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 Water Sampling Report
Clemson University - Barre Hall
Clemson, South Carolina
Terracon Project No. 86127158 – Task 81

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) collected water samples in two locations from the HVAC system in Barre Hall located on the main campus of Clemson University in Clemson, South Carolina. It is our understanding that this sampling was requested to screen for *Legionella pneumophila* in the heating, ventilation, and air conditioning (HVAC) system at Barre Hall.

PROJECT DESCRIPTION

Scope of Services

At your request, Terracon conducted limited water sampling in two locations within Barre Hall for *Legionella pneumophila*:

- Penthouse Mechanical Room – HVAC closed loop system drain; and,
- Basement level Mechanical Room – HVAC closed loop system drain.

Terracon representative Mr. Benjamin Hestir performed this sampling event on March 31, 2017. We were assisted in identifying sample locations by Mr. Wesley Smith of University Facilities. Samples were collected from system drains in each location for bacterial analysis.

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 can potentially 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

Criteria

The American Industrial Hygiene Association (AIHA) document "Recognition, Evaluation and Control of *Legionella* in Building Water Systems" has guidance on response to sampling results depending on the type of system being sampled and the level of Legionella bacteria detected. For cooling tower and evaporative condensers levels of <10 colony forming units (CFUs) per milliliter (mL) are considered essentially non-detectable, levels of 10-100 CFU/mL are considered acceptably low, levels of 100-1000 CFU/mL are evidence of possible amplification and levels above 1000 CFU/mL are considered definite amplification.

Water Sampling

Water samples were collected at two (2) client selected locations using laboratory supplied 250 milliliter (ml) sample collection bottles.

- Samples Barre-1 and Barre-2 (1st draw and 2nd draw) were collected from the Barre Hall Penthouse Mechanical Room HVAC system drain.

- Samples Barre-3 and Barre-4 (1st draw and 2nd draw) were collected from the Barre Hall Basement Mechanical Room HVAC system drain.

Water samples included a pre-flush or first draw sample in conjunction with a post-flush or second draw sample after the water was allowed to run for 60 seconds.

After collection, the samples were placed on ice and shipped via overnight courier under standard chain-of-custody (COC) protocol to U.S. Micro-Solutions, Inc. in Greensburg, Pennsylvania. Samples were analyzed for the presence of primary species of legionella (*Legionella pneumophila*) via US Micro Systems (USMS) analytical method B007 based on Centers for Disease Control (CDC) standards. Samples are required to be cultured in the lab for eight (8) days in order to identify the bacteria on the following media types:

- buffered charcoal yeast extract (BCYE) agar media with glycine, polymyxin B, cyclohexamide, vanomycin (GPCV); and
- buffered charcoal yeast extract (BCYE) agar media with cephalothin, colistin, vanomycin and cyclohexamide (CCVC).

FINDINGS

The building has a total of four air handling units (AHUs). The three AHUs that serve the first 2 floors are hot deck/cold deck systems with a heating and cooling coil that serves two individual ducts so each mixing box has a cold and hot duct. All the heating hot water in the building is common on a closed loop system and our samples were collected at relief valves in the penthouse and basement mechanical rooms. According to Brian Kauer of University Utilities, the closed loop system is generally maintained above 140° Fahrenheit, but if they have to open the system for maintenance or if they confirm bacteriological growth through their in-house dip slide testing they would treat the system with a biocide, usually either isothiazoline or glutaraldehyde.

Legionella was not cultured from the samples submitted. The laboratory analytical reports are attached.

Terracon appreciates the opportunity to provide this service for Clemson University. If you have any questions regarding this limited water sampling 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: Laboratory Results

Laboratory Results

U.S. Micro-Solutions, Inc. * 1075 South Main Street, Suite 104 * Greensburg, PA 15601
Phone: (724) 853-4047 Fax: (724) 853-4049
www.usmslab.com

Customer Name:	**Terracon Consultants, Inc**	**Sample Date:**	**March 31, 2017**
Customer Address:	**72 Pointe Cricle**	**Date Received:**	**April 4, 2017**
	Greenville, SC 29615	**Date of Report:**	**April 12, 2017**
Customer Phone:	**(864) 293-7348**	**Fax:**	
PO Number:		**Attention:**	**Ben Hestir**
Project Name/Number:	**86127158 Task 81**		

