April 26, 2017

Clemson University
310 Klugh Avenue
Clemson, South Carolina 29634

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

Re: Limited Volatile Organic Compound Investigation Report
Barre Hall, Lehotsky Hall and Edwards Hall
Clemson University, Clemson, South Carolina
Terracon Project No. 86127158 – Task 81

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited volatile organic compound (VOC) and a limited mold volatile organic compound (MVOC) investigation in four offices at Clemson University that have been occupied by Ms. Jessi Wilson on the main campus at Clemson University, Clemson, South Carolina. Reportedly, Ms. Wilson has reported experiencing severe allergic reactions in three of the four office locations we tested, but not in the fourth location. 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 VOC and MVOC investigation in the following office spaces at Clemson University on Wednesday, April 5, 2017:

- Barre Hall – Room 2073
- Barre Hall – Room 2035
- Lehotsky Hall - Room 284E
- Edwards Hall – Room 534 (non-complaint office)

The investigation consisted of the collection of four (4) thermal desorption tube samples for VOC analysis.

Standard of Care

This limited 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 building occupancy, ventilation patterns, cleaning and maintenance operations, 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 METHODS AND CRITERIA

Sampling Criteria

VOCs are emitted as gases from certain solids and liquids. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands. Examples include: personal care products; hand sanitizers; hair sprays; fingernail polish remover and polish; paints and lacquers, paint strippers; cleaning supplies; pesticides; mothballs; furnishings; craft materials including glues and adhesives; and permanent markers.

Chemical pollutants such as VOCs may have deleterious effects on indoor air quality. Many individual VOCs have been regulated by OSHA or other governmental bodies in the industrial workplace, and Occupational Exposure Limit (OEL) for 8-hour TWA exposures have been established. Typically, individual VOC's in the indoor environment are well below the OEL but combinations of low concentrations of VOCs may have synergistic effects resulting in building occupant complaints. Typically it is not recommended to compare VOCs in indoor air to OELs.

To help interpret the AirSurvey results, Fike Analytical provided interpretation of the total VOC (TVOC) results for each sample in the form of qualitative categories for each sample. Based on the TVOC for the sample each was rated as either "Ideal", "Good", "Acceptable" or "Marginal" taking into consideration whether the sorbent tube samples were collected in a home, commercial, production or manufacturing space. See the attached IAQ Summary Report for qualitative category results and the basis for the categories.

The analytical reporting in the IAQ Summary Reports also include a Total Mold Volatile Organic Compound (TMVOC) analysis. These results are also interpreted both quantitatively and qualitatively with quantitative results expressed in ng/L and qualitative results expressed based on the individuals being exposed as:

Normal Individuals:

- Minimal amount of actively growing mold (< 6 ng/L)
- Low level of actively growing mold (between 6 and 20 ng/L)
- Moderate level of actively growing mold (between 20 and 60 ng/L)
- High level of actively growing mold (> 60 ng/L)

For hypersensitive Individuals:

- Very reduced levels of actively growing mold which typically won't affect hypersensitive individuals (< 3 ng/L)
- Actively growing mold which may affect hypersensitive individuals (between 3 and 10 ng/L)
- Actively growing mold – significant allergic reactions are possible (between 10 and 20 ng/L)
- Significant, active mold growth present - will probably affect hypersensitive individuals (>20 ng/L)

The qualitative results reported here for both TVOCs and TMVOCs are based on categories created by Fike in their interpretation of the analytical results from Beacon.

Sampling Methods

VOC/MVOC were collected using proprietary sorbent media tubes from Fike Analytical (Fike) of Clarkston, Michigan in conjunction with laboratory analysis by Beacon Environmental Services (Beacon) of Forest Hill, Maryland. The samples were collected by drawing approximately 40 liters (L) of air through the media tube in each office of interest using a low flow personal air sampling pump calibrated by the lab at a flow rate of 200 milliliters/minute (mL/min) for 200 min.

After collection, the sorbent tubes were capped on each end, placed in a glass beaker with a screw-on top and delivered by overnight courier to Beacon in Forest Hill, MD for thermal desorption analysis by gas chromatograph using NIOSH Method 2549. Beacon is accredited under the National Environmental Laboratory Accreditation Program (NELAP EPA # MD01091).

The AirSurvey analysis report and Indoor Air Quality Summary analysis report provided by Fike based on the analytical findings from Beacon includes a list of approximately 400 volatile organic compounds that are reported either quantitatively or semi-quantitatively. The quantitation limits for the analyses are 0.5 nanograms/L (ng/L) for the quantitative compounds and 2 ng/L for the semi-quantitative compounds. Semi-quantitative compounds are reported as an estimated range of possible values. The AirSurvey analytical results and the compound list are attached.

FINDINGS

General Observations

- Barre 2073 and Barre 2035 were unoccupied at the time of our air sampling.
- Lehotsky 284E and Edwards 534 were occupied at the time of our air sampling.
- Lehotsky 284E was reportedly renovated just prior to Ms. Wilson's brief time there and had recently installed carpet and recently painted walls.
- Select photographs from the assessment are attached.

