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Architecture | Engineering | Construction

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December 29, 2020

Prince George's County Public Schools
13300 Old Marlboro Pike
Upper Marlboro, Maryland 20772
Attention: Mr. Alex Baylor

RE: Indoor Air Quality Assessment, Allenwood Elementary School
IFB: 022-19
ATI Project Number: 20-715

Dear Mr. Baylor:

Prince George's County Public Schools requested that ATI, Inc., conduct a proactive indoor air quality (IAQ) assessment at Allenwood Elementary School on December 18, 2020. Its key findings are enclosed in the Executive Summary on page three, and the official laboratory report for total fungal spore trap sampling is enclosed in Appendix A.

Thank you for the opportunity to provide Industrial Hygiene services for Prince George's County Public Schools. If you have any questions regarding this report, please contact us at (202) 643-4283.

Sincerely,
ATI, INC.

Courtney E. McCall
Project Manager

Nate Burgei, CIH, CSP
Certified Industrial Hygienist

Indoor Air Quality Assessment Report

Prince George's County Public Schools
Allenwood Elementary School
6300 Harley Lane
Temple Hills, Maryland 20748

Prepared for:

Prince George's County Public Schools
13300 Old Marlboro Pike
Upper Marlboro, Maryland 20772

December 29, 2020

Submitted by:

ATI Job # 20-715

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Abbreviations and Acronyms

AHU	Air-Handling Unit
AIHA	American Industrial Hygiene Association
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
CO	Carbon Monoxide
CO_2	Carbon Dioxide
EMLAP	Environmental Microbiology Laboratory Accreditation Program
HVAC	Heating, Ventilating, And Air-Conditioning
IAQ	Indoor Air Quality
NIST	National Institute for Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
RH	Relative Humidity
Rev.	Revision

Abbreviations involving scientific volume and measurements involving media or water sampling

Spores/m^3	Mold spores per cubic meter of air
LPM	Liters per minute
NTE	Not to exceed
°F	Degree Fahrenheit
PPM	Parts per million

1 Executive Summary

ATI conducted a proactive Indoor Air Quality (IAQ) assessment on December 18, 2020, at Allenwood Elementary School, located at 6300 Harley Lane, Temple Hills, MD 20748.

The assessment included a visual assessment of randomly selected classrooms and other frequently occupied spaces, such as the cafeteria, the main office, and classrooms, for potential IAQ contributors and pathways. As part of the assessment, ATI measured common IAQ comfort parameters, including temperature, relative humidity, carbon dioxide, and carbon monoxide. Also, ATI collected total fungal air samples on spore trap cassettes for microbiological analysis.

The following is a summary of the key findings from this assessment:

1. Two of the tested spaces had a temperature outside of the ASHRAE recommended winter range of 68-75°F; one greater than, and one less than the recommended range.
2. The relative humidity in all tested spaces was less than the ASHRAE guidelines of <65%, yet most tested locations were also <30%, which can cause occupant discomfort.
3. Carbon dioxide concentrations in all tested spaces were less than the ASHRAE limit for carbon dioxide, which was 1,011 parts per million (PPM) for the day of the assessment.
4. Carbon monoxide concentrations were less than the IAQ meter's detection limit throughout the tested spaces.
5. The spore trap sampling results suggest that significant indoor amplification of mold was not present. While some concentrations of basidiospores, ascospores and *Cladosporium* detected in the Main Office, Room 10, and Room 219 exceeded the ambient sample, the observed concentrations of these spores indoors do not suggest noteworthy amplification.

2 Assessment Methods

Mikal Frater of ATI, Inc. conducted a visual assessment and air sampling on December 18, 2020. Sampled rooms were randomly selected and accounted for approximately 10% of classrooms or a minimum of five samples. Ms. Frater documented visual observations at the time she collected the air samples. ATI references the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) *Standard 62.1 – 2016* and ASHRAE *Standard 55 – 2017* when providing IAQ services to clients. ASHRAE is an industry leader on energy efficiency and indoor air quality.

All measurements and air samples were collected between three-six feet from floor elevation, which represents a typical adult breathing zone, and away from air-supply and return diffusers. Real-time direct reading measurements for temperature, relative humidity, carbon dioxide (CO_2), and carbon monoxide (CO), were measured with a calibrated TSI Q-Trak 7575-X Meter and attached 982 Probe.

Total fungal air samples were collected with a Buck BioAire High-Volume Sampling Pump on Zefon Air-O-Cell spore-trap cassettes at a flow rate of 15 liters per minute for five minutes, for a sample volume of 75 liters. AMA Analytical Services, Inc. of Lanham, MD, analyzed the samples using direct microscopic examination per ASTM D7391-09, which spores both viable and non-viable mold spores and particulates, which combined yields *total fungal* results. EMSL participates in the National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) for general laboratory performance and management, and the American Industrial Hygiene Association (AIHA) for Environmental Microbial Laboratory Accreditation Program (EMLAP). The EMSL laboratory reports are included in Appendix A.

3 Visual Observations

Table 1 lists the areas, conditions, observations, and other pertinent details related to this IAQ assessment. On the date of the sampling event, few occupants were present in the school because of the COVID-19 global pandemic.

