September 6, 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
Physics Fabrication Shop (Daniel Annex)
Clemson, South Carolina 29631
Terracon Project No. 86127158 – Task 95

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted a limited mold investigation in the shop located between Kinard Hall and Daniel Hall on the main campus of Clemson University in Clemson, South Carolina. Reportedly, employees working in this area have experienced respiratory issues. 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 Physics Fabrication Shop on Tuesday, July 11, 2017. The building housing the fabrication shop was reportedly constructed in the late 1960's and was converted from a performing arts space to the fabrication shop for the Physics Department in 1994. The building has a footprint of approximately 4,600 square feet and contains a multi-room shop, a welding area, restrooms, and an office.

On our July 11th visit, Terracon made measurements of temperature and relative humidity and conducted airborne mold sampling which consisted of collecting spore trap air samples in four locations inside the building and the collection of two additional samples outside for comparison.

On our July 25th visit, Terracon collected swab samples of accumulated dust in four locations inside the building.

### 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.

## SAMPLING 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 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.

Mold dust swabs were collected using Healthlink Transporterä sterile swabs with a 100 square centimeter area template.

After collection, the dust swabs were delivered by overnight courier under standard chain of custody to Scientific Analytical Institute (SAI) in Greensboro, North Carolina. SAI is accredited by the AIHA Environmental Microbiology Proficiency Analytical Testing (EMPAT) program for fungi analysis, Accreditation 173190.

SAI has established descriptive criteria for the findings of direct physical examination of the dust on the swabs based on the following:

- Trace (1-10 spores)
- Light (11-100 spores)
- Abundant (101-300 spores)
- Loaded (>300 spores)

No state or federal exposure limits have been established for fungal aerosols or dust swabs. 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

- The building construction is primarily concrete masonry unit (CMU) construction with a sloped metal roof.
- The central portion of the building has an approximately twenty-foot high ceiling with multiple metal HVAC ducts that are reportedly insulated on the inside.
- The HVAC duct supply and return registers had dust build-up.
- There were a few (2-3) through the wall exhaust fans present on exterior walls.
- No local exhaust systems were observed associated with the metal machining tools present.
- A slight odor of petroleum was present, possibly from machine tool cutting oil.
- According to shop employees the majority of metal work is done in aluminum.
- Employee questionnaires complained of excess dust accumulations, mold, poor air flow, and high humidity.
- Photographs from the assessment are attached.

## Mold Air Sampling

On the afternoon of July 11, 2017, Terracon collected four mold spore trap samples inside the Physics Fabrication Shop building and two samples in outdoor locations for comparison. The results of the total spore count samples analyses are summarized in Table 1 below:

Table 1: Summary of Total Spore Count Analyses and IAQ Measurements – July 11, 2017

| Sample # | PS-1 | PS-2 | PS-3 | PS-4 | PS-5 | PS-6 |
|---|---|---|---|---|---|---|
| **Location Description** | **West side of shop** | **Center bench in main shop** | **East side - shop office** | **North side – welding area** | **Outside Kinard entrance** | **Outside East employee parking** |
| **Spore Type** | **Spores/m$^3$** | **Spores/m$^3$** | **Spores/m$^3$** | **Spores/m$^3$** | **Spores/m$^3$** | **Spores/m$^3$** |
| Alternaria | --- | --- | --- | --- | 26 | 91 |
| Ascospores | 39 | --- | --- | 39 | 1,640 | 1,170 |
| Basidiospores | 351 | 312 | 130 | 507 | 2,510 | 2,640 |
| *Cladosporium* | 39 | 39 | 13 | 13 | 741 | 975 |
| *Curvularia* | --- | --- | --- | --- | 13 | --- |
| *Epicoccum* | --- | --- | --- | --- | --- | 13 |
| *Cercospora* | --- | --- | --- | --- | 13 | --- |
| *Penicillium/ Aspergillus* | 273 | 429 | 377 | 468 | 1,210 | 1,370 |
| Smuts/*Periconia*/ Myxomycetes | --- | --- | --- | --- | --- | 78 |
| *Torula* | --- | --- | --- | --- | 26 | 26 |
| *Polythrincium* | --- | --- | --- | --- | --- | 13 |
| *Zygomycetes* | --- | --- | --- | --- | 78 | --- |
| **Total** | **702** | **780** | **520** | **1,030** | **6,260** | **6,380** |

| Sample # | PS-1 | PS-2 | PS-3 | PS-4 | PS-5 | PS-6 |
|---|---|---|---|---|---|---|
| Location Description | West side of shop | Center bench in main shop | East side - shop office | North side – welding area | Outside Kinard entrance | Outside East employee parking |
| Spore Type | Spores/m³ | Spores/m³ | Spores/m³ | Spores/m³ | Spores/m³ | Spores/m³ |
| Temperature (ºF) | 73 | 71.7 | 72.3 | 73 | 87.8 | --- |
| Relative Humidity (%) | 64.9 | 70.1 | 67.8 | 68.7 | 56.3 | --- |