TVOC Sampling

On the morning of Wednesday, April 5, 2017, Terracon conducted VOC sampling in Barre, Lehotsky and Edwards Halls. The results of the TVOC analyses are summarized in Table 1 below:

Table 1: Summary of Total VOC Analyses – April 5, 2017

Sample #	Barre-2073	Barre-2035 (Original Office)	Lehotsky-284E	Edwards-534 (Non-Complaint Office)
Location Description	**Conf. table**	**Desk by window**	**On desk**	**On desk**
VOC Type	**ng/L**	**ng/L**	**ng/L**	**ng/L**
C5 Hydrocarbons (pentane)	11	3.7	2.3	---
C6 Hydrocarbons (hexane)	1.1	---	---	---
Benzene	0.8	0.5	0.6	0.6
Toluene	3.0	3.0	2.7	3.9
C8 Hydrocarbons (octane)	0.9	0.7	---	---
Ethylbenzene	0.9	0.8	1.7	---
m,p-Xylene	3.0	2.7	6.4	1.6
C9 Hydrocarbons (nonane)	0.7	0.7	---	---
o-Xylene	1.1	1.0	1.1	0.6
C10 Hydrocarbons (decane)	2.0	2.3	0.9	0.7
1,2,4-Trimethylbenzene	1.7	2.0	1.1	0.9
C11 Hydrocarbons (undecane)	1.3	2.7	1.7	0.6
C12 Hydrocarbons (dodecane)	0.5	0.9	1.1	0.7
C4 Hydrocarbons (butane)	2-10	1-4	---	---
Acetone	2-10	1-6	2-8	2-10
Naphthalene	0.5	0.9	---	---
Ethanol	5-20	5-20	2-8	4-16
Isopropanol	1-4	0.5-2	5-22	---
Methylacetate	---	1-4	1-4	0.5-2
C14 Hydrocarbons (tetradecane)	---	0.9	7.4	0.8
C15 Hydrocarbons (n-Pentadecane)	---	---	5.0	0.6
Hexanal	1-4	1-4	1-6	---
a-Pinene	1-4	1-4	2-8	1-4
C8-C10 Hydrocarbons	---	2-10	---	---
2-Butoxyethanol	0.5-2	0.5-2	---	---
Cyclohexanone	---	---	0.5-2	---

Sample #	Barre-2073	Barre-2035 (Original Office)	Lehotsky-284E	Edwards-534 (Non-Complaint Office)
Location Description	**Conf. table**	**Desk by window**	**On desk**	**On desk**
VOC Type	**ng/L**	**ng/L**	**ng/L**	**ng/L**
b-Pinene	0.5-2	0.5-2	0.5-2	0.5-2
Benzaldehyde	1-6	2-8	1-4	0.5-2
Limonene	3-12	3-14	3-12	1-4
2-Ethyl-1-hexanol	0.5-2	1-6	0.5-2	---
Nonanal	1-4	1-4	1-4	0.5-2
Methyl salicylate	0.1-0.6	0.5-2	---	---
Texanol-A	---	0.2-0.8	---	---
Texanol-B	0.2-0.8	0.4-1.6	---	0.2-0.8
A glycol ether	---	2-8	---	---
Octamethylcyclotetrasiloxane	1-6	1-6	0.5-2	0.5-2
Diethylene glycol diethyl ether	0.2-0.8	31-130	---	0.2-0.8
Total VOCs	**170**	**290**	**290**	**180**
Quantitative Description	**Ideal**	**Good**	**Good**	**Ideal**

VOCs highlighted in blue were not detected in the non-complaint office (Edwards 534)

The laboratory analytical report is attached.

Total Mold VOC (TMVOC) Sampling

On the morning of Wednesday, April 5, 2017, Terracon conducted TMVOC sampling in Barre, Lehotsky and Edwards Halls. The results of the TMVOC analyses are summarized in Table 2 below. Qualitative results are expressed based on the criteria described previously for both individuals with a normal response to MVOCs and individuals who are hypersensitive:

Table 2: Summary of Total Mold VOC Analyses – April 5, 2017

Sample #	Barre-2073	Barre-2035	Lehotsky-284E	Edwards-534
Location Description	**Conf. table**	**Desk by window**	**On desk**	**On desk**
	ng/L	**ng/L**	**ng/L**	**ng/L**
Total	**3.3**	**4.1**	**2.3**	**1.8**
Qualitative – Normal	**Minimal amount of mold**	**Minimal amount of mold**	**Minimal amount of mold**	**Minimal amount of mold**
Qualitative - Hypersensitive	**May affect hypersensitive**	**May affect hypersensitive**	**Typically won't affect hypersensitive**	**Typically won't affect hypersensitive**

The laboratory analytical report is attached.

CONCLUSIONS

The following conclusions are provided based on our assessment:

- Sixteen (16) volatile organic compounds were identified in one or more of the three offices in which Ms. Wilson reportedly experienced a reaction (Barre 2073, Barre 2035 and Lehotsky 284E) but were not found in the office she is currently based in (Edwards 534) as shown in blue highlight in Table 1.
- Two of the four TMVOC samples (both in Barre Hall) identified levels of mold VOCs which "may affect hypersensitive individuals" based on interpretation of the results by Fike Analytical.
- The highest individual VOC concentration identified in the four samples was slightly less than 10 parts per billion.
- None of the four TVOC/TMVOC samples were numerically substantially different from the other three.
- Further study by a board certified occupational physician or toxicologist who can review the complaintant's medical history is an option for the next step.

Terracon appreciates the opportunity to provide this service to Clemson University. If you have any questions regarding this limited volatile organic compound and mold volatile organic compounds 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 Office location of Barre – 1 air sample



Photo #2



Photo #3 Office location of Barre – 2 air sample

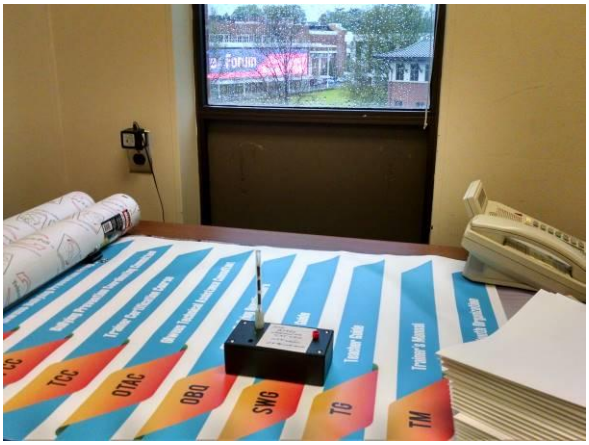


Photo #4

Laboratory Results

Fike
Analytical Technologies, L.L.C.

