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Architecture | Engineering | Construction

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March 4, 2021

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

RE: Indoor Air Quality Assessment, Phyllis E. Williams Elementary School
Purchase Order: 734977
ATI Project Number: 20-688

Dear Mr. Baylor:

Prince George's County Public Schools requested that ATI, Inc., conduct a proactive indoor air quality (IAQ) assessment at Phyllis E. Williams Elementary School on March 2, 2021. The assessment's key findings are enclosed in the Executive Summary on page three, and the official laboratory reports for total fungal spore trap sampling are 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.

Reviewed By:

Courtney E. McCall
Project Manager

Nate Burgei, CIH, CSP
Certified Industrial Hygienist

Indoor Air Quality Assessment Report

Prince George's County Public Schools
Phyllis E. Williams Elementary School
9601 Prince Place
Upper Marlboro, MD 20774

Prepared for:

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

March 4, 2021

Submitted by:

ATI Job # 21-624

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List of Tables

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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 March 2, 2021, at Phyllis E. Williams Elementary School, located at 9601 Prince Pl, Upper Marlboro, MD.

The assessment included a visual assessment of randomly selected classrooms and other frequently occupied spaces, such as the cafeteria/gym, the main office, and randomly selected 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 these assessments:

1. One of the tested spaces had a temperature greater than the ASHRAE recommended winter range of 68°F - 75°F during the assessment. All other tested spaces were within the ASHRAE range.
2. The relative humidity in all tested spaces was less than the ASHRAE maximum recommended guidelines of ≤ 65% during the March 2 assessment, but was also less than 30%, which can cause occupant discomfort.
3. Carbon dioxide concentrations in all tested spaces were less than the ASHRAE limits for carbon dioxide, which was 1,081 parts per million (ppm) for March 2.
4. Carbon monoxide concentrations were less than the IAQ meter's detection limit throughout the tested spaces.
5. The spore trap sampling results suggested that significant indoor amplification of mold was not present in the tested rooms. Any spores present in the rooms can be removed using HEPA vacuums and wet wiping as part of the standard cleaning and readying of the school before the students return this school year. Water damaged ceiling tiles in the Media Center and Room NW101 should be replaced prior to cleaning. ATI has no additional recommendations at this time.

2 Assessment Methods

Sama Wanigasundara, Industrial Hygienist of ATI, Inc. conducted the initial visual assessment and air sampling on March 2, 2021. Sampled rooms were randomly selected and accounted for approximately 10% of classrooms or a minimum of five samples. Mr. Wanigasundara documented visual observations at the time he 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 readings 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 field calibrated Buck BioAire High-Volume Sampling Pump on Zefon Air-O-Cell spore-trap cassettes at a flow rate of 15 liters per minute for a sample volume of 75 liters. AMA Analytical Services, Inc. of Lanham, MD analyzed the samples using direct microscopic examination per ASTM D7391, which spores both viable and non-viable mold spores and particulates, which combined yields total fungal results. AMA 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 AMA laboratory report is included in Appendix A.

3 Visual Observations

Table 1 lists the areas, conditions, observations, and other pertinent details related to the initial and follow-up IAQ assessments. On both dates of sampling, few occupants were present in the school because of the COVID-19 global pandemic.

Table 1: Visual Observations and Sampling Locations

Sample Location	March 2, 2021 Observations
Parking Lot – Outdoors	• Scattered clouds, mostly clear skies • Light foot and vehicle traffic observed
Main Office	• Three occupants in the area during sampling • No odors, stained ceiling tiles, or visible mold growth observed • Door to corridor OPEN during sampling • Room splits into three adjoining office spaces • One air return in this space • No dust accumulation • Space is approximately 790ft.^{2}
Cafeteria	• No odors • No stained-on ceiling and no suspect mold growth observed • Two occupants in area during sampling • No dust accumulation • Six air returns in this space had accumulated dust • Three air diffusers in this space had accumulated dust • Space is approximately 2400 ft.^{2}
Gymnasium	• No odors, stained ceiling tiles, or visible mold growth observed • Four air diffusers and three air returns had accumulated dust • No visual dust accumulation on surfaces in this space • All the doors closed, and no occupants • Space is approximately 2400 ft.^{2}
Media Center	• No occupants in the area during sampling • No odors • Door to corridor OPEN during sampling • Room splits into three adjoining rooms • Four air returns and four air diffusers in this space had accumulated dust • Computer room had excessive dust and the corner ceiling tile had suspect mold growth on it • Space is approximately 790ft.^{2}
Room E-102	• No odors, stained ceiling tiles, or visible mold growth observed • No occupants in the area during sampling • Two air diffusers, four air returns • No visual dust accumulation in this space • Space is approximately 780 ft.^{2}
Room MS-101	• No occupants in the area during sampling • No dust accumulation on surfaces in this space • No visible mold growth observed • One air return and five air diffusers with accumulated dust • Carpet floor