Table 1: Visual Observations and Sampling Locations

Sample Location	Observations
Parking Lot – Outdoors	• Scattered clouds, mostly clear skies • Light foot and vehicle traffic observed
Main Office	• One occupant in the area during sampling • No odors, stained ceiling tiles, or visible mold growth observed • Door to corridor CLOSED during sampling • One air diffuser in this space • Room splits into three adjoining office spaces • One air return in this space • Trace dust accumulation in this space • Space is approximately 324 ft.^{2}
Room 3	• No odors or visible mold growth observed • One occupant in the area during sampling • Outside access through emergency exit • Room is connected to adjacent classroom • Univent ON during sampling • Trace dust accumulation • Light brown stained ceiling tile near grid in ceiling • Space is approximately 972 ft.^{2}
Room 19	• No odors, stained ceiling tiles, or visible mold growth observed • Four diffusers in this space • Door to corridor OPEN during sampling • One occupant in the area during sampling • Space is approximately 807 ft.^{2}
Room 10	• Univent ON during sampling • Outdoor access through emergency exit • Peeling paint on wall next to uninvent • Door to corridor OPEN during sampling • One occupant in the area during sampling • Space is approximately 1,145 ft.^{2}
Room 15	• No odors or visible mold growth observed • Univent ON during sampling • Outdoor access through emergency exit • Trace dust accumulation • Brown stained ceiling tile above sink • One occupant in area during sampling

Sample Location	Observations
	• Space is approximately 1,145 ft.^{2}
Multipurpose Room	• Currently used as equipment storage • One occupant in area during sampling • Two diffusers in this space • Four returns in this space • No odors, stained ceiling tiles, or visible mold growth observed • Space is approximately 2,654 ft.^{2}
Room 7	• Univent ON during sampling • Light brown stained ceiling tile next to light fixture • Outdoor access through emergency exit • Room connected to adjacent classroom • No odor or visible mold growth observed • Door to corridor OPEN during sampling • One occupant in area during sampling • Space is approximately 972 ft.^{2}

4 Thermal Environmental Conditions for Human Occupancy

ASHRAE *Standard 55-2017, Thermal Environmental Conditions for Human Occupancy*, addresses thermal comfort in an office environment, which means that an employee wearing a normal amount of clothing feels neither too cold nor too warm. This standard discusses thermal comfort within the context of air temperature, humidity, and air movement and provides recommended ranges for temperature and humidity that are intended to satisfy 80% of occupants. The recommended ASHRAE ranges are referenced below by each comfort parameter.

4.1 Temperature

The ASHRAE standard establishes a winter comfort range of between 68°F and 75°F and a summer range of between 73°F and 79°F. The temperature measured during the December 18, 2020, assessment are summarized in Table 2. As indicated by the data in the table, temperatures in the school averaged between 64°F and 78°F, with one location measuring less than the ASHRAE recommended winter range, and one location measuring greater than the ASHRAE recommended winter range.

Table 2: Temperature

Sample Location	12/18/2020 °F			ASHRAE Standard °F
	Min	Max	Average	
Outdoors	35	38	37	N/A
Indoors				
Main Office	63	64	64	68-75°F
Room 3	73	74	74	68-75°F

Sample Location	12/18/2020 °F			ASHRAE Standard °F
	Min	Max	Average	
Room 19	74	74	74	68-75°F
Room 10	71	71	71	68-75°F
Room 15	71	71	71	68-75°F
Multipurpose Room	73	74	74	68-75°F
Room 3	77	78	78	68-75°F

4.2 Relative Humidity

Relative humidity is a key factor for mold growth. Mold has the potential of growing on suitable surfaces with humidity levels above 65%. ASHRAE *Standard 62.1-2016*, *Ventilation for Acceptable Indoor Air Quality,* recommends a maximum indoor relative humidity of 65% to prevent condensation of moisture on surfaces. Relative humidity below 30% may result in drying of occupants' mucous membranes and skin. Relative humidity measurements are summarized in Table 3. As indicated by the data in the table, the average relative humidity ranged between 17% and 33% with all tested locations measuring less than the ASHRAE maximum recommendation of 65% relative humidity, and most locations also less than 30% relative humidity.

Table 3: Relative Humidity

Sample Location	12/18/2020 (% RH)			ASHRAE Standard (% RH)
	Min	Max	Average	
Outdoors	47	50	49	N/A
Indoors				
Main Office	32	34	33	< 65
Room 3	22	22	22	< 65
Room 19	19	19	19	< 65
Room 10	18	19	19	< 65
Room 15	21	21	21	< 65
Multipurpose Room	19	19	19	< 65
Room 3	16	17	17	< 65

4.3 Carbon Dioxide

Carbon dioxide concentrations within an occupied building are a standard method used to gauge the efficiency of ventilation systems. Carbon dioxide is a by-product of human respiration and does not pose an acute health hazard alone. Elevated concentrations may suggest that insufficient fresh air is being supplied to an occupied space and/or that the ventilation system does not provide a sufficient rate of air exchange.

Research has indicated that buildings with adequately operating ventilation systems are able to remove odors generated by activities in an indoor office environment efficiently. ASHRAE *Standard 62.1-2016* states that comfort (odor) criteria with respect to human bioeffluents are likely to be satisfied if the ventilation can maintain indoor carbon dioxide concentrations less than 700 parts per

million (ppm) greater than the outdoor air concentration. Typically, outdoor carbon dioxide concentrations range from 300 ppm to 450 ppm, with the higher range typically found in urban areas during peak rush hour.

Carbon dioxide concentrations are summarized in Table 4. On the day of the assessment, the average outdoor carbon dioxide concentration was 311 ppm, which calculates to a maximum indoor concentration of 1,011 ppm (700 + 311). All tested locations indoors were less than the recommended maximum for the day of the assessment.

Table 4: Carbon Dioxide

Sample Location	12/18/2020 Concentration (parts per million)			ASHRAE Standard (ppm) NTE
	Min	Max	Average	
Outdoors	281	341	311	N/A
Indoors				
Main Office	415	415	415	1,011
Room 3	414	419	417	1,011
Room 19	423	432	428	1,011
Room 10	347	407	377	1,011
Room 15	390	399	395	1,011
Multipurpose Room	397	411	404	1,011
Room 3	415	435	425	1,011

4.4 Carbon Monoxide

Carbon monoxide is a colorless and odorless gas produced by the incomplete combustion of carbon containing fuels. Oil, gasoline, diesel fuels, wood, coke, and coal are the major sources of carbon monoxide. ASHRAE recommends that carbon monoxide not exceed nine ppm indoors over an eight-hour time-weighted average. ATI measured carbon monoxide concentrations using a TSI Q-Trak model number 7575-X with an attached IAQ probe (model number 982). The instrument's carbon monoxide sensor has an error range of ± 3% of the reading or three (3) ppm, whichever is greater. As indicated by the data in Table 5, carbon monoxide concentrations were less than the Q-Trak's detection limit throughout the school.

