February 12, 2016

Clemson University
310 Klugh Avenue
Clemson, South Carolina 29634

Attn: Mr. W. Robert Newberry, IV
E: wnewber@clemson.edu

Re: Limited IAQ and Allergen Investigation Report
116 Jordan Hall
Clemson, South Carolina
Terracon Project No. 86127158 – Task 49

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited indoor air quality (IAQ) and allergen investigation in 116 Jordan Hall on the main campus of Clemson University in Clemson, South Carolina. The office occupant is reporting allergy like symptoms (possibly due to dust mite and cockroach allergens) that they believe are related to air quality at the office. The sampling was performed in general accordance with our IDC with Clemson University.

PROJECT DESCRIPTION

Scope of Services

At the request of Clemson University Terracon conducted a limited IAQ and allergen investigation in 116 Jordan Hall. No other area of the building was assessed. The office was inspected for evidence of potential allergenic materials. A dust sample was collected from the office of the complainant for allergen analyses. Terracon representative Mr. Benjamin Hestir performed this investigation on December 1, 2015.

Standard of Care

This 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 investigation. 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 investigation. 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

Physical Assessment

The physical assessment was conducted to determine whether materials were present in the office that might have caused a reported allergic reaction type symptoms. The assessment focused primarily on collecting observational data (i.e., information obtained by physical inspection of the office and interviews with the building management and occupants). The assessment can help to formulate plans for more in-depth investigation.

The physical inspection included:

- an examination of the office space and potential indoor sources of allergens.

Allergen Sampling

An allergen dust sample was collected from various horizontal surfaces in the office of the complainant using a high volume air sampling pump in conjunction with a Zefon 25-millimeter dust sampling cassette preloaded with a 0.45 micrometer mixed cellulose ester (MCE) filter.

After dust sample collection, the sample was shipped by overnight courier to EMSL in Cinnaminson, New Jersey. EMSL is accredited by the AIHA® Laboratory Accreditation Programs, LLC under the Environmental Microbiology Laboratory Accreditation Program (EMLAP), Accreditation #100194. Allergen samples were analyzed by direct microscopic examination for allergens from dust mites and cockroach. Allergen results are reported in micrograms per gram of dust (µg/g).

Temperature and Relative Humidity

Indoor air temperature and RH 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 performing "office" work and 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 low indoor humidity, below 60% relative humidity, ideally 30-50%, if possible.

Readings of temperature and relative humidity were made with an Extech Model 445580 instrument which was calibrated by the manufacturer.

FINDINGS

Physical Assessment

The office located in 116 Jordan Hall is currently occupied by Dr. Min Cao of the Biological Sciences Department and consists of approximately 96 square feet (8' by 12') on the lowest floor of the building. Building management staff (Michael Moore) reported that the building had occasional water intrusion issues, but they were not common. Mr. Moore stated that the office had a brand new drop ceiling installed and was freshly painted prior to Dr. Cao's occupying the space in late summer 2015. Mr. Moore stated that there had been no one else on the floor reporting similar health-related issues to Dr. Cao. A variety of potential products which may cause allergic reactions were observed in the office including household chemical products such as lotions, cleaners, insect repellant, sunscreen, scented candles, and several houseplants in small containers.

At the time of the assessment, no musty odor, active water intrusion or visible mold growth was observed.

Allergen in Dust Sampling

On the afternoon of December 1, 2015 Terracon collected one (1) dust sample from the vinyl flooring and other horizontal surfaces (primarily bookcases and shelves) in Room 116. The sample was analyzed for allergens from dust mites and cockroach. No cockroach allergens were identified in the sample. Dust mite allergens were detected at a level of 0.74 ug/g which is described as "Low" risk by the laboratory report. The laboratory analytical report is attached.

Conclusions and Recommendations

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

- Temperature and relative humidity readings were within normal comfort levels for an office environment (69.6° F and 55% relative humidity).
- No cockroach allergens were detected from the dust sample.
- Dust mite allergens were detected at a level that is described as “Low” risk by the laboratory.
- A variety of potential allergens were observed in the office in the form of common household chemical products and a variety of houseplants in different growth media. These products have the potential to cause allergic reactions; however, Terracon cannot conclusively determine if these products are causing the occupant complaints.

Terracon appreciates the opportunity to provide this service to Clemson University. If you have any questions regarding this IAQ and Allergen Investigation report, please contact the undersigned at 864-292-2901.

Sincerely,
Terracon Consultants, Inc.