Sample Location	March 2, 2021 Observations
	• Space is approximately 600 ft.^{2}
Room NW-101	• No odors • One air return or four diffusers in this space with accumulated dust • No occupants in the area during sampling • Space is approximately 720 ft.2 • Corner ceiling tile was broken due to water leak and had suspect mold growth on it
Art Room	• No odors, stained ceiling tiles or mold • No visible dust on floor or other furniture surfaces • Two air return and five air diffusers with accumulated dust • Space is approximately 450 ft.^{2}
Room A-101	• No odors, stained ceiling tiles or mold • No visible dust on floor or other furniture surfaces • No air returns and five air diffusers in this space • Space is approximately 720 ft.^{2}
Room D-101	• No odors, stained ceiling tiles • No visible mold growth observed • unoccupied • No air returns in this space and four air diffusers • Space is approximately 720 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 temperatures measured during the March 2, 2021 assessment are summarized in Table 2. As indicated by the data in the table, temperatures in the school on March 2 averaged between 69°F and 76°F, with one tested location greater than the ASHRAE recommended winter range.

Table 2: Temperature

Sample Location	3/2/2021 °F			ASHRAE Standard °F
	Min	Max	Average	
Outdoors	46	46	46	N/A
Indoors				
Main Office	70	70	70	68°F - 75°F

Sample Location	3/2/2021 °F			ASHRAE Standard °F
	Min	Max	Average	
Cafe	69	70	70	68°F - 75°F
Gym	68	69	69	68°F - 75°F
Media Center	73	73	73	68°F - 75°F
E-102	70	70	70	68°F - 75°F
MS-101	71	71	71	68°F - 75°F
NW-101	73	73	73	68°F - 75°F
Art Room	69	69	69	68°F - 75°F
A-101	76	76	76	68°F - 75°F
D-101	73	73	73	68°F - 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 less than 30% may result in drying of occupants' mucous membranes and skin. Relative humidity measurements for March 2, 2021 are summarized in Table 3. As indicated by the data in the table, the average relative humidity ranged between 11% and 23% with all tested locations measuring less than the ASHRAE maximum recommendation of 65% relative humidity, but also less than 30% relative humidity, which can cause occupant discomfort.

Table 3: Relative Humidity

Sample Location	3/2/2021 (% RH)			ASHRAE Standard (% RH)
	Min	Max	Average	
Outdoors	12	12	12	N/A
Indoors				
Main Office	20	20	20	≤ 65
Cafe	17	17	17	≤ 65
Gym	17	17	17	≤ 65
Media Center	19	19	19	≤ 65
E-102	21	21	21	≤ 65
MS-101	18	18	18	≤ 65
NW-101	11	11	11	≤ 65
Art Room	23	23	23	≤ 65
A-101	19	19	19	≤ 65
D-101	18	18	18	≤ 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 for March 2, 2021 are summarized in Table 4. On the day of the assessment, the average outdoor carbon dioxide concentration was 381 ppm, which calculates to a maximum indoor concentration of 1,081 ppm (700 + 381). All tested locations indoors were less than the recommended maximum for the day of the assessment.