The lowest outdoor total spore count was approximately 6 times higher than the highest total spore count inside. The dominant mold genera indoors were *Basidiospores and Aspergillus/Penicillium.* The dominant mold spore types outdoors were *Ascospores, Basidiospores* and *Aspergillus/Penicillium*. Conditions outside on the day we sampled were hot and sunny.

The laboratory analytical report is attached.

## Temperature and Relative Humidity

The highest indoor temperature measured was 73ºF and the highest indoor relative humidity measured was 70.1%. The outdoor temperature was 87.8ºF and the relative humidity was 56.3%.

## Mold Dust Swabs

Mold dust swabs were collected in four locations in the Physics Fabrication Shop with sterile swabs. Results from the direct physical examination are summarized in Table 2 below:

Table 2: Summary of Mold Dust Swabs – July 25, 2017

| Sample # | PS-5 | PS-8 | PS-11 | PS-14 |
|---|---|---|---|---|
| Location Description | Exterior of Duct - Southeast | Exterior of Duct – East Entrance | Top of Cabinet | West Side Return |
| Spore Type | ID | ID | ID | ID |
| Alternaria | --- | 2 | --- | --- |
| *Aspergillus* | --- | 2 | --- | --- |
| *Aspergillus/Penicillium-like* | --- | 4 | 2 | 2 |
| Basidiospores | --- | 2 | --- | --- |
| *Cladosporium* | 2 | 1 | 2 | 1 |
| *Epicoccum* | 1 | 1 | --- | --- |
| *Nigrospora* | 1 | 2 | 4 | 2 |
| Rust, Myxomycetes, Smut-like | 1 | 2 | 2 | 1 |

| Sample # | PS-5 | PS-8 | PS-11 | PS-14 |
|---|---|---|---|---|
| **Location Description** | **Exterior of Duct - Southeast** | **Exterior of Duct – East Entrance** | **Top of Cabinet** | **West Side Return** |
| **Spore Type** | **ID** | **ID** | **ID** | **ID** |
| Fruiting Bodies | --- | 3 | 1 | 1 |
| Hyphal Fragments | 2 | 4 | 3 | 3 |
| Pollen | 3 | 2 | 1 | 1 |
| Debris | 4 | 3 | 3 | 3 |
| **1=Trace** | **1-10 spores** | | | |
| **2=Light** | **11-100 spores** | | | |
| **3=Abundant** | **101-300 spores** | | | |
| **4=Loaded** | **>300 spores** | | | |
| **Note: duct samples PS-5 and PS-8 collected adjacent to HVAC supply registers** | | | | |

## 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 concentrations of mold spore types inside the building were less than or similar to the highest corresponding outdoor mold spore levels measured. This is considered to be a favorable condition in the indoor environment.
- Dust wipes found either abundant or loaded results for pollen, debris, *Aspergillus/Penicillium-like*, hyphal fragments and *Nigrospora.*
- This indicates that while indoor mold air levels do not exceed outdoor levels, there is a significant number of mold spores in surficial dust that has accumulated adjacent to supply grilles on the surfaces of metal ducts within the lab.
- Temperature levels were within ASHRAE guideline ranges, however, relative humidity levels were above the EPA guideline ranges of 30 – 60%.

## RECOMMENDATIONS

The following recommendations are provided based on our assessment:

- Relative humidity readings were not within recommended ranges and efforts to reduce these airborne moisture levels should be undertaken.
- Cleaning of particulate accumulations observed in and around the HVAC ductwork should be conducted.

- Duct work that is insulated on the inside and heavily coated with dust/debris may not be able to clean effectively and may have to be replaced.