Table 5: Carbon Monoxide

Sample Location	12/18/2020 Concentration (parts per million)			ASHRAE Standard (ppm)
	Min	Max	Average	
Outdoors	<3	<3	<3	N/A
Inside				
Main Office	<3	<3	<3	< 9
Room 3	<3	<3	<3	< 9
Room 19	<3	<3	<3	< 9
Room 10	<3	<3	<3	< 9
Room 15	<3	<3	<3	< 9
Multipurpose Room	<3	<3	<3	< 9
Room 3	<3	<3	<3	< 9

5 Total Fungal Air Sampling Results

Mold is carried indoors through building entrances, open windows, loading docks, foot traffic into buildings, and the HVAC system. To thrive indoors, mold requires a food source, proper temperature and humidity to foster its growth.

The December 18, 2020 mold assessment sampled air using spore trap cassettes in randomly selected classrooms and other areas throughout the facility. These cassettes collect both viable spores, those capable of producing more fungal colonies, and non-viable spores, which cannot reproduce. Based upon recognized industry practices, indoor mold concentrations are compared with those detected outdoors, which are also known as ambient or baseline samples.

In normal circumstances, the diversity of spores identified indoors and outdoors should be similar with some exceptions. The high concentration of one or two species of fungal spores identified indoors and the absence of the same species outdoors can indicate a moisture problem with the potential to degrade the air quality. Fungi species present indoors are typically found at levels ranging from approximately 10-50% of their levels in the outdoor air, reflecting the filtering by the building's HVAC system.

The results suggest the indoor concentrations were generally favorable compared to the outdoor concentrations. The total ambient, outdoor spore concentration was 676 spores/m^3, and most tested rooms had total spore concentrations less than the ambient total. Room 10 had a total spore concentration of 1,664 spores/m^3 and a basidiospores concentration of 624 spores/m^3, which is greater than the outdoor concentration of 312 spores/m^3. Ascospores, *Cladosporium*, and unknown spore concentrations in Room 10 also exceeded the ambient concentrations; however, the concentration ratio of spore types closely matches the outdoor concentration ratios, suggesting outdoor origin. *Cladosporium* concentrations in the Main Office and Room 19 (both 104 spores/m^3) exceeded the ambient concentration of 52 spores/m^3, yet the concentration measured indoors does not suggest significant elevation. The measured concentrations are not unusual in occupied spaces, as most total spore concentrations in a typical indoor space are at or less than 1,000 spores/m^3. It is also noteworthy that the ambient, outdoor spore concentration was unusually low relative to the season as outdoor concentrations can range from 1,000 spores/m^3 to well beyond 100,000 spores/m^3 on any given day.

The official laboratory report with spore trap samples collected on December 18, 2020, is presented in Appendix A.

6 Summary of Findings

1. Two of the tested spaces had a temperature outside of the ASHRAE recommended winter range of 68-75°F; one greater than, and one less than the recommended range.
2. The relative humidity in all tested spaces was less than the ASHRAE guidelines of <65%, yet most tested locations were also <30%, which can cause occupant discomfort.
3. Carbon dioxide concentrations in all tested spaces were less than the ASHRAE limit for carbon dioxide, which was 1,011 parts per million (PPM) for the day of the assessment.
4. Carbon monoxide concentrations were less than the IAQ meter's detection limit throughout the tested spaces.
5. The spore trap sampling results suggest that significant indoor amplification of mold was not present. While some concentrations of basidiospores, ascospores and *Cladosporium* detected in the Main Office, Room 10, and Room 219 exceeded the ambient sample, the observed concentrations of these spores indoors do not suggest noteworthy amplification.

We appreciate the opportunity to provide these IAQ testing services for you. If you have any questions, please contact us at (202) 643-4283.

Best,
ATI, INC.

Courtney E. McCall
Project Manager

Nate Burgei, CIH, CSP
Certified Industrial Hygienist

Appendix A: Laboratory Report and Chain of Custody

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	285308	**Job Name:**	IAQ PGCPS	**Date Submitted:**	12/18/2020
Client:	ATI, Inc.	**Job Location:**	Allenwood Elementary	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-715	**Date Analyzed:**	12/23/2020
		P.O. Number:	Not Provided	**Report Date:**	12/23/2020
Attention:	Mikal Frater				

AMA Sample #	285308-1	**AMA Sample #**	285308-2	**AMA Sample #**	285308-3
Client ID	20-715-1	**Client ID**	20-715-2	**Client ID**	20-715-3
Analyst ID	TLW	**Analyst ID**	TLW	**Analyst ID**	TLW
Collection Apparatus	Air-O-Cell	**Collection Apparatus**	Air-O-Cell	**Collection Apparatus**	Air-O-Cell
Sample Volume (L)	75	**Sample Volume (L)**	0	**Sample Volume (L)**	75
Sample Condition	Acceptable	**Sample Condition**	Acceptable	**Sample Condition**	Acceptable
Debris Loading	1	**Debris Loading**	1	**Debris Loading**	1
Location	Parking Lot	**Location**	Field Blank	**Location**	Main Office

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	1	15	52	52	7.7%
Basidiospores	6	15	52	312	46.2%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	52	52	7.7%
Curvularia					
Penicillium / Aspergillus	3	15	52	156	23.1%
Smuts/Periconia/Myxomycetes	1	15	52	52	7.7%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	1	15	52	52	7.7%
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*					
Total Raw Ct:	13		**Total sp/m³:**	676	

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*					
Total Raw Ct:	0		**Total sp/m³:**	0	

Comments

No mold spores observed.