Benjamin Hestir, P.E.
Project Industrial Hygienist



Jeffrey A. Gurrie
Sr. Industrial Hygienist

Attachments: Photographs
Laboratory Results

Photographs



Photo #1 Office of Dr. Min Cao – 116 Jordan Hall



Photo #2 View of temperature and relative humidity reading and the allergen sampling cassette



Photo #3 View of potential allergen source in office



Photo #4 View of potential allergen source in office



Photo #5 View of potential allergen source in office



Photo #6 View of potential allergen source in office



Photo #7 View of potential allergen source in office



Photo #8 View of potential allergen source in office



Photo #9 View of potential allergen source in office



Photo #10 View of potential allergen source in office

Laboratory Results



EMSL Analytical, Inc.

200 Route 130 North
Cinnaminson, NJ 08077

Tel: (856) 858-4800
Fax: (856) 786-0262

Indoor Allergen Analysis by ELISA

Prepared Exclusively For

Ben Hestir
Terracon Consultants, Inc.
3534 Rutherford Road
Taylors, SC 29687

Date Received:	**12/3/2015**
Date Reported:	**12/10/2015**
Project:	**116 Jordan Hall**
EMSL Order:	**371522079**
Client ID	**GTER78**

If you have any questions, please do not hesitate to contact us at (856)858-4800.

All samples were collected by and all sampling data was provided by the client. The results are valid only for those samples analyzed, and only for those samples collected in accordance with the appropriate methodology as determined by the client.
The results herein do not denote or represent a medical or clinical diagnosis or conclusion. In the event that sample(s) were submitted in opened, used non-sterile or otherwise adulterated condition, EMSL shall not be responsible or liable.

EMSL Analytical (Cinnaminson, NJ) is accredited by the American Industrial Hygiene Association (AIHA) in the EMLAP accreditation program for specified Field(s) of Testing as documented on the scope of accreditation.

Please visit our website at http://www.emsl.com for more information about our certifications and accreditations.

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Ben Hestir
Terracon Consultants, Inc.
3534 Rutherford Road
Taylors, SC 29687

EMSL Reference: 371522079
Date Collected: 12/1/2015
Date Received: 12/3/2015
Date Reported: 12/10/2015

Indoor Allergen Report

Lab Sample ID	**371522079-1**
Client Sample ID	**116 Jordan**
Sample Location	**Clemson University**

Test Parameter	*Antigens*	*Detection Limits*	*Concentrations*		*Allergen Risk Levels*
Dust Mites Allergen	Der f1	0.40	**0.47**	**µg/g**	Low
Dust Mites Allergen	Der p1	0.40	**ND**	**µg/g**	ND
Cockroach Allergen	Bla g1	0.60	**ND**	**U/g**	ND

Farbod Nekouei M.S., Lab Manager
Or Other Approved Signatory

Low: Not Sufficient to cause symptoms. Moderate: Risk for sensitization and bronchial hyperactivity. High: Risk for acute allergic asthma attack. µg/g: Micrograms per gram, U/g: Units per gram, ng/g: Nanogram per gram. N/A: Not Applicable. ND (None Detected): Indicates that the amount of allergen in the sample is below the detection limits.
†: Sufficient evidence is not available for risk levels
This report and guidelines furnish information only. Whether an individual suffers allergic symptoms or not depends on his/her medical history and previous exposure.

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EMSL Order: 371522079

Guidelines to Interpretation

Allergens

	<DL	<1	1	2	3	4	5	6	7	8	9	>10
µg/g												
Fel d1	ND	Low	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High	High	High
Can f1	ND	Low	Low	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High
Der p1	ND	Low	Low	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High
Der f1	ND	Low	Low	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Mod	High
Mus m1	ND	Low	Mod	Mod	Mod	High	High	High	High	High	High	High
µg/m3												
Rat n1	ND	<0.7 µg /m3 = Not associated with increased risk of asthma										
Hev b5	ND	<0.6 ng/m3 = Not associated with increased risk of asthma										
Hev b6.02	ND	<0.6 ng/m3 = Not associated with increased risk of asthma										
U/g												
Bla g1 †	ND	Low	Mod	Mod	Mod	High	High	High	High	High	High	High
Bla g2 †	ND	Low	Mod	Mod	Mod	High	High	High	High	High	High	High

† *Suggested levels. Not officially established.*

Note: This report and guidelines furnish information only.

Whether an individual suffers allergic symptoms or not depends on his/her medical history and previous exposure.