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** Exterior view of the Physics Fabrication Shop / Daniel Annex looking southeast



**Photo #2** East side of the Physics Fabrication Shop looking west from employee parking




**Photo #3** View of the main shop room looking north



**Photo #4** Typical supply register in the main shop



**Photo #5** View of the office space on the NW corner of the building looking south

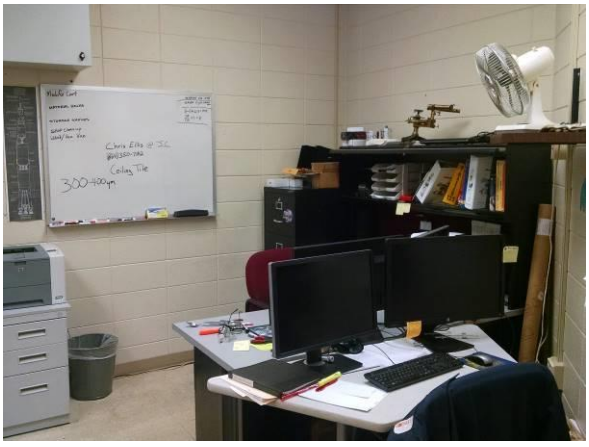


**Photo #6** View of the office space looking north/northwest



**Photo #7** View of welding bench on the NE corner of the building looking east

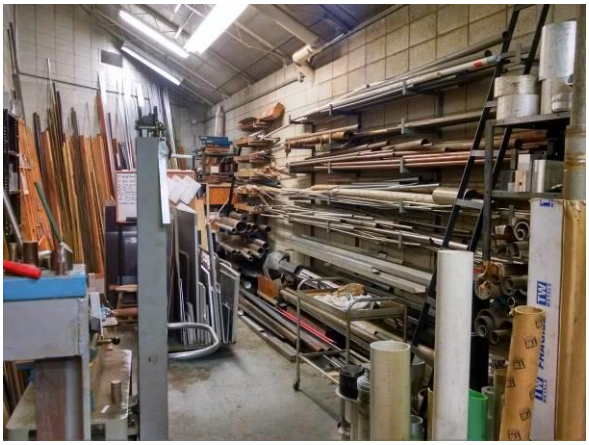


**Photo #8** View of welding stock area on the north side of the building looking west

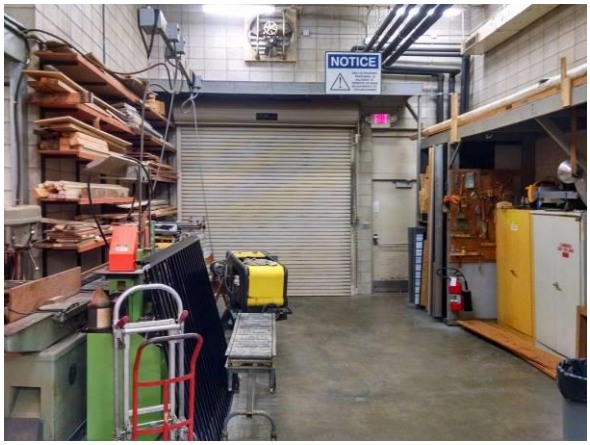



**Photo #9** View of E side entry doors looking east



**Photo #10** View of entry HVAC supply ducts



**Photo #11** Close up view of HVAC supply duct



**Photo #12** View of supply duct in main shop

# Laboratory Results

SEEML Reference Number:
170712064

**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: 07/12/17

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:
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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: 07/11/17 |
| Terracon | Date Received: 07/12/17 |
| 72 Pointe Circle | Date Analyzed: 07/12/17 |
| Greenville, SC 29615 | Date Reported: 07/12/17 |
| | Date Revised: |
| | Project Name: Physics Shop |
| | Project Address: 86127158 Task 94 |
| | Project City, State, ZIP: |
| | SEEML Reference # : 170712064 |