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	2	15	52	104	28.6%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	2	15	52	104	28.6%
Curvularia					
Penicillium / Aspergillus	2	15	52	104	28.6%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa	1	15	52	52	14.3%
Pithomyces					
Epicoccum					
Hyphal Fragments*	1	15	52	52	14.3%
Total Raw Ct:	7		**Total sp/m³:**	364	

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody: 285308
Client: ATI, Inc.
Address: 9220 Rumsey Road
Suite 100
Columbia, MD 21045
Attention: Mikal Frater

Job Name: IAQ PGCPS
Job Location: Allenwood Elementary
Job Number: 20-715
P.O. Number: Not Provided

Date Submitted: 12/18/2020
Person Submitting: Mikal Frater
Date Analyzed: 12/23/2020
Report Date: 12/23/2020

AMA Sample #	285308-4
Client ID	20-715-4
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Room 3

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	2	15	52	104	66.7%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	52	52	33.3%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes	Present	15	52	<52	
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*	Present	15	52	<52	

Total Raw Ct: 3 **Total sp/m³:** 156

Comments

AMA Sample #	285308-5
Client ID	20-715-5
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Room 19

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	2	15	52	104	40%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	2	15	52	104	40%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces	1	15	52	52	20%
Epicoccum					
Hyphal Fragments*					

Total Raw Ct: 5 **Total sp/m³:** 260

Comments

AMA Sample #	285308-6
Client ID	20-715-6
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	2
Location	Room 10

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria	Present	15	52	<52	
Ascospores	7	15	52	364	21.9%
Basidiospores	12	15	52	624	37.5%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	6	15	52	312	18.8%
Curvularia					
Penicillium / Aspergillus	3	15	52	156	9.4%
Smuts/Periconia/Myxomycetes	1	15	52	52	3.1%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown	3	15	52	156	9.4%
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum	Present	15	52	<52	
Hyphal Fragments*	1	15	52	52	3.1%

Total Raw Ct: 32 **Total sp/m³:** 1664

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody: 285308
Client: ATI, Inc.
Address: 9220 Rumsey Road
Suite 100
Columbia, MD 21045
Attention: Mikal Frater

Job Name: IAQ PGCPS
Job Location: Allenwood Elementary
Job Number: 20-715
P.O. Number: Not Provided

Date Submitted: 12/18/2020
Person Submitting: Mikal Frater
Date Analyzed: 12/23/2020
Report Date: 12/23/2020

AMA Sample #	285308-7
Client ID	20-715-7
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Room 15

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	2	15	52	104	100%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*					

Total Raw Ct: 2 **Total sp/m³:** 104

Comments
No visible trace.

AMA Sample #	285308-8
Client ID	20-715-8
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Multi-purpose Room

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	3	15	52	156	75%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	52	52	25%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*					

Total Raw Ct: 4 **Total sp/m³:** 208

Comments

AMA Sample #	285308-9
Client ID	20-715-9
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	2
Location	Room 7

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	1	15	52	52	16.7%
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	3	15	52	156	50%
Smuts/Periconia/Myxomycetes	2	15	52	104	33.3%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Tetraploa					
Pithomyces					
Epicoccum					
Hyphal Fragments*					

Total Raw Ct: 6 **Total sp/m³:** 312

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	285308	**Job Name:**	IAQ PGCPS	**Date Submitted:**	12/18/2020
Client:	ATI, Inc.	**Job Location:**	Allenwood Elementary	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-715	**Date Analyzed:**	12/23/2020
		P.O. Number:	Not Provided	**Report Date:**	12/23/2020
Attention:	Mikal Frater				

Spore Comparison Guide

The criteria for these specifications are outlined, but not limited to those listed, below. Final specifications may differ from the listed criteria for certain samples. AMA Analytical Services, Inc. reserves the right to make changes to these criteria at any time without notice.

Normal ecology	Slightly above normal ecology	Moderately above normal ecology	Substantially above normal ecology

Stachybotrys / Memnoniella, and Chaetomium	**Other Spores* (Control Present)**	**Other Spores* (No Control)**
1-4 Spores: Yellow 5-9 Spores: Orange 10+ Spores: Red	< 10 Spores: Insignificant (no color) <= Control's spore count: Green Between Control and 2x Control: Yellow Between 2x Control and 3x Control: Orange 3x+ Control: Red	< 10 Spores: Insignificant (no color) 10-20 Spores: Yellow 20-50 Spores: Orange 50+ Spores: Red

*No evalutation is provided for the following spore types: Other, Other Colorless, and Unknown Fungi, and Misc

Interpretation of the data contained in this report is the sole responsibility of the client or the persons who conducted the field work. There are no federal or national standards for the number of fungal spores that may be present in the indoor environment. As a general rule and guideline that is widely accepted in the indoor air quality field, the numbers and types of spores that are present in the indoor environment should be comparable to those that are present outdoors at any given time. There will always be some mold spores present in "Normal" indoor environments. The purpose of sampling and counting spores is to help determine whether an abnormal condition exists within the indoor environment and if it does, to help pinpoint the area of contamination. Spore counts should not be used as the sole determining factor of mold contamination. There are many factors that can cause anomalies in the comparison of indoor and outdoor samples due to the dynamic nature of both of those environments.

This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. Sampling techniques, possible contaminants, unrepresentative samples and other similar or dissimilar factors may affect these results. With the statistical evaluation provided, as with all statistical comparisons and analyses, false-positive and false-negative results can and do occur. AMA Analytical Services, Inc. hereby disclaims any liability for any and all direct, indirect, punitive, incidental, special or consequential damages arising out of the use or interpretation of the data contained in, or any actions taken or omitted in reliance upon, this report.

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	285308	**Job Name:**	IAQ PGCPS	**Date Submitted:**	12/18/2020
Client:	ATI, Inc.	**Job Location:**	Allenwood Elementary	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-715	**Date Analyzed:**	12/23/2020
		P.O. Number:	Not Provided	**Report Date:**	12/23/2020
Attention:	Mikal Frater				

General Comments, Disclaimers, and Footnotes

Analytical Method: Sample are analyzed following the instructions and guidelines outlined in ASTM 7391-09.

