts	---	---	---	---	---	39	39
Smuts/Periconia/ Myxomy	---	13	13	13	39	13	26
Spegazzinia	---	---	---	---	13	---	---
Oidium	13	---	---	---	---	---	39
Total	**1,070**	**1,120**	**702**	**1,500**	**3,630**	**533**	**754**

Four of the five indoor total spore counts were higher than the results from the two outdoor samples. The dominant genera indoors were *Basidiospores, Cladosporium* and *Aspergillus / Penicillium*. The dominant genera outdoors were *Basidiospores* and *Cladosporium.*

The laboratory analytical report is attached.

Temperature and Relative Humidity

The indoor temperature was 74.4º F and indoor relative humidity was 31.6%. The outdoor temperatures was 81.6º F and outdoor relative humidity was 37.5% on a cloudy, warm day.

Indoor temperatures and humidity levels were within recommended comfort ranges.

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 the residence at 104A Eaton Circle.
- The source of the sewage-like odor in the storage closet should be investigated further. A check of sanitary drains is recommended.
- Four of the five indoor total spore counts were higher than the spore counts from the two outdoor samples. It should be noted at the time of sampling the occupants were moving out and therefore may have biased the sampling. The dominant indoor mold genera (*Aspergillis/Penicillium)* was not detected in the outdoor samples. Based on the past mold event and the process of moving, there is the possibility the spores detected indoors could be a remnant of previous indoor growth reported on personal belongings or from general mold spore accumulation. Terracon recommends a damp wiping of all surfaces and a thorough HEPA vacuuming of the residence with simultaneous use of a HEPA filtered air scrubber to remove as much airborne particulate as feasible. Once cleaning is complete additional air testing should be performed to determine the cleaning effectiveness.
- Temperature and relative humidity readings were within normal comfort levels for a residential environment in spring.

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 104A Eaton Circle living room looking toward kitchen



Photo #2 View of living room looking toward storage closet



Photo #3 View of right side of storage closet



Photo #4 View of left side of storage closet



Photo #5 View of kitchen



Photo #6 View of bathroom



Photo #7 View of Left Bedroom



Photo #8 View of front entrance



Photo #9 View of back entrance

Laboratory Results

SEEML Reference Number:
160422036

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: 04/22/16

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:
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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: 04/21/16
Terracon	Date Received: 04/22/16
72 Pointe Circle	Date Analyzed: 04/22/16
Greenville, SC 29615	Date Reported: 04/22/16
	Date Revised:
	Project Name: 104A Eaton Circle
	Project Address: 86127158- Task 59
	Project City, State, ZIP: Clemson, SC.
	SEEML Reference # : 160422036

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

Client Sample ID	104A-1			104A-2			104A-3		
Location	Living Room			Storage Closet			Kitchen		
Lab Sample ID	160422036-127			160422036-128			160422036-129		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments				6	78		5	65	
Pollen	2	26		3	39		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									
Basidiospores	24	312	29	6	78	7	9	117	17
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	3	39	4	3	39	3	3	39	6
Curvularia									
Epicoccum				1	13	1			
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	54	702	66	75	975	87	42	546	78
Polythrincium									
Rusts									
Smuts/Periconia/Myxomy				1	13	1			
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium	1	13	1						
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3			3			3		
Sample Volume(liters)	75			75			75		
TOTAL SPORES/M^3	82	**1070**		86	**1120**		54	**702**	

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: 04/21/16
Terracon	Date Received: 04/22/16
72 Pointe Circle	Date Analyzed: 04/22/16
Greenville, SC 29615	Date Reported: 04/22/16
	Date Revised:
	Project Name: 104A Eaton Circle
	Project Address: 86127158- Task 59
	Project City, State, ZIP: Clemson, SC.
	SEEML Reference # : 160422036