Table 4: Carbon Dioxide

Sample Location	3/2/2021 Concentration (parts per million)			ASHRAE Standard (ppm), NTE
	Min	Max	Average	
Outdoors	380	382	381	N/A
Indoors				
Main Office	494	496	495	< 1,081
Cafe	429	430	430	< 1,081
Gym	440	442	441	< 1,081
Media Center	420	422	421	< 1,081
E-102	416	418	417	< 1,081
MS-101	425	426	426	< 1,081
NW-101	445	446	446	< 1,081
Art Room	418	419	419	< 1,081
A-101	426	428	427	< 1,081
D-101	416	417	417	< 1,081

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 for March 2, 2021 were less than the Q-Trak's detection limit throughout the school.

Table 5: Carbon Monoxide

Sample Location	3/2/2021 Concentration (parts per million)			ASHRAE Standard (ppm)
	Min	Max	Average	
Outdoors	< 3	< 3	< 3	N/A
Indoors				
Main Office	< 3	< 3	< 3	< 9
Cafe	< 3	< 3	< 3	< 9

Sample Location	3/2/2021 Concentration (parts per million)			ASHRAE Standard (ppm)
	Min	Max	Average	
Gym	< 3	< 3	< 3	< 9
Media Center	< 3	< 3	< 3	< 9
E-102	< 3	< 3	< 3	< 9
MS-101	< 3	< 3	< 3	< 9
NW-101	< 3	< 3	< 3	< 9
Art Room	< 3	< 3	< 3	< 9
A-101	< 3	< 3	< 3	< 9
D-101	< 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 March 2, 2021 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 March 2, 2021 spore trap sampling results suggest that no significant indoor mold amplification was present. The outdoor total mols spore concentration was 371 spores/m3, with an *Aspergillus/Penicillium*-like spore concentration of 212 spores/m^3, which made up 57% of the spores identified on the sample. The outdoor spore concentration was on the very low end of the typical outdoor spore concentration, making comparison to the outdoors difficult. The Cafeteria had the greatest total mold spore concentration of 1,272 spores/m^3, and the *Aspergillus/Penicillium*-like spore concentration was 795 counts/m^3. While the Cafeteria and several other spaces had mold spore concentrations greater than the outdoor concentrations, they are all within the typical range for an occupied space without major moisture issues.

Water damaged ceiling tiles with some suspect mold growth or staining were observed in the Media Center and Room NW101. ATI recommends fixing the cause of the water issues, and replacing the ceiling tiles prior to cleaning these rooms. Based on the mold spore results and the observations, ATI has no further recommendations at this time.

The official laboratory report with spore trap samples collected on March 2, 2021 is presented in Appendix A.

6 Summary of Findings

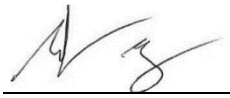
1. One of the tested spaces had a temperature greater than the ASHRAE recommended winter range of 68°F - 75°F during the assessment. All other tested spaces were within the ASHRAE range.

2. The relative humidity in all tested spaces was less than the ASHRAE maximum recommended guidelines of ≤ 65% during the March 2 assessment, but was also less than 30%, which can cause occupant discomfort.
3. Carbon dioxide concentrations in all tested spaces were less than the ASHRAE limits for carbon dioxide, which was 1,081 parts per million (ppm) for March 2.
4. Carbon monoxide concentrations were less than the IAQ meter's detection limit throughout the tested spaces.
5. The spore trap sampling results suggested that significant indoor amplification of mold was not present in the tested rooms. Any spores present in the rooms can be removed using HEPA vacuums and wet wiping as part of the standard cleaning and readying of the school before the students return this school year. Water damaged ceiling tiles in the Media Center and Room NW101 should be replaced prior to cleaning. ATI has no additional recommendations at this time.