Sample Condition: Acceptable: The sample was collected and delivered to the our location without disturbing the material on the sampling media.
Unacceptable: 1. The sample trace (TR) has been disturbed. 2. The sample was damaged or otherwise unsuitable for analysis.
0 = No particulate matter detected; 1= >nd-~5% Particulate Loading; 2 = ~5%-25% Particulate Loading; 3 = ~25%- 75% Particulate Loading; 4 = ~75%-90% Particulate Loading; 5 = >90% Particulate Loading

Spore Notes: Based on their small size and very few distinguishing characteristics, Aspergillus and Penicillium cannot be differentiated by non-viable sampling methods. There are other types of spores whose morphology is similar to Aspergillus and Penicillium and cannot be differentiated by non-viable sampling methods. Examples of these similar spores are Acremonium, Paecilomyces, Wallemia, Trichoderma, Scopulariopsis, and Gliocladium.
Smuts, Periconia and Myxomycetes are three different types of genera that have similar morphological characteristics.
Bipolaris/Dreschlera/Helm: Bipolaris / Dreschlera / Helminthosporium are three different types of genera that have smiliar morphological characteristics.
Other Colorless represents all colorless spores that are non-distinctive and unidentifiable.
*Hyphal Fragments: A portion of the mycelium that becomes separated from the remainder of the thallus (vegetative body), each of which has the capacity to grow and form new individuals. Results for hyphal fragments are in fragments/m3 and are not incorporated in the total spore concentration.
The droplet symbol (💧) refers to water-intrusion indicator spores. These fungal spores, when found on indoor air samples, can be an indication of moisture sources and resultant fungal growth that may be problematic.

Quantification: Analytical Sensitivity (A.S.): This is dependent on the volume of air collected, size of the trace, ocular diameter, and the amount of the trace that was analyzed.
The value of "Present" indicated in the Raw Count column represents the presence of this spore type during the preliminary exam at 400x. The Raw Count converts to a whole number if the spore type is encountered again during the 600x-1,000x enumeration. The sp/m3concentration will be reported as less than the analytical sensitivity if "Present" is reported in the Raw Count.
Results are reported to 3 significant figures. sp/m3: Spores per cubic meter.
Uncertainty: for raw count in the range of 0-50 the SR is 0.375, 51-100 SR=0.333, 101-200 SR=0.257, >200 SR=0.245
All results are to be considered preliminary and subject to change unless signed by the Technical Director or Deputy.
Analyst(s): Tristan Ward

Technical Director Tristan Ward

MOLD SPORE DESCRIPTIONS

Alternaria

Alternaria is ubiquitous in the environment and are normal agents of decay and decomposition. The spores are airborne and common outdoors than indoors isolated from plants, soil, and food. Indoors, the spores are found in house dust, carpets, textiles, wallboard and window frames. The production of melanin-like pigment is one of its major identifying characteristics. The club-shaped spores (conidia) are single or in long chains. They can grow thick colonies with grayish-white surfaces at the beginning which later darken to greenish black or olive brown colors. Health Effects: Allergies are common, but serious infections are rare, except in people with compromised immune systems. Certain species of this genus are often prolific producers of a variety of toxic compounds whose effects on human health are not well known.

Ascospores

Ascospores are spores formed inside an ascus (asci-plural) or sac-like cell which is contained inside a fruiting body called an ascocarp or an ascoma (ascomata-plural). An ascus typically contains a definite nuimber of ascospores, usually eight. Ascospores are unique in shape, size, and color as to the Genus/species they represent. These spores are specific to fungi classified as Ascomycetes. They are ubiquitous in nature. Many decay organic matter, others are plant or animal pathogens. They can grow indoors on damp materials. Release of ascospores are released by forcible ejection and dispersed by wind, water, animals and other agents. Health Effects: Depending on the Genera, Ascospores may be allergenic.

Basidiospores

Basidiospores are reproductive spores produced by a group of fungi called basidiomycetes. This group includes the mushrooms, shelf fungi and various other macrofungi. Basidipspores serve as the main air (wind) dispersal units for the fungi and their release is dependent upon moisture. The structure of the spore complex can develop in various manners resulting in different appearances. It is often found growing in soil, decaying plant debris, compost piles and fruit rot. Indoors, it can be found on water damaged building materials (chipboard /OSB, plywood, wallpaper, and glue) as well as on food items (dried foods, cheeses, fruits, herbs, spices, cereals). Health effects: Some basidiospores may produce toxins and can act as allergens. They have not been reported to be pathogens.

Cladosporium

Cladosporium is the most common indoor and outdoor mold. The spores are wind dispersed and are often extremely abundant in outdoor air. Many species are commonly found on living and dead plant material. Indoors, they may grow on surfaces with high moisture or high humidity levels such as damp window sills, poorly ventilated bathrooms and soiled refrigerators. It produces powdery or velvety olive-green to brown or black colonies. The conidia (spores) vary depending on the species and are formed in simple or branching chains with multi-attachment points. Health Effects: Cladosporium species are rarely pathogenic to humans, but have been reported to occassionally cause sinusitis and pulmonary infections as well as infections of the skin and toenails. The airborne spores are significant allergens, and in large amounts they may severely affect asthmatics and people with respiratory diseases.

Epicoccum

Epicoccum is a cosmopolitan fungus that is often found growing outside in soil, plant litter, decaying plants, and damaged plant tissue. Indoors, it can be found growing on a variety of building materials including paper and textiles. Colonies have a rapid growth rate with cottony texture, initially yellow or orange becoming brown to black in color. Conidiophores or fruiting bodies produce dense masses where conidia (spores) arise. Spores are round to pear-shaped, smooth to warty, brown to black in color and muriform (partitioned in both directions, like a soccer ball). Health Effects: This mold can act as a potential allergen. Some people may experience hay fever and or asthma. This mold has not been linked to any human or animal infection.

Hyphal Fragments

Hyphal Fragments are segments or pieces of hyphae or mycelium that may have broken off during sampling (air, tape, dust). The mycelium is the entire mass of hyphae that makes up the vegetative body of a fungus. The presence of hyphal fragments may indicate the presence of viable mold.