Customer sample numbers below are uniquely identified by prefixing Laboratory # 42255-17

Water/Liquid Sample(s) for Legionella Culture - Analytical Method USMS-B007 (based on CDC standards)

Sample Number	Media	Sample Description	Results of Microbial Analysis
Barre-1	BCYE/GPCV BCYE/CCVC	Penthouse HVAC Tap First Draw	***Not Detected***
AS = 10 CFU/mL (Volume examined: 0.4 mL)			
Barre-2	BCYE/GPCV BCYE/CCVC	Penthouse HVAC Tap Second Draw	***Not Detected***
AS = 10 CFU/mL (Volume examined: 0.2 mL)			
Barre-3	BCYE/GPCV BCYE/CCVC	Basement HVAC Top First Draw	***Not Detected***
AS = 10 CFU/mL (Volume examined: 0.4 mL)			
Barre-4	BCYE/GPCV BCYE/CCVC	Basement HVAC Tap Second Draw	***Not Detected***
AS = 10 CFU/mL (Volume examined: 0.2 mL)			

Notes:

CFU/mL = Colony forming units per milliliter, AS = analytical sensitivity.
Results are reported as Positive or Not Detected.

A negative culture for *Legionella* spp. from a sample does not necessarily rule out the presence.

All internal test methods are proprietary and remain the property of U.S. Micro-Solutions, Inc. (USMS). When customers provide duplicates of this report, the document should be provided in total. USMS shall have no liability to the customer or the customer's customer for opinions stated, recommendations made, actions taken, or conduct implemented by either the customer or the customer's customer based on the results reported. USMS has provided interpretation of results in good faith using the best information available at the time of the analysis. Results only relate to the samples tested. Any unauthorized or improper disclosure, copying, distribution, use, or falsification of these results is prohibited.

Technical Manager: Herbert Layman
Herbert Layman, BS, SM, CIEC

End of Report

U.S. Micro-Solutions, Inc.

1075 S Main Street, Suite 104
Greensburg, PA 15601
PHONE: 724-853-4047 FAX: 724-853-4049
supplies@usmslab.com

AIHA –LAP, LLC
EMLAP #103009

Lab ID # 103009

NY ELAP #12055
The New York Environmental Laboratory Approval Program

CDC's ELITE Program

LEGIONELLA / WATER LABORATORY TEST REQUEST/CHAIN OF CUSTODY

CUSTOMER NAME: Terracon Consultants, Inc.	PHONE #: 864-293-7348	FAX #:	
ADDRESS: 72 Pointe Circle	CITY: Greenville	STATE: SC	ZIP: 29615
ATTENTION TO: Ben Hestir	E-MAIL: ben.hestir@terracon.com		
SAMPLE OBTAINED BY: Ben Hestir	RESULTS: ☐ FAX ☐ EMAIL		
PROJECT NAME/NUMBER: 86127158 Task 81	PO#		
# SAMPLES: 4	Samples collected in New York state? ☐ Yes ☑ No		

SAMPLE NUMBER	SAMPLE DATE/TIME	SAMPLE LOCATION AND DESCRIPTION	SAMPLE TYPE: WATER	SAMPLE TYPE: SWAB	POTABLE WATER: YES	POTABLE WATER: NO	TEST TYPE: LEGIONELLA	TEST TYPE: Heterotrophic Plate Count	TEST TYPE: COLILERT	LAB USE ONLY: Chlorine (ppm)	LAB USE ONLY: Temperature (°c)
Barre-1	March 31, 2017 13:58	Penthouse HVAC tap First draw	✓			✓	✓				
Barre-2	14:00	Penthouse HVAC tap Second draw	✓			✓	✓				
Barre-3	14:05	Basement HVAC tap First draw	✓			✓	✓				
Barre-4	14:08	Basement HVAC tap Second draw	✓			✓	✓				

RELINQUISHED BY – CUSTOMER (MUST SIGN)	DATE AND TIME	Analyst Initials
Ben Hestir - Terracon	4/3/17 12 noon	
RECEIVED BY – LAB USE ONLY	DATE AND TIME	LABORATORY NUMBER
	4/4/17 9:30	42255-17

Rev 11/16/16