Analytical Report

Client: Terracon Consultants, Inc.
Project: CU-Barre Hall
Location: Clemson, SC
Sampled By: B. Hestir

C.O.C. No.: 3743
Order Date: 04/06/2017
Report Date: 04/15/2017

NIOSH 2549 AirSurvey Analysis All results are reported in ng/L

A scan was made for all compounds contained in the attached AirSurvey List of Compounds Quantitative List and Semiquantitative List. All compounds detected are listed below:

Client Sample ID: Barre 2073
Laboratory ID: 3743 -1
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Total VOCs		170	Total volatile organic compounds calculated based on internal standard ratio; does not include C1, C2, or methanol
C 5		11	Pentane ppb 3.7 MW 72 CAS 109-66-0
C 6		1.1	Hexane ppb 0.3 MW 86 CAS 110-54-3
Benzene		0.8	Cyclohexatriene ppb 0.2 MW 78 CAS 71-43-2
Toluene		3.0	Methyl benzene ppb 0.8 MW 92 CAS 108-88-3
C 8		0.9	Octane ppb 0.2 MW 114 CAS 111-65-9
Ethylbenzene		0.9	 ppb 0.2 MW 106 CAS 100-41-4
m,p-Xylene		3.0	m,p-Dimethylbenzene; CAS number is for the para isomer ppb 0.7 MW 106 CAS 106-42-3
C 9		0.7	Nonane ppb 0.1 MW 128 CAS 111-84-2
o-Xylene		1.1	o-Dimethylbenzene ppb 0.2 MW 106 CAS 95-47-6
C10		2.0	Decane ppb 0.3 MW 142 CAS 124-18-5
1,2,4-Trimethylbenzene		1.7	1,2,4-TMB ppb 0.3 MW 120 CAS 95-63-6
C11		1.3	Undecane ppb 0.2 MW 156 CAS 1120-21-4
C12		0.5	Dodecane ppb 0.07 MW 170 CAS 112-40-3

Client Sample ID: Barre 2073
Laboratory ID: 3743 -1
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Naphthalene		0.5	ppb 0.09 MW 128 CAS 91-20-3
C 4	5	2-10	Butane ppb 1.9 MW 58 CAS 106-97-8
Ethanol	10	5-20	Ethyl alcohol ppb 5.0 MW 46 CAS 64-17-5
Acetone	5	2-10	2-Propanone ppb 1.9 MW 58 CAS 67-64-1
Isopropanol	2	1-4	Isopropyl alcohol; 2-propanol ppb 0.8 MW 60 CAS 67-63-0
Hexanal	2	1-4	Hexaldehyde; caproic aldehyde ppb 0.4 MW 100 CAS 66-25-1
a-Pinene	2	1-4	2-Pinene ppb 0.3 MW 136 CAS 80-56-8
2-Butoxyethanol	1	0.5-2	Butylcellosolve; ethylene glycol mono-n-butyl ether ppb 0.2 MW 118 CAS 111-76-2
Octamethylcyclotetrasiloxane	3	1-6	ppb 0.2 MW 296 CAS 556-67-2
B-Pinene	1	0.5-2	Pseudopinene; bicyclo[3.1.1]heptane ppb 0.2 MW 136 CAS 127-91-3
Benzaldehyde	3	1-6	ppb 0.8 MW 106 CAS 100-52-7
Limonene	6	3-12	AirSurvey does not differentiate between Limonene (CAS 138-86-3) and d-Limonene (CAS 5989-27-5) ppb 1.0 MW 136 CAS 138-86-3
2-Ethyl-1-hexanol	1	0.5-2	ppb 0.3 MW 130 CAS 104-76-7
Diethylene glycol diethyl ether	0.4	0.2-0.8	1-ethoxy-2-(2-ethoxyethoxy)ethane ppb 0.06 MW 162 CAS 112-36-7
Nonanal	2	1-4	ppb 0.3 MW 142 CAS 124-19-6
Methyl salicylate	0.3	0.1-0.6	ppb 0.05 MW 152 CAS 119-36-8

Client Sample ID: Barre 2073
Laboratory ID: 3743 -1
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Texanol-B	0.4	0.2-0.8	

ppb 0.05 MW 216 CAS 74367-34-3

These results have been reviewed and approved by the Technical Director

Randall S. Fike, Ph.D.

Fike Analytical Technologies, L.L.C.
9800 Reese Rd.
Clarkston, MI 48348
248-241-6713

The results contained in this report are dependent upon a number of factors over which Fike Analytical Technologies, L.L.C. (Fike), has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, the ability of the sampler to collect a proper or suitable sample, or the quantitative values reported by supporting laboratories. Validation regarding these parameters is the responsibility of either the supporting laboratories or the submitter. Neither Fike, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the actions of the submitter, the data supplied by supporting laboratories, or any opinions contained within this report.

Fike

Analytical Technologies, L.L.C.