Other Colorless

- “Other Colorless” are all non-distinctive, unidentifiable, colorless spores seen on spore trap samples and include all the genera that do not have distinguishing morphology to belong to any of the other defined categories."

Penicillium/Aspergillus Like

Penicillium and Aspergillus are ubiquitous, filamentous fungi that are found in soil, decaying plant debris, compost piles, and in the air. Indoors, spores are commonly found in house dust, in water-damaged buildings (wallpaper, wallpaper glue, decaying fabrics, moist chipboards, and behind paint) as well as fruit and grains. They are the most common fungal genera, worldwide. Both produce chains of spores that are small, round to oval, colorless or slightly pigmented, and smooth to rough walled. These spores are indistinguishable between the two as well as other genera, such as Gliocladium, Trichoderma, Paecilomyces, and Scopulariopsis. They differ as to their conidiophores or fruiting bodies. While, Aspergillus spores are produced from phialides supported on conidia heads or swollen vesicles, Penicillium spores are produced on finger-like projections. Depending on species, typical colonies of Aspergillus are initially white and later turn to either shades of green, yellow, orange, brown or black. Texture is usually velvety to cottony. Typical colonies of Penicillium, other than Penicillium marneffei (yeast-like at 37oC), grow rapidly, white in color at first, later becoming bluish green with white borders with velvety to powdery textures depending on species. Some species produce radial patterns. Health Effects: Both Aspergillus and Penicillium are potential allergens. Several species of Aspergillus (A. flavus and A. parasiticus) produce aflatoxins or natually occurring mycotoxins that are toxic and carcinogenic. These are found in contaminated foodstuff and are hazardous to consumers. Penicillium has only one known species that is pathogenic to humans (P. marneffei) that causes lethal systemic infection (Penicilliosis) in immunocompromised individuals.

Pithomyces

Pithomyces is a cosmopolitan, dark-walled fungus often found growing outside in soil, decaying leaves, and grasses. It is rarely found growing indoors, but will grow on paper given the right conditions. Colonies grow rapidly, cottony in texture with light to dark brownish black surface color. Spores are single, oval yellow to dark brown, multi-celled, and usually rough. One identification feature of the spores is the resemblance to barrels. Another identifying character is beak-like structures on young spores. Spores of Pithomyces chartarum are most common and are identified by distinctive tranverse septa. This species has been linked to facial eczema in sheep. Health Effects: It is a potential but not well-studied allergen or human pathogen.

Smuts/Periconia/Myxomycetes

Smuts, Periconia, and Myxomycetes spores are grouped together due to their similar round, brown morphology. Smuts are outdoor parasitic plant pathogens. They rarely grow indoors but may grow on host plants if appropriate conditions are present. They are parasitic plant pathogens. They can be found on cereal crops, grasses, flowing plants, weed, and other fungi. They can cause allergies. Periconia are found in soils, dead herbaceous stems and leaf spots, and grasses. They have wind dispersed dry spores. Their spores are abundant in the air but it is not known if they are allergenic. Myxomycetes are found on decaying logs, stumps and dead leaves. They have wind-dispersed dry spores and wet motile (amoebic phase) spores. During favorable conditions they move about like amoebae. They form dry airborne spores when conditions are unfavorable. They are rarely found indoors. Health Effects: They may cause Type 1 allergies (hay fever, asthma). No human infections have been reported.

Tetraploa

Tetraploa is typically isolated from plants, on leaf bases and stems close to the soil. Some species may also be found on decaying wood and moist forest litter. The spores are born directly on hyphae, lack fruiting bodies, and are composed of four columns of 4-6 cells with appendages. The spore body is light to dark brown in color, muriform (have brick-like partitions) or verrucose (warty). Appendages are hyaline (colorless) and septated (divided or partitioned). Certain species have been reported to cause keratitis (inflammation of the cornea) and subcutaneous infection.

Unknown Fungi

“Unknown Fungi” are spores that cannot be identified under direct microscopic analysis. This includes partial spores. This category also includes spores that are hidden or hard to see during microscopic examination due to heavy presence of particulate.

AMA Analytical Services, Inc.
Focused on Results www.amalab.com
AIHA-LAP (#100470) NVLAP (#101143-0) NY ELAP (10920)
4475 Forbes Blvd. • Lanham, MD 20706
(301) 459-2640 • (800) 346-0961 • Fax (301) 459-2643

CHAIN OF CUSTODY

(Please Refer To This Number For Inquires) 285308

Mailing/Billing Information:

1. Client Name: ATI, Inc
2. Address 1: 4221 Forbes Blvd
3. Address 2: Suite 250
4. Address 3: Lanham, MD 20706
5. Phone #: _____ Fax #: _____

Submittal Information:

1. Job Name: IAQ PCCPS
2. Job Location: Allenwood Elementary
3. Job #: 20-715 P.O. #: _____
4. Contact Person: Mikal Frater Cell: (848) 702-8621
5. Collected by: " Cell: "

Reporting Info (Results provided as soon as technically feasible). If no TAT/Reporting Info is provided, AMA will assign defaults of 5-Day and email/fax to contacts on file.

AFTER HOURS (must be pre-scheduled)
❑ 4 Hours
❑ Immediate Date Due: _____
❑ 24 Hours Time Due: _____
Comments: _____

NORMAL BUSINESS HOURS
❑ 4 Hours ❑ 3 Day ❑ Results Required By Noon
❑ Same Day ● 5 Day + Date Due: 12/28/20
❑ Next Day
❑ 2 Day

REPORT TO:
● Email: mikal@atiinc.com
❑ Email 2: _____
❑ Verbals: _____

Asbestos Analysis
*PCM Air – Please Indicate Filter Type: _____
❑ NIOSH 7400 _____ (QTY)
❑ Fiberglass _____ (QTY)
TEM Air* – Please Indicate Filter Type: _____
❑ AHERA _____ (QTY)
❑ NIOSH 7402 _____ (QTY)
❑ Other (specify _____) _____ (QTY)
PLM Bulk
❑ EPA 600 – Visual Estimate _____ (QTY) ❑ Pos Stop
❑ EPA Point Count _____ (QTY)
❑ NY State Friable 198.1 _____ (QTY)
❑ Grav. Reduction ELAP 198.6 _____ (QTY)
❑ Other (specify _____) _____ (QTY)
MISC
❑ Vermiculite
❑ Asbestos Soil PLM__(Qual) PLM__(Quan) PLM/TEM__(Qual) PLM/TEM__(Quan)
*It is recommended that blank samples be submitted with all air and surface samples