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

Client Sample ID	104A-4			104A-5			104A-6		
Location	Left Bedroom			Right Bedroom			Outside Front		
Lab Sample ID	160422036-130			160422036-131			160422036-132		
Detection Limit (spores/m^3)	13			13			13		
Hyphal Fragments				2	26		3	39	
Pollen				1	13		36	468	
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	7
Basidiospores	15	195	13	12	156	4	24	312	59
Bipolaris/Drechslera				1	13	<1			
Chaetomium									
Cladosporium	21	273	18	12	156	4	9	117	22
Curvularia				2	26	<1			
Epicoccum	1	13	<1	1	13	<1	1	13	2
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus	78	1010	67	246	3200	88			
Polythrincium									
Rusts							3	39	7
Smuts/Periconia/Myxomy	1	13	<1	3	39	1	1	13	2
Spegazzinia				1	13	<1			
Stachybotrys									
Stemphylium									
Tetraploa				1	13	<1			
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	116	**1500**		279	**3630**		41	**533**	

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.

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: 04/21/16
Terracon	Date Received: 04/22/16
72 Pointe Circle	Date Analyzed: 04/22/16
Greenville, SC 29615	Date Reported: 04/22/16
	Date Revised:
	Project Name: 104A Eaton Circle
	Project Address: 86127158- Task 59
	Project City, State, ZIP: Clemson, SC.
	SEEML Reference # : 160422036

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

Client Sample ID	104A-7								
Location	Outside Back								
Lab Sample ID	160422036-133								
Detection Limit (spores/m^3)	13								
Hyphal Fragments	3	39							
Pollen	52	676							
Spore Trap Used	AOC								
	raw ct.	spores/m^3	%						
Alternaria									
Ascospores	3	39	5						
Basidiospores	33	429	57						
Bipolaris/Drechslera									
Chaetomium									
Cladosporium	12	156	21						
Curvularia									
Epicoccum	2	26	3						
Cercospora									
Fusarium									
Memnoniella									
Nigrospora									
Penicillium/Aspergillus									
Polythrincium									
Rusts	3	39	5						
Smuts/Periconia/Myxomy	2	26	3						
Spegazzinia									
Stachybotrys									
Stemphylium									
Tetraploa									
Torula									
Ulocladium									
Colorless/Other Brown 2									
Oidium	3	39	5						
Zygomycetes									
Pithomyces									
Background debris (1-5)3	3								
Sample Volume(liters)	75								
TOTAL SPORES/M^3	58	**754**							

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

506 Laurens Rd, Greenville, SC 29607

Phone : 864-233-3770, Fax: 864-233-6589, www.seeml.com, AIHA-LAP, LLC. (EMLAP) #173667

Page 1 of 1

For Lab Use Only			
Condition of samples is acceptable	☑ YES ☐ NO	SEEML Ref #: 160422036	Lab ID: 127 - 133

Company Information	Client Information		Environmental Conditions	
Terracon	Date Sampled:	4-21-16	Precipitation in last 16hrs:	none
72 Pointe Circle	Project Name:	104A Eaton Circle	Relative Humidity I/O:	31.6%/ 37.5%
Greenville, SC 29615	Project Address:	86127158 - Task 59	Temperature I/O:	74.4°F/ 81.6°F
Ben Hestir	City, State, Zip:	Clemson, SC	Wind Conditions	breezy < 10mph
ben.hestir@terracon.com				
864-293-7348				

Sample Type Abbreviations:
A- Allergenco S-Swab AP-Andersen Plate
AOC- Air O Cell T-Tape W- Water
MS- 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
104A-1	Living Room	AOC	1		75	
104A-2	Storage Closet	"	"		"	
104A-3	Kitchen	"	"		"	
104A-4	Left bedroom	"	"		"	
104A-5	Right bedroom	"	"		"	
104A-6	Outside Front	"	"		"	
104A-7	Outside Back	"	"		"	

Relinquished By:	Date/Time	Received By:	Date/Time
Ben Hestir	4-22-16 10:07am	[signature]	4-22-16

* Area is only required for culturable surface samples.

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