References

Journal of Allergy and Clinical Immunology 1989; 83:416-427

Journal of Allergy and Clinical Immunology 1995; 96:449-456

The American review of respiratory disease 1990; 141:361-367

The American review of respiratory disease 1993; 147:573-578

Environmental Health Perspectives 2002; 110:419-425

Clinical and Experimental Allergy 1998; 28(5):537-44

Terminology

Allergen	A substance which reacts with the body's immune system to produce an allergic reaction.
Antigen	A substance, foreign to the body, which stimulates the production of antibodies by the immune system.
Bla g1	*Blattella germanica* (Cockroach) allergen 1
Bla g2	*Blattella germanica* (Cockroach) allergen 2
Can f1	*Canis familiaris* (Dog) allergen 1
Der f1	*Dermatophagoides farinae* (Dust Mites) allergen 1
Der p1	*Dermatophagoides pteronyssinus* (Dust Mites) allergen 1
Detection Limits	DL is the smallest amount of a substance, in this case antigens, which can be measured.
Fel d1	*Felis domesticus* (Cat) allergen 1
Hev b5	*Hevea brasiliensis* (Latex) allergen 5
Hev b6.02	*Hevea brasiliensis* (Latex) allergen 6.02
Mus m1	*Mus musculus* (Mouse) allergen 1
ND	None detected, if any allergens are present they are below the detection limits.
Rat n1	*Rattus norvegicus* (Rat) allergen 1

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EMSL Order: 371522079

Important Terms, Conditions, and Limitations

A. Sample Retention

Samples analyzed by EMSL will be retained for 60 days after analysis date. Storage beyond this period is available for a fee with written request prior to the initial 30 day period. Samples containing hazardous/toxic substances which require special handling will be returned to the client immediately. EMSL reserves the right to charge a sample disposal fee or return samples to the client.

B. Change Orders and Cancellation

All changes in the scope of work or turnaround time requested by the client after sample acceptance must be made in writing and confirmed in writing by EMSL. If requested changes result in a change in cost the client must accept payment responsibility. In the event work is cancelled by a client, EMSL will complete work in progress and invoice for work completed to the point of cancellation notice. EMSL is not responsible for holding times that are exceeded due to such changes.

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EMSL warrants to its clients that all services provided hereunder shall be performed in accordance with established and recognized analytical testing procedures and with reasonable care in accordance with applicable federal, state and local laws. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied. EMSL disclaims any other warranties, express or implied, including a warranty of fitness for particular purpose and warranty of merchantability.

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Client shall indemnify EMSL and its officers, directors and employees and hold each of them harmless for any liability, expense or cost, including reasonable attorney's fees, incurred by reason of any third party claim in connection with EMSL's services, the test result data or its use by client.

THIS IS THE LAST PAGE OF THE REPORT

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Industrial Hygiene Chain of Custody

EMSL Order Number (Lab Use Only): 371522079

Report To Contact Name: Ben Hestir	Bill To Company: Same
Company Name: Terracon	Attention To:
Street: 3534 Rutherford Road	Street:
City: Taylors State/Province: SC Zip/Postal Code: 29687	City: State/Province: Zip/Postal Code:
Phone: 864-293-7348 Fax:	Phone: Fax:
Project Name: 116 Jordan Hall	Reference on invoice ✓ U.S. State where Samples Collected: SC
Number of Samples in Shipment: 1 Date of Shipment: 12/2/15	Purchase Order: 86127158 Task 52 Sampled By (Signature): Ben Hestir
Please Provide results: ☐ Fax ☑ Email ☐ Mail	Email Results To: ben.hestir@[redacted]terracon.com

Turnaround Time – Please Check: Please Note Standard TAT is 2 Week.

2 Week	1 Week	4 Day	3 Day	2 Day	1 Day	Other (Call Lab)
☐	☑	☐	☐	☐	☐	☐ _____

Media Type: Zefon Dust Cassette
Manufacturer/Part #: 2045CC
Lot #: 39856

Sample ID	Media	Analyte / Method	Volume	Sample Date/Time	Location	Comments
116 Jordan	Dust Cassette	Dust Mite/Cockroach Allergens		12/1/15 1600	Clemson University	From vinyl floor tile

RECEIVED EMSL CINNAMINSON, N.J. 2015 DEC -3 A 10:41

Note: Most NIOSH and OSHA methods require field blanks. It is the IH field sampler's responsibility to submit the proper number of field blanks and duplicates.

Released By	Date	Received By	Date
Ben Hestir	12/2/2015	ARM FX	12-3-15 9:20

Comments:

Controlled Document – Industrial Hygiene COC – R3 – 7/12/2011

OrderID: 371522079