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

| Client Sample ID | PS-1 | | | PS-2 | | | PS-3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | W. Side Of Shop | | | Center Bench In Main Shop | | | E. Side - Shop Office | | |
| Lab Sample ID | 170712064-174 | | | 170712064-175 | | | 170712064-176 | | |
| 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 | 3 | 39 | 6 | | | | | | |
| Basidiospores | 27 | 351 | 50 | 24 | 312 | 40 | 10 | 130 | 25 |
| Bipolaris/Drechslera | | | | | | | | | |
| Chaetomium | | | | | | | | | |
| Cladosporium | 3 | 39 | 6 | 3 | 39 | 5 | 1 | 13 | 3 |
| Curvularia | | | | | | | | | |
| Epicoccum | | | | | | | | | |
| Cercospora | | | | | | | | | |
| Fusarium | | | | | | | | | |
| Memnoniella | | | | | | | | | |
| Nigrospora | | | | | | | | | |
| Penicillium/Aspergillus | 21 | 273 | 39 | 33 | 429 | 55 | 29 | 377 | 73 |
| Polythrincium | | | | | | | | | |
| Rusts | | | | | | | | | |
| Smuts/Periconia/Myxomy | | | | | | | | | |
| Spegazzinia | | | | | | | | | |
| Stachybotrys | | | | | | | | | |
| Stemphylium | | | | | | | | | |
| Tetraploa | | | | | | | | | |
| Torula | | | | | | | | | |
| Ulocladium | | | | | | | | | |
| Colorless/Other Brown 2 | | | | | | | | | |
| Oidium | | | | | | | | | |
| Zygomycetes | | | | | | | | | |
| Pithomyces | | | | | | | | | |
| Background debris (1-5)3 | 2 | | | 2 | | | 2 | | |
| Sample Volume(liters) | 75 | | | 75 | | | 75 | | |
| **TOTAL SPORES/$M^3$** | 54 | **702** | | 60 | **780** | | 40 | **520** | |

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: 07/11/17 |
| Terracon | Date Received: 07/12/17 |
| 72 Pointe Circle | Date Analyzed: 07/12/17 |
| Greenville, SC 29615 | Date Reported: 07/12/17 |
| | Date Revised: |
| | Project Name: Physics Shop |
| | Project Address: 86127158 Task 94 |
| | Project City, State, ZIP: |
| | SEEML Reference # : 170712064 |

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

| Client Sample ID | PS-4 | | | PS-5 | | | PS-6 | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | N. Side- Welding Area | | | Outside Near Kinard Entrance | | | Outside E Side Employee Parking | | |
| Lab Sample ID | 170712064-177 | | | 170712064-178 | | | 170712064-179 | | |
| Detection Limit (spores/$m^3$) | 13 | | | 13 | | | 13 | | |
| Hyphal Fragments | 1 | 13 | | 1 | 13 | | 3 | 39 | |
| Pollen | 1 | 13 | | 2 | 26 | | 1 | 13 | |
| Spore Trap Used | Allergenco | | | Allergenco | | | Allergenco | | |
| | raw ct. | spores/$m^3$ | % | raw ct. | spores/$m^3$ | % | raw ct. | spores/$m^3$ | % |
| Alternaria | | | | 2 | 26 | <1 | 7 | 91 | 1 |
| Ascospores | 3 | 39 | 4 | 126 | 1640 | 26 | 90 | 1170 | 18 |
| Basidiospores | 39 | 507 | 49 | 193 | 2510 | 40 | 203 | 2640 | 41 |
| Bipolaris/Drechslera | | | | | | | | | |
| Chaetomium | | | | | | | | | |
| Cladosporium | 1 | 13 | 1 | 57 | 741 | 12 | 75 | 975 | 15 |
| Curvularia | | | | 1 | 13 | <1 | | | |
| Epicoccum | | | | | | | 1 | 13 | <1 |
| Cercospora | | | | 1 | 13 | <1 | | | |
| Fusarium | | | | | | | | | |
| Memnoniella | | | | | | | | | |
| Nigrospora | | | | | | | | | |
| Penicillium/Aspergillus | 36 | 468 | 45 | 93 | 1210 | 19 | 105 | 1370 | 21 |
| Polythrincium | | | | | | | 1 | 13 | <1 |
| Rusts | | | | | | | | | |
| Smuts/Periconia/Myxomy | | | | | | | 6 | 78 | 1 |
| Spegazzinia | | | | | | | | | |
| Stachybotrys | | | | | | | | | |
| Stemphylium | | | | | | | | | |
| Tetraploa | | | | | | | | | |
| Torula | | | | 2 | 26 | <1 | 2 | 26 | <1 |
| Ulocladium | | | | | | | | | |
| Colorless/Other Brown 2 | | | | | | | | | |
| Oidium | | | | | | | | | |
| Zygomycetes | | | | 6 | 78 | 1 | | | |
| Pithomyces | | | | | | | | | |
| Background debris (1-5)3 | 2 | | | 3 | | | 3 | | |
| Sample Volume(liters) | 75 | | | 75 | | | 75 | | |
| **TOTAL SPORES/$M^3$** | 79 | **1030** | | 481 | **6260** | | 490 | **6380** | |