Indoor Air Quality Summary

Client:	Terracon Consultants, Inc.	Sample Number:	3743 - 1
Project:	CU-Barre Hall	Date Sampled:	04/05/2017
Location:	Clemson, SC	Order Date:	04/06/2017
Sampled By:	B. Hestir	Date Analyzed:	04/07
Submitter ID:	Barre 2073	Date Reported:	04/16/2017

IAQ Summary

Total VOCs (TVOC), ng/L: 170

Mold VOCs (TMVOC), ng/L: 3.3

Sample Volume (L): 40

Notes: -

Understanding the Results:

TVOC (Total Volatile Organic Compounds)

No federal or state agency has specified a specific limit for Total Volatile Organic Compounds (TVOCs) in indoor air; however, several members of the European Union and the U. S. Green Building Council (USGBC) have recommended 500 ng/L as the limit. Note that if all of the TVOC is the result only one or a small number of components, a hazardous condition may still exist.

In homes, usually, TVOC levels below 200 ng/L indicate that the Indoor Air Quality (IAQ) is "Ideal," TVOC levels between 200 and 300 ng/L indicate that the IAQ is "Good," TVOC levels between 300 and 400 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 400 and 500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 500 ng/L indicate that a problem may exist and it should be addressed.

In commercial buildings, TVOC levels below 200 ng/L indicate that the IAQ is "Ideal," TVOC levels between 200 and 350 ng/L indicate that the IAQ is "Good," TVOC levels between 350 and 500 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Marginal." TVOC levels above 700 ng/L indicate that a problem may exist and it should be addressed.

In production and manufacturing facilities, TVOC levels below 500 ng/L indicate that the IAQ is "Ideal," TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Good," TVOC levels between 700 and 1,000 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 1,000 and 1,500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 1500 ng/L indicate that a problem may exist and it should be addressed.

In all cases, exposure effects are possible with TVOC levels between 1,500 and 3,000 and exposure effects are probable at TVOC levels above 3,000 ng/L. Exposure effects may include eye and respiratory irritation, headaches, drowsiness, nausea, general malaise, etc.

Based on what the individual compounds are that make up the TVOC, it is possible to suggest actions which will lower the level into an acceptable range. Contact the person who took this sample for more information.

Fike
Analytical Technologies, L.L.C.

Sample Number: 3743 - 1

Indoor Air Quality Summary

Understanding the Results:

TMVOC (Total Mold Volatile Organic Compounds)

This is an assessment of the quantity of actively growing mold in the building. This test will not detect inactive or dormant mold. Like TVOC, no federal or state agency has specified specific limits for TMVOC. Typically, if there is no plumbing leak or water intrusion into the building, there will not be a mold problem. If the presence of mold is indicated, the first step in fixing the problem is to find and eliminate the water source. Typical places to check are roof leaks, plumbing leaks, leaks under the windows, leaking appliances, and sweating fixtures.

For Normal Individuals:

TMVOC levels below 6 ng/L typically indicate that there is a minimal amount of actively growing mold present. Levels between 6 and 20 ng/L indicate a low level of mold is present and people sensitive to mold may be affected. Levels between 20 and 60 ng/L indicate that actively growing mold is present at a moderate level and building occupants will probably be affected. Levels above 60 ng/L indicate that a high level of mold is present and most building occupants will be affected.

For Hypersensitive Individuals:

TMVOC levels below 3 ng/L indicate very reduced levels of actively growing mold may be present which will typically not affect hypersensitive individuals. Levels between 3 and 10 ng/L indicate that actively growing mold is present that may affect hypersensitive individuals. Levels between 10 and 20 ng/L indicate that actively growing mold is present; and significant allergic reactions for hypersensitive individuals are possible. Levels above 20 ng/L indicate that significant, active mold growth is present that will probably affect most hypersensitive individuals.

The TMVOC ranges cited above and their interpretation are not absolute as many conditions affect the quantity of MVOCs detected. Therefore, it must be understood that these results are not definitive but are meant as a general guideline only.

Caution should always be exercised when removing mold and it is recommended that a professional mold remediator be consulted before any removal is initiated.

Fike Analytical Technologies, L.L.C. (Fike), is not a laboratory but serves as a clearinghouse for data submitted by laboratories chosen by the submitter. The results contained in this report are dependent upon a number of factors over which Fike has no control, which may include, but are not limited to, the sampling technique utilized, the size or source of sample, the ability of the sampler to collect a proper or suitable sample, or the values reported by the submitter's laboratory. Therefore, the opinions contained in this report may be invalid and cannot be considered or construed as definitive and neither Fike, nor its agents, officers, directors, employees, or successors shall be liable for any claims, actions, causes of action, costs, loss of service, medical or other expenses or any compensation whatsoever which may now or hereafter occur or accrue based upon the information or opinions contained herein.

Fike
Analytical Technologies, L.L.C.

Analytical Report

Client: Terracon Consultants, Inc.
Project: CU-Barre Hall
Location: Clemson, SC
Sampled By: B. Hestir

C.O.C. No.: 3743
Order Date: 04/06/2017
Report Date: 04/15/2017

NIOSH 2549 AirSurvey Analysis All results are reported in ng/L

A scan was made for all compounds contained in the attached AirSurvey List of Compounds Quantitative List and Semiquantitative List. All compounds detected are listed below:

Client Sample ID: Barre 2035
Laboratory ID: 3743 -2
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Total VOCs		290	Total volatile organic compounds calculated based on internal standard ratio; does not include C1, C2, or methanol
C 5		3.7	Pentane ppb 1.2 MW 72 CAS 109-66-0
Benzene		0.5	Cyclohexatriene ppb 0.2 MW 78 CAS 71-43-2
Toluene		3.0	Methyl benzene ppb 0.8 MW 92 CAS 108-88-3
C 8		0.7	Octane ppb 0.1 MW 114 CAS 111-65-9
Ethylbenzene		0.8	 ppb 0.2 MW 106 CAS 100-41-4
m,p-Xylene		2.7	m,p-Dimethylbenzene; CAS number is for the para isomer ppb 0.6 MW 106 CAS 106-42-3
C 9		0.7	Nonane ppb 0.1 MW 128 CAS 111-84-2
o-Xylene		1.0	o-Dimethylbenzene ppb 0.2 MW 106 CAS 95-47-6
C10		2.3	Decane ppb 0.4 MW 142 CAS 124-18-5
1,2,4-Trimethylbenzene		2.0	1,2,4-TMB ppb 0.4 MW 120 CAS 95-63-6
C11		2.7	Undecane ppb 0.4 MW 156 CAS 1120-21-4
C12		0.9	Dodecane ppb 0.1 MW 170 CAS 112-40-3
Naphthalene		0.9	 ppb 0.2 MW 128 CAS 91-20-3

Client Sample ID: Barre 2035
Laboratory ID: 3743 -2
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
C14		0.9	Tetradecane ppb 0.1 MW 198 CAS 629-59-4
C 4	2	1-4	Butane ppb 0.9 MW 58 CAS 106-97-8
Ethanol	10	5-20	Ethyl alcohol ppb 5.3 MW 46 CAS 64-17-5
Acetone	3	1-6	2-Propanone ppb 1.4 MW 58 CAS 67-64-1
Isopropanol	1	0.5-2	Isopropyl alcohol; 2-propanol ppb 0.6 MW 60 CAS 67-63-0
Methylacetate	2	1-4	 ppb 0.5 MW 74 CAS 79-20-9
Hexanal	2	1-4	Hexaldehyde; caproic aldehyde ppb 0.6 MW 100 CAS 66-25-1
a-Pinene	2	1-4	2-Pinene ppb 0.3 MW 136 CAS 80-56-8
2-Butoxyethanol	1	0.5-2	Butylcellosolve; ethylene glycol mono-n-butyl ether ppb 0.3 MW 118 CAS 111-76-2
Octamethylcyclotetrasiloxane	3	1-6	 ppb 0.2 MW 296 CAS 556-67-2
B-Pinene	1	0.5-2	Pseudopinene; bicyclo[3.1.1]heptane ppb 0.3 MW 136 CAS 127-91-3
C8-C10 Hydrocarbon	5	2-10	10.9 min; contains oxygen
Benzaldehyde	4	2-8	 ppb 0.9 MW 106 CAS 100-52-7
A glycol ether	4	2-8	11.2 min
Limonene	7	3-14	AirSurvey does not differentiate between Limonene (CAS 138-86-3) and d-Limonene (CAS 5989-27-5) ppb 1.3 MW 136 CAS 138-86-3
2-Ethyl-1-hexanol	3	1-6	 ppb 0.6 MW 130 CAS 104-76-7
Diethylene glycol diethyl ether	63	31-130	1-ethoxy-2-(2-ethoxyethoxy)ethane ppb 9.4 MW 162 CAS 112-36-7
Nonanal	2	1-4	 ppb 0.4 MW 142 CAS 124-19-6
Methyl salicylate	1	0.5-2	 ppb 0.2 MW 152 CAS 119-36-8
Texanol-A	0.4	0.2-0.8	 ppb 0.05 MW 216 CAS 74367-33-2

Client Sample ID: Barre 2035
Laboratory ID: 3743 -2
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Texanol-B	0.8	0.4-1.6	

ppb 0.09 MW 216 CAS 74367-34-3

These results have been reviewed and approved by the Technical Director



Randall S. Fike, Ph.D.

Fike Analytical Technologies, L.L.C.
9800 Reese Rd.
Clarkston, MI 48348
248-241-6713

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Fike

Analytical Technologies, L.L.C.

Indoor Air Quality Summary

Client:	Terracon Consultants, Inc.	Sample Number:	3743 - 2
Project:	CU-Barre Hall	Date Sampled:	04/05/2017
Location:	Clemson, SC	Order Date:	04/06/2017
Sampled By:	B. Hestir	Date Analyzed:	04/07
Submitter ID:	Barre 2035	Date Reported:	04/16/2017

IAQ Summary

Total VOCs (TVOC), ng/L: 290

Mold VOCs (TMVOC), ng/L: 4.1

Sample Volume (L): 40

Notes: -

Understanding the Results:

TVOC (Total Volatile Organic Compounds)

No federal or state agency has specified a specific limit for Total Volatile Organic Compounds (TVOCs) in indoor air; however, several members of the European Union and the U. S. Green Building Council (USGBC) have recommended 500 ng/L as the limit. Note that if all of the TVOC is the result only one or a small number of components, a hazardous condition may still exist.

In homes, usually, TVOC levels below 200 ng/L indicate that the Indoor Air Quality (IAQ) is "Ideal," TVOC levels between 200 and 300 ng/L indicate that the IAQ is "Good," TVOC levels between 300 and 400 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 400 and 500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 500 ng/L indicate that a problem may exist and it should be addressed.

In commercial buildings, TVOC levels below 200 ng/L indicate that the IAQ is "Ideal," TVOC levels between 200 and 350 ng/L indicate that the IAQ is "Good," TVOC levels between 350 and 500 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Marginal." TVOC levels above 700 ng/L indicate that a problem may exist and it should be addressed.

In production and manufacturing facilities, TVOC levels below 500 ng/L indicate that the IAQ is "Ideal," TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Good," TVOC levels between 700 and 1,000 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 1,000 and 1,500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 1500 ng/L indicate that a problem may exist and it should be addressed.