TEM Bulk
❑ ELAP 198.4/Chatfield _____ (QTY)
❑ NY State PLM/TEM _____ (QTY)
❑ Residual Ash _____ (QTY)
TEM Dust*
❑ Qual. (pres/abs) Vacuum/Dust _____ (QTY)
❑ Quan. (s/area) Vacuum D5755-95 _____ (QTY)
❑ Quan. (s/area)Dust D6480-99 _____ (QTY)
TEM Water
❑ Qual. (pres/abs) _____ (QTY)
❑ ELAP 198.2/EPA 100.2 _____ (QTY)
❑ EPA 100.1 _____ (QTY)

✓ ❑ All samples received in good condition unless otherwise noted.
(TEM Water samples _____ °C)

If field data sheets are submitted, there is no need to complete bottom section.

Metals Analysis
❑ Pb Paint Chip _____ (QTY)
❑ *Pb Dust Wipe (wipe type _____) _____ (QTY)
❑ *Pb Air _____ (QTY)
❑ Pb Soil/Solid _____ (QTY)
❑ Pb TCLP _____ (QTY)
❑ Drinking Water ❑ Pb _____ (QTY) ❑ Cu _____ (QTY) ❑ As _____ (QTY)
❑ Waste Water ❑ Pb _____ (QTY) ❑ Cu _____ (QTY) ❑ As _____ (QTY)
❑ Pb Furnace (Media _____) _____ (QTY)

Fungal Analysis
Collection Apparatus for Spore Traps/Air Samples: _____
Collection Media _____
● *Spore-Trap 9 (QTY) ❑ Surface Vacuum Dust _____ (QTY)
❑ *Surface Swab _____ (QTY) ❑ Culturable ID Genus (Media _____) _____ (QTY)
❑ *Surface Tape _____ (QTY) ❑ Culturable ID Species (Media _____) _____ (QTY)
❑ Other (Specify _____) _____ (QTY)

SAMPLE INFORMATION CLIENT ID #	SAMPLE LOCATION/ ID	DATE/ TIME (12/18/20)	VOL (L)/ Wipe Area	ANALYSIS: TEM	PCM	PLM	LEAD	MOLD	MATRIX: AIR	BULK	DUST	WATER AND OTHER	SPORE TRAP	TAPE	SWAB	CLIENT CONTACT (LABORATORY STAFF ONLY)
20-715 1	Parking Lot	9:49	75L					✓					✓			Date/Time: Contact:By:
20-715 2	Field Blank	—	↓					✓					✓			
20-715 3	Main Office	10:01						✓					✓			
20-715 4	Room 3	10:10						✓					✓			
20-715 5	Room 19	10:18						✓					✓			Date/Time: Contact:By:
20-715 6	Room 10	10:26						✓					✓			
20-715 7	Room 15	10:46						✓					✓			
20-715 8	Multipurpose Rm	10:55						✓					✓			
20-715 9	Room 7	11:02	↓					✓					✓			Date/Time: Contact:By:

	Print Name	Signature	Date	Time
Relinquished by:	Mikal Frater	Mikal Frater	12/18/20	1:30 PM
Received by:				
Relinquished by:				
Received for Lab by:			12/18/20	1330

Shipping Information
❑ UPS ✓ In-Person ❑ Other
❑ FedEx ❑ Drop Box
❑ USPS ❑ Courier
Airbill/Tracking No: _____

Appendix B: Instrument Calibration Records

Certificate of Calibration

(✓) Buck™ BioAire Pump Calibration Rotameter

( ) Buck™ BioSlide Pump Calibration Rotameter

Serial number: R14536

Date Calibrated: 12/27/19 **Calibration Due Date:** 12/27/20

Flow Calibration

This is to certify that the rotameter listed above has been calibrated using a Buck Primary calibrator listed below which is calibrated according to A.P. Buck, Inc. calibration procedure APB-1, Ver. 6.2 and is traceable to the National Institute of Standards & Technology (N.I.S.T). A.P. Buck guarantees the accuracy of the rotameter to be within ± 5% of the actual flow rate.

AMBIENT CONDITIONS: Temperature 74±3° F Relative Humidity 50±10%

Description	MFR.	Model	Serial #
Primary Calibrator	A.P. Buck Inc.	M30B	☐ A40020 ☑ A40021

QA Approval By: Moroni Menk

A.P. BUCK, INC.
7101 Presidents Drive, Suite 110
Orlando, FL 32809
Phone: 407-851-8602
Fax: 407-851-8910

BUCK
A.P. BUCK, INC.

CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITIONS		
TEMPERATURE	74.0 (23.3)	°F (°C)
RELATIVE HUMIDITY	34	%RH
BAROMETRIC PRESSURE	29.20 (988.8)	inHg (hPa)

MODEL	982
SERIAL NUMBER	P17100007

☐ AS LEFT ☒ AS FOUND

☐ IN TOLERANCE ☒ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

GAS CO_2 AS FOUND — SYSTEM G-101 — *Unit: ppm*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0	0	0~50	4	3015.3	* 2902.7	2924.9~3105.8
2	499	458	449~549	5	5056	* 4859.6	4904.3~5207.7
3	1002	963	952~1052				

GAS CO AS FOUND — SYSTEM G-101 — *Unit: ppm*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	35.1	* 29.5	32.1~38.1	2	100.5	* 84.8	97.5~103.5

TEMPERATURE AS FOUND — SYSTEM T-101 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	32.1 (0.0)	32.8 (0.4)	31.1~33.1 (−0.5~0.6)	2	140.02 (60.01)	* 141.31 (60.73)	139.02~141.02 (59.45~60.57)