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

SEEML Labs

# 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



| For Lab Use Only | | | |
|---|---|---|---|
| Condition of samples is acceptable | ☑ YES ☐ NO | SEEML Ref #: 1707120104 | Lab ID: 174 - 179 |

| Company Information | | Client Information | | Environmental Conditions | |
|---|---|---|---|---|---|
| (Project Manager) | Ben Hestir | Date Sampled: | 7/11/17 | Precipitation in last 16hrs: | No |
| (Company Name) | Terracon | Project Name: | Physics Shop | Relative Humidity I/O: | 68% / 52% |
| (Address) | 72 Ponte Circle | Project Address: | 8127158 Task 94 | Temperature I/O: | 73° / 85° |
| (City, State, Zip) | Greenville, SC 29615 | City, State, Zip: | | Wind Conditions | 5-10 mph |
| (Phone) | 864-293-7348 | | | | |
| (Email) | ben.hestir@terracon.com | | | | |

**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 |
|---|---|---|---|---|---|---|
| PS-1 | W side of shop | A | 1 | | 75 | |
| PS-2 | Center bench in main shop | " | " | | " | |
| PS-3 | E side - shop office | " | " | | " | |
| PS-4 | N side - welding area | " | " | | " | |
| PS-5 | Outside near Kinard entrance | " | " | | " | |
| PS-6 | Outside E side employee parking | " | " | | " | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

| Relinquished By: | Date/Time | Recieved By: | Date/Time |
|---|---|---|---|
| Ben Hestir | 7/12/17 10:35am | | 7-12-17 |

* Area is only required for culturable surface samples.
** Volume = Pump setting (L/min) x minutes

# Direct Exam: Swab Analysis

SAI Method B-SOP-005

| | | | |
|---|---|---|---|
| **Client:** | Terracon | **Attn:** | Ben Hestir |
| | 72 Pointe Circle | **Lab ID:** | 1716280 |
| | Greenville, SC 29615 | **Received:** | 7/28/2017 |
| **Project ID**: | Physics Fab Shop/86127158 Taks 95 | **Reported:** | 8/2/2017 |

| **Sample ID** | PFS-5 | PFS-8 | PFS-11 | PFS-14 | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sample Description** | Ext Duct SE | Ext Duct E Ent | Top of Cabinet | W Side Return | | | | |
| **IDENTIFICATION: 1=Trace (1-10 spores); 2=Light (11-100 spores); 3=Abundant (101-300 spores) 4=Loaded (>300 spores)** | | | | | | | | |
| *Alternaria* | | 2 | | | | | | |
| Ascospores | | | | | | | | |
| *Aspergillus* | | 2 | | | | | | |
| *Aspergillus/Penicillium-like* | | 4 | 2 | 2 | | | | |
| Basidiospores | | 2 | | | | | | |
| *Chaetomium* | | | | | | | | |
| *Cladosporium* | 2 | 1 | 2 | 1 | | | | |
| *Curvularia* | | | | | | | | |
| *Drechslera/Bipolaris* | | | | | | | | |
| *Epicoccum* | 1 | 1 | | | | | | |
| Myxomycete/Rust/Smut-like | 1 | 2 | 2 | 1 | | | | |
| *Nigrospora* | 1 | 2 | 4 | 2 | | | | |
| *Penicillium* | | | | | | | | |
| *Pithomyces* | | | | | | | | |
| *Scopulariopsis* | | | | | | | | |
| *Spegazzinia* | | | | | | | | |
| *Stachybotrys* | | | | | | | | |
| *Stemphylium* | | | | | | | | |
| *Tetraploa* | | | | | | | | |
| *Torula* | | | | | | | | |
| *Ulocladium* | | | | | | | | |
| Unknown/Other | | | | | | | | |
| | | | | | | | | |
| Fruiting bodies | | 3 | 1 | 1 | | | | |
| Hyphal fragments | 2 | 4 | 3 | 3 | | | | |
| Pollen | 3 | 2 | 1 | 1 | | | | |
| Debris | 4 | 3 | 3 | 3 | | | | |
| **COMMENT:** | | | | | | | | |

Microbiology Technical Manager
B-F-015 EXP: 3/1/2020



*Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA EMPAT program for fungi. EMPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Reporting Limit equals the Analytical Sensitivity.*

**Scientific Analytical Institute, Inc.**
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www.sailab.com lab@sailab.com