In all cases, exposure effects are possible with TVOC levels between 1,500 and 3,000 and exposure effects are probable at TVOC levels above 3,000 ng/L. Exposure effects may include eye and respiratory irritation, headaches, drowsiness, nausea, general malaise, etc.

Based on what the individual compounds are that make up the TVOC, it is possible to suggest actions which will lower the level into an acceptable range. Contact the person who took this sample for more information.

Indoor Air Quality Summary

Understanding the Results:

TMVOC (Total Mold Volatile Organic Compounds)

This is an assessment of the quantity of actively growing mold in the building. This test will not detect inactive or dormant mold. Like TVOC, no federal or state agency has specified specific limits for TMVOC. Typically, if there is no plumbing leak or water intrusion into the building, there will not be a mold problem. If the presence of mold is indicated, the first step in fixing the problem is to find and eliminate the water source. Typical places to check are roof leaks, plumbing leaks, leaks under the windows, leaking appliances, and sweating fixtures.

For Normal Individuals:

TMVOC levels below 6 ng/L typically indicate that there is a minimal amount of actively growing mold present. Levels between 6 and 20 ng/L indicate a low level of mold is present and people sensitive to mold may be affected. Levels between 20 and 60 ng/L indicate that actively growing mold is present at a moderate level and building occupants will probably be affected. Levels above 60 ng/L indicate that a high level of mold is present and most building occupants will be affected.

For Hypersensitive Individuals:

TMVOC levels below 3 ng/L indicate very reduced levels of actively growing mold may be present which will typically not affect hypersensitive individuals. Levels between 3 and 10 ng/L indicate that actively growing mold is present that may affect hypersensitive individuals. Levels between 10 and 20 ng/L indicate that actively growing mold is present; and significant allergic reactions for hypersensitive individuals are possible. Levels above 20 ng/L indicate that significant, active mold growth is present that will probably affect most hypersensitive individuals.

The TMVOC ranges cited above and their interpretation are not absolute as many conditions affect the quantity of MVOCs detected. Therefore, it must be understood that these results are not definitive but are meant as a general guideline only.

Caution should always be exercised when removing mold and it is recommended that a professional mold remediator be consulted before any removal is initiated.

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Fike
Analytical Technologies, L.L.C.

Analytical Report

Client: Terracon Consultants, Inc.
Project: CU-Barre Hall
Location: Clemson, SC
Sampled By: B. Hestir

C.O.C. No.: 3743
Order Date: 04/06/2017
Report Date: 04/15/2017

NIOSH 2549 AirSurvey Analysis All results are reported in ng/L

A scan was made for all compounds contained in the attached AirSurvey List of Compounds Quantitative List and Semiquantitative List. All compounds detected are listed below:

Client Sample ID: Lehotsky 284 E
Laboratory ID: 3743 -3
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Total VOCs		290	Total volatile organic compounds calculated based on internal standard ratio; does not include C1, C2, or methanol
C 5		2.3	Pentane ppb 0.8 MW 72 CAS 109-66-0
Benzene		0.6	Cyclohexatriene ppb 0.2 MW 78 CAS 71-43-2
Toluene		2.7	Methyl benzene ppb 0.7 MW 92 CAS 108-88-3
Ethylbenzene		1.7	 ppb 0.4 MW 106 CAS 100-41-4
m,p-Xylene		6.4	m,p-Dimethylbenzene; CAS number is for the para isomer ppb 1.5 MW 106 CAS 106-42-3
o-Xylene		1.1	o-Dimethylbenzene ppb 0.2 MW 106 CAS 95-47-6
C10		0.9	Decane ppb 0.2 MW 142 CAS 124-18-5
1,2,4-Trimethylbenzene		1.1	1,2,4-TMB ppb 0.2 MW 120 CAS 95-63-6
C11		1.7	Undecane ppb 0.3 MW 156 CAS 1120-21-4
C12		1.1	Dodecane ppb 0.2 MW 170 CAS 112-40-3
C14		7.4	Tetradecane ppb 0.9 MW 198 CAS 629-59-4
C15		5.0	n-Pentadecane ppb 0.6 MW 212 CAS 629-62-9
Ethanol	4	2-8	Ethyl alcohol ppb 2.0 MW 46 CAS 64-17-5

Client Sample ID: Lehotsky 284 E
Laboratory ID: 3743 -3
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Acetone	4	2-8	2-Propanone ppb 1.6 MW 58 CAS 67-64-1
Methylacetate	2	1-4	 ppb 0.5 MW 74 CAS 79-20-9
Hexanal	3	1-6	Hexaldehyde; caproic aldehyde ppb 0.7 MW 100 CAS 66-25-1
a-Pinene	4	2-8	2-Pinene ppb 0.7 MW 136 CAS 80-56-8
Cyclohexanone	1	0.5-2	 ppb 0.2 MW 98 CAS 108-94-1
Octamethylcyclotetrasiloxane	1	0.5-2	 ppb 0.07 MW 296 CAS 556-67-2
B-Pinene	1	0.5-2	Pseudopinene; bicyclo[3.1.1]heptane ppb 0.2 MW 136 CAS 127-91-3
Benzaldehyde	2	1-4	 ppb 0.5 MW 106 CAS 100-52-7
Limonene	6	3-12	AirSurvey does not differentiate between Limonene (CAS 138-86-3) and d-Limonene (CAS 5989-27-5) ppb 1.0 MW 136 CAS 138-86-3
2-Ethyl-1-hexanol	1	0.5-2	 ppb 0.2 MW 130 CAS 104-76-7
Nonanal	2	1-4	 ppb 0.4 MW 142 CAS 124-19-6

These results have been reviewed and approved by the Technical Director

Randall S. Fike, Ph.D.