HUMIDITY AS FOUND — SYSTEM H-102 — *Unit: %RH*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	10.0	10.4	7.0~13.0	4	70.0	67.1	67.0~73.0
2	30.0	29.3	27.0~33.0	5	90.01	* 85.88	87.01~93.01
3	50.0	48.5	47.0~53.0				

**Indicates Out-of-Tolerance Condition*

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due
5000 CO_2	14A044095	04-06-20	04-06-25
N2	T-0608	05-19-20	05-19-28
Flow	E003341	09-03-19	09-30-20
Flow	E003525	01-06-20	01-31-21
2000 C4H8	EB0054467	08-13-19	08-12-22
Temperature	E010657	02-14-20	02-28-21
Temperture	E010655	01-21-20	01-31-21

Measurement Variable	System ID	Last Cal.	Cal. Due
200 CO	149886	04-30-20	03-24-28
Air	T17939	04-09-20	04-09-28
Flow	E003980	04-22-20	04-30-21
Flow	E003342	09-03-19	09-30-20
100 C4H8	CC507339	03-24-20	03-24-28
Temperature	E010658	02-14-20	02-28-21
Humidity	E003539	02-26-20	08-31-20

Chimoua Vue
VERIFIED

June 15, 2020
DATE

DOC. ID: CERT_GEN_WCC

TSI P/N 2300157

CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITIONS		
TEMPERATURE	70.41 (21.3)	°F (°C)
RELATIVE HUMIDITY	50.3	%RH
BAROMETRIC PRESSURE	29.15 (987.1)	inHg (hPa)

MODEL	982
SERIAL NUMBER	P17100007

☒ AS LEFT ☐ AS FOUND

☒ IN TOLERANCE ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

TEMPERATURE VERIFICATION — SYSTEM T-101 — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	32.1 (0.0)	31.9 (-0.1)	31.1~33.1 (-0.5~0.6)	2	140.0 (60.0)	140.3 (60.3)	139.0~141.0 (59.5~60.6)

HUMIDITY VERIFICATION — SYSTEM H-102 — *Unit: %RH*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	10.0	9.0	7.8~12.2	4	70.0	69.5	67.8~72.2
2	30.0	29.1	27.8~32.2	5	90.0	88.7	87.8~92.2
3	50.0	49.6	47.8~52.2				

CO2 GAS VERIFICATION — SYSTEM G-101 — *Unit: ppm*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0	0	0~50	4	3016	3012	2926~3107
2	502	502	452~552	5	5056	5032	4904~5208
3	1005	1019	955~1055				

CO GAS VERIFICATION — SYSTEM G-101 — *Unit: ppm*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	35	36	32~38	2	101	100	98~104

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E010657	02-14-20	02-28-21
Temperture	E010655	01-21-20	01-31-21
5000 CO2	14A044095	04-06-20	04-06-25
N2	T-0608	05-19-20	05-19-28
Flow	E003341	09-03-19	09-30-20
Flow	E003525	01-06-20	01-31-21
2000 C4H8	EB0054467	08-13-19	08-12-22

Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E010658	02-14-20	02-28-21
Humidity	E003539	02-26-20	08-31-20
200 CO	149886	04-30-20	03-24-28
Air	T17939	04-09-20	04-09-28
Flow	E003980	04-22-20	04-30-21
Flow	E003342	09-03-19	09-30-20
100 C4H8	CC507339	03-24-20	03-24-28

Chao Vang
CALIBRATED

June 16, 2020
DATE

Doc ID: CERT_GEN_WCC

TSI P/N 2300157

CERTIFICATE OF CALIBRATION AND TESTING

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

ENVIRONMENT CONDITIONS		
TEMPERATURE	70.72 (21.5)	°F (°C)
RELATIVE HUMIDITY	39.0	%RH
BAROMETRIC PRESSURE	29.15 (987.1)	inHg (hPa)

MODEL	7575-X
SERIAL NUMBER	7575X1711006

☒ AS LEFT ☒ IN TOLERANCE
☐ AS FOUND ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

THERMO COUPLE — **SYSTEM PRESSURE01-02** — *Unit: °F (°C)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	70.9 (21.6)	70.8 (21.6)	68.9~72.9 (20.5~22.7)				

BAROMETRIC PRESSURE — **SYSTEM PRESSURE01-02** — *Unit: inHg (hPa)*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	29.22 (989.5)	29.23 (989.8)	28.64~29.80 (969.9~1009.1)				

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E004626	02-14-20	02-28-21	Pressure	E005254	10-10-19	10-31-20
Pressure	E003982	01-24-20	07-31-20	DC Voltage	E003493	08-14-19	08-31-20

Chao Vang
CALIBRATED

June 15, 2020
DATE

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TSI P/N 2300157

CERTIFICATE OF CALIBRATION AND TESTING

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ENVIRONMENT CONDITIONS		
TEMPERATURE	70.68 (21.5)	°F (°C)
RELATIVE HUMIDITY	38.0	%RH
BAROMETRIC PRESSURE	29.16 (987.5)	inHg (hPa)

MODEL	7575-X
SERIAL NUMBER	7575X1711006

☐ AS LEFT ☒ IN TOLERANCE
☒ AS FOUND ☐ OUT OF TOLERANCE

– CALIBRATION VERIFICATION RESULTS –

THERMO COUPLE			SYSTEM PRESSURE01-02				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	70.8 (21.6)	71.1 (21.7)	68.8~72.8 (20.4~22.7)				

BAROMETRIC PRESSURE			SYSTEM PRESSURE01-02				Unit: inHg (hPa)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	29.22 (989.5)	29.17 (987.8)	28.64~29.80 (969.9~1009.1)				

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E004626	02-14-20	02-28-21	Pressure	E005254	10-10-19	10-31-20
Pressure	E003982	01-24-20	07-31-20	DC Voltage	E003493	08-14-19	08-31-20

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VERIFIED

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