*Lab Use Only*
Lab Order ID: 71628
Client Code: _____

## Company Contact Information

| | |
|---|---|
| Company: Terracon | Contact: Ben Hestir |
| Address: 72 Ponte Circle | Phone ☑: 864-293-7348 |
| Greenville, SC 29615 | Fax ☐: |
| | Email ☑: ben.hestir@terracon.com |

## Billing/Invoice Information

SAME ☑
Company:
Contact:
Address:

**PO Number:**
**Project Name/Number:** Physics Fab Shop / 86127158 Task 95

## Turn Around Times^

| | |
|---|---|
| 90 Min. ☐ | 48 Hours ☐ |
| 3 Hours ☐ | 72 Hours ☐ |
| 6 Hours ☐ | 96 Hours ☐ |
| 12 Hours ☐ | 120 Hours ☑ |
| 24 Hours ☐ | 144+Hours ☐ |

^TATs not available for certain test types

## Industrial Hygiene Test Types

| | |
|---|---|
| Silica as Alpha Quartz* | ☐ |
| Silica as Cristobalite* | ☐ |
| Silica as Tridymite* | ☐ |
| Silica as Alpha Quartz, Cristobalite, Tridymite* | ☐ |
| *Include Respirable Dust* | ☐ |
| Silica Bulk* | ☐ |
| Bulk Phase ID/Whole Rock SAI Method H-SOP-003 | ☐ |
| Total Dust NIOSH Method 0500 | ☐ |
| Respirable Dust NIOSH Method 0600 | ☐ |
| PCM NIOSH 7400 (Fibers) | ☐ |
| TEM NIOSH 7402 (Asbestos) | ☐ |
| Hexavalent Chromium (OSHA ID-215) (Note if from spray paint operations) | ☑ |
| Metals (NIOSH 7300) (Specify Metals Under Comments) | ☑ |
| Other Mold - Direct Exam | ☑ |

*Modified NIOSH 7500/OSHA ID 142

| Sample ID # | Description/Location | Volume/Area | Comments (List Metals Here) |
|---|---|---|---|
| PFS-1 | MCE Cassette / W side Main Shop | 2,920 L | Welding Fumes |
| PFS-2 | MCE Cassette / Welding Rm NE corner | 2,740 L | Welding Fumes |
| PFS-3 | PVC wipe / Exterior of duct SE corner | ~100 cm² | Welding Fumes |
| PFS-4 | PVC wipe / same as PFS-3 | ~100 cm² | Hexavalent Chromium (HexCr |
| PFS-5 | Sterile swab / same as PFS-3 | ~100 cm² | Mold |
| PFS-6 | PVC wipe / Exterior of duct E entrance | ~100 cm² | Welding Fumes |
| PFS-7 | PVC wipe / same as PFS-6 | ~100 cm² | Hex Chrom |
| PFS-8 | Sterile swab / same as PFS-6 | ~100 cm² | Mold |
| PFS-9 | PVC wipe / top of cabinet welding area | ~100 cm² | Welding Fumes |
| PFS-10 | PVC wipe / same as PFS-9 | ~100 cm² | Hex Chrom |
| PFS-11 | Sterile swab / same as PFS-9 | ~100 cm² | Mold |
| PFS-12 | PVC wipe / W side return air | ~20 cm² | Welding Fumes |
| PFS-13 | PVC wipe / same as PFS-12 | ~20 cm² | Hex Chrom |
| PFS-14 | Sterile Swab / same as PFS-12 | ~20 cm² | Mold |
| PFS-15 | PVC cassette / W side Main Shop | 4,800 L | Hex Chrom |

Total # of Samples _____

| Relinquished by | Date/Time | Received by | Date/Time |
|---|---|---|---|
| Ben Hestir / Terracon | 7/27/13 1200 | [signature] | 7/28 9:30 AM |
| | | | |

Accepted ☑

Rejected ☐

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*Lab Use Only*
Lab Order ID: 171628
Client Code: _____

| Sample ID # | Description/Location | Volume/Area | Comments |
|---|---|---|---|
| PFS-16 | PUC Cassette / Welding Rm NE corner | 4,800L | Hex Chrom |
| PFS-17 | MCE Cassette / Field Blank | — | Welding Fumes |
| PFS-18 | PUC Cassette / Field Blank | — | Hex Chrom |

Note:

PFS1 – PFS-14
Sample date 7/25/17

PFS 15 and PFS-16
Sample date 7/26/17

Field Blanks 7/25/17 and 7/26/17