Fike Analytical Technologies, L.L.C.
9800 Reese Rd.
Clarkston, MI 48348
248-241-6713

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Analytical Technologies, L.L.C.

Indoor Air Quality Summary

Client:	Terracon Consultants, Inc.	Sample Number:	3743 - 3
Project:	CU-Barre Hall	Date Sampled:	04/05/2017
Location:	Clemson, SC	Order Date:	04/06/2017
Sampled By:	B. Hestir	Date Analyzed:	04/07
Submitter ID:	Lehotsky 284 E	Date Reported:	04/16/2017

IAQ Summary

Total VOCs (TVOC), ng/L: 290

Mold VOCs (TMVOC), ng/L: 2.3

Sample Volume (L): 40

Notes: -

Understanding the Results:

TVOC (Total Volatile Organic Compounds)

No federal or state agency has specified a specific limit for Total Volatile Organic Compounds (TVOCs) in indoor air; however, several members of the European Union and the U. S. Green Building Council (USGBC) have recommended 500 ng/L as the limit. Note that if all of the TVOC is the result only one or a small number of components, a hazardous condition may still exist.

In homes, usually, TVOC levels below 200 ng/L indicate that the Indoor Air Quality (IAQ) is "Ideal," TVOC levels between 200 and 300 ng/L indicate that the IAQ is "Good," TVOC levels between 300 and 400 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 400 and 500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 500 ng/L indicate that a problem may exist and it should be addressed.

In commercial buildings, TVOC levels below 200 ng/L indicate that the IAQ is "Ideal," TVOC levels between 200 and 350 ng/L indicate that the IAQ is "Good," TVOC levels between 350 and 500 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Marginal." TVOC levels above 700 ng/L indicate that a problem may exist and it should be addressed.

In production and manufacturing facilities, TVOC levels below 500 ng/L indicate that the IAQ is "Ideal," TVOC levels between 500 and 700 ng/L indicate that the IAQ is "Good," TVOC levels between 700 and 1,000 ng/L indicate that the IAQ is "Acceptable," and TVOC levels between 1,000 and 1,500 ng/L indicate that the IAQ is "Marginal." TVOC levels above 1500 ng/L indicate that a problem may exist and it should be addressed.

In all cases, exposure effects are possible with TVOC levels between 1,500 and 3,000 and exposure effects are probable at TVOC levels above 3,000 ng/L. Exposure effects may include eye and respiratory irritation, headaches, drowsiness, nausea, general malaise, etc.

Based on what the individual compounds are that make up the TVOC, it is possible to suggest actions which will lower the level into an acceptable range. Contact the person who took this sample for more information.

Indoor Air Quality Summary

Understanding the Results:

TMVOC (Total Mold Volatile Organic Compounds)

This is an assessment of the quantity of actively growing mold in the building. This test will not detect inactive or dormant mold. Like TVOC, no federal or state agency has specified specific limits for TMVOC. Typically, if there is no plumbing leak or water intrusion into the building, there will not be a mold problem. If the presence of mold is indicated, the first step in fixing the problem is to find and eliminate the water source. Typical places to check are roof leaks, plumbing leaks, leaks under the windows, leaking appliances, and sweating fixtures.

For Normal Individuals:

TMVOC levels below 6 ng/L typically indicate that there is a minimal amount of actively growing mold present. Levels between 6 and 20 ng/L indicate a low level of mold is present and people sensitive to mold may be affected. Levels between 20 and 60 ng/L indicate that actively growing mold is present at a moderate level and building occupants will probably be affected. Levels above 60 ng/L indicate that a high level of mold is present and most building occupants will be affected.

For Hypersensitive Individuals:

TMVOC levels below 3 ng/L indicate very reduced levels of actively growing mold may be present which will typically not affect hypersensitive individuals. Levels between 3 and 10 ng/L indicate that actively growing mold is present that may affect hypersensitive individuals. Levels between 10 and 20 ng/L indicate that actively growing mold is present; and significant allergic reactions for hypersensitive individuals are possible. Levels above 20 ng/L indicate that significant, active mold growth is present that will probably affect most hypersensitive individuals.

The TMVOC ranges cited above and their interpretation are not absolute as many conditions affect the quantity of MVOCs detected. Therefore, it must be understood that these results are not definitive but are meant as a general guideline only.

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Fike
Analytical Technologies, L.L.C.

Analytical Report

Client: Terracon Consultants, Inc.
Project: CU-Barre Hall
Location: Clemson, SC
Sampled By: B. Hestir

C.O.C. No.: 3743
Order Date: 04/06/2017
Report Date: 04/15/2017

NIOSH 2549 AirSurvey Analysis All results are reported in ng/L

A scan was made for all compounds contained in the attached AirSurvey List of Compounds Quantitative List and Semiquantitative List. All compounds detected are listed below:

Client Sample ID: Edwards 534
Laboratory ID: 3743 -4
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Total VOCs		180	Total volatile organic compounds calculated based on internal standard ratio; does not include C1, C2, or methanol
Benzene		0.6	Cyclohexatriene ppb 0.2 MW 78 CAS 71-43-2
Toluene		3.9	Methyl benzene ppb 1.0 MW 92 CAS 108-88-3
m,p-Xylene		1.6	m,p-Dimethylbenzene; CAS number is for the para isomer ppb 0.4 MW 106 CAS 106-42-3
o-Xylene		0.6	o-Dimethylbenzene ppb 0.1 MW 106 CAS 95-47-6
C10		0.7	Decane ppb 0.1 MW 142 CAS 124-18-5
1,2,4-Trimethylbenzene		0.9	1,2,4-TMB ppb 0.2 MW 120 CAS 95-63-6
C11		0.6	Undecane ppb 0.09 MW 156 CAS 1120-21-4
C12		0.7	Dodecane ppb 0.1 MW 170 CAS 112-40-3
C14		0.8	Tetradecane ppb 0.1 MW 198 CAS 629-59-4
C15		0.6	n-Pentadecane ppb 0.07 MW 212 CAS 629-62-9
Ethanol	8	4-16	Ethyl alcohol ppb 4.1 MW 46 CAS 64-17-5
Acetone	5	2-10	2-Propanone ppb 2.0 MW 58 CAS 67-64-1
Isopropanol	11	5-22	Isopropyl alcohol; 2-propanol ppb 4.5 MW 60 CAS 67-63-0

Client Sample ID: Edwards 534
Laboratory ID: 3743 -4
Date Sampled: 04/05/2017
Date Analyzed: 04/07 Volume: 40. L

Detection Limits	
Quantitative List:	0.5 ng/L
Semiquantitative List:	2 ng/L

Compound	Calculated Result	Actual Result	Comments
Methylacetate	1	0.5-2	ppb 0.4 MW 74 CAS 79-20-9
a-Pinene	2	1-4	2-Pinene ppb 0.4 MW 136 CAS 80-56-8
Octamethylcyclotetrasiloxane	1	0.5-2	ppb 0.08 MW 296 CAS 556-67-2
B-Pinene	1	0.5-2	Pseudopinene; bicyclo[3.1.1]heptane ppb 0.2 MW 136 CAS 127-91-3
Benzaldehyde	1	0.5-2	ppb 0.3 MW 106 CAS 100-52-7
Limonene	2	1-4	AirSurvey does not differentiate between Limonene (CAS 138-86-3) and d-Limonene (CAS 5989-27-5) ppb 0.3 MW 136 CAS 138-86-3
Diethylene glycol diethyl ether	0.4	0.2-0.8	1-ethoxy-2-(2-ethoxyethoxy)ethane ppb 0.06 MW 162 CAS 112-36-7
Nonanal	1	0.5-2	ppb 0.2 MW 142 CAS 124-19-6
Texanol-B	0.4	0.2-0.8	ppb 0.05 MW 216 CAS 74367-34-3

These results have been reviewed and approved by the Technical Director

Randall S. Fike, Ph.D.

Fike Analytical Technologies, L.L.C.
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Fike

Analytical Technologies, L.L.C.

Indoor Air Quality Summary

Client:	Terracon Consultants, Inc.	Sample Number:	3743 - 4
Project:	CU-Barre Hall	Date Sampled:	04/05/2017
Location:	Clemson, SC	Order Date:	04/06/2017
Sampled By:	B. Hestir	Date Analyzed:	04/07
Submitter ID:	Edwards 534	Date Reported:	04/16/2017

IAQ Summary

Total VOCs (TVOC), ng/L: 180

Mold VOCs (TMVOC), ng/L: 1.8

Sample Volume (L): 40

Notes: -

Understanding the Results:

TVOC (Total Volatile Organic Compounds)

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Indoor Air Quality Summary

Understanding the Results:

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Fike
Analytical Technologies, L.L.C.

Laboratory Addresses and Contact Information

**SEM-EDS Analyses
Off Gas Analyses
Special Analyses**
9800 Reese Rd.
Clarkston, MI 48348
randall@reagan.com
Phone: 248-241-6713

Thermal Desorption Tube Analyses Only
c/o Beacon Env. Serv.
2203A Commerce Rd, Suite 1
Forest Hill, MD 21050
randall@reagan.com
Phone: 248-241-6713

**Pump Rental and Supplies
Rental Pump Return**
9800 Reese Rd.
Clarkston, MI 48348
randall@reagan.com
Phone: 248-241-6713

Chain of Custody # 3743

PAGE 1 of 1

Client Information		Contact Information		Project Information
Company: Terracon		Contact Name: Ben Hestir		Project Name: CU-Barre Hall
Address: 72 Pointe Circle Greenville, SC 29615		Contact Phone: 864-293-7348		Location: Clemson, SC
Email invoice to:		Email Results To: ben.hestir@terracon.com		Sampled By: Ben Hestir

Lab Sample Number	Date Collected	Sampling Time (min.)	Air Volume	Tube Serial Number	Client Sample Identification	Descriptor (Home, Office, Mfg., Airport, etc.)	PARAMETERS: AirSurveyIH Analysis (400+ compounds using GC-MS)	IAQ Summary (TVOC and TMVOC)	SmokeScan (Stale Tobacco Smoke)	Scanning Electron Microscope	Turnaround Time: Remarks
	4/5/17	200	40 L	752	Barre 2073	Office	✓				with mold add-on
	4/5/17	200	40L	605	Barre 2035	"	✓				"
	4/5/17	200	40 L	556	Lehotsky 284E	"	✓				"
	4/5/17	200	40 L	610	Edwards 534	"	✓				"

Turnaround Time:
- Normal (5-8 working days):
- Same Day Wkend/Holiday (4X):
- Same Day Workday (3X):
- 24 hour RUSH (2X surcharge):
- 48 hour RUSH (1.75X surcharge):
- Other:

Brief description of the problem:

Comments or special instructions:

Relinquished By:	Date/Time	Received By:	Date/Time
Ben Hestir-Terracon	1700 4/5/17	Augusto Berrios	13:27 4-6-17