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:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

AMA Sample #	327013-1	**AMA Sample #**	327013-2	**AMA Sample #**	327013-3
Client ID	3156-9732	**Client ID**	3156-9804	**Client ID**	3156-9731
Analyst ID	CD	**Analyst ID**	CD	**Analyst ID**	CD
Collection Apparatus	Air-O-Cell	**Collection Apparatus**	Air-O-Cell	**Collection Apparatus**	Air-O-Cell
Sample Volume (L)	75	**Sample Volume (L)**	75	**Sample Volume (L)**	75
Sample Condition	Acceptable	**Sample Condition**	Acceptable	**Sample Condition**	Acceptable
Debris Loading	1	**Debris Loading**	1	**Debris Loading**	1
Location	Outside	**Location**	Main Office	**Location**	Media Center

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	1	15	53	53	14.3%
Basidiospores	2	15	53	106	28.6%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	4	15	53	212	57.1%
Smuts/Periconia/Myxomycetes	Present	15	53	<53	
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*					
Total Raw Ct:	7	**Total sp/m³:**	371		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores					
Basidiospores	2	15	53	106	66.7%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	53	53	33.3%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*					
Total Raw Ct:	3	**Total sp/m³:**	159		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	2	15	53	106	22.2%
Basidiospores	1	15	53	53	11.1%
Bipolaris/Drechslera/Helm.					
Chaetomium	1	15	53	53	11.1%
Cladosporium	2	15	53	106	22.2%
Curvularia					
Penicillium / Aspergillus	2	15	53	106	22.2%
Smuts/Periconia/Myxomycetes	1	15	53	53	11.1%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*	1	15	53	53	11.1%
Total Raw Ct:	9	**Total sp/m³:**	477		

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

AMA Sample #	327013-4	**AMA Sample #**	327013-5	**AMA Sample #**	327013-6
Client ID	3156-9778	**Client ID**	3156-9840	**Client ID**	3156-9829
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)**	75	**Sample Volume (L)**	75
Sample Condition	Acceptable	**Sample Condition**	Acceptable	**Sample Condition**	Acceptable
Debris Loading	2	**Debris Loading**	2	**Debris Loading**	1
Location	Gym	**Location**	Cafeteria	**Location**	RM E102

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores	Present	15	53	<53	
Basidiospores	4	15	53	212	30.8%
Bipolaris/Drechslera/Helm.					
Chaetomium	1	15	53	53	7.7%
Cladosporium					
Curvularia					
Penicillium / Aspergillus	6	15	53	318	46.2%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	2	15	53	106	15.4%
Hyphal Fragments*					
Total Raw Ct:	13	**Total sp/m^3:**	689		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores	3	15	53	159	12.5%
Basidiospores	4	15	53	212	16.7%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	15	15	53	795	62.5%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown	2	15	53	106	8.3%
Other Colorless					
Hyphal Fragments*	2	15	53	106	8.3%
Total Raw Ct:	24	**Total sp/m^3:**	1272		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*					
Total Raw Ct:	0	**Total sp/m^3:**	0		

Comments

No visible trace. No mold spores observed.

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

AMA Sample #	327013-7	**AMA Sample #**	327013-8	**AMA Sample #**	327013-9
Client ID	3156-9805	**Client ID**	3156-9753	**Client ID**	3156-9748
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)**	75	**Sample Volume (L)**	75
Sample Condition	Acceptable	**Sample Condition**	Acceptable	**Sample Condition**	Acceptable
Debris Loading	2	**Debris Loading**	1	**Debris Loading**	1
Location	RM MS101	**Location**	RM NW101	**Location**	RM Art Room

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores	3	15	53	159	16.7%
Basidiospores	2	15	53	106	11.1%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	9	15	53	477	50%
Curvularia					
Penicillium / Aspergillus	1	15	53	53	5.6%
Smuts/Periconia/Myxomycetes	3	15	53	159	16.7%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*	3	15	53	159	16.7%
Total Raw Ct:	18		**Total sp/m^3:**	954	

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	53	53	25%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown	2	15	53	106	50%
Other Colorless	1	15	53	53	25%
Hyphal Fragments*					
Total Raw Ct:	4		**Total sp/m^3:**	212	

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores	2	15	53	106	50%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes	1	15	53	53	25%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	1	15	53	53	25%
Hyphal Fragments*	1	15	53	53	25%
Total Raw Ct:	4		**Total sp/m^3:**	212	

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

AMA Sample #	327013-10	**AMA Sample #**	327013-11	**AMA Sample #**	327013-12
Client ID	3156-9744	**Client ID**	3156-9737	**Client ID**	3156-9781
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)**	75	**Sample Volume (L)**	0
Sample Condition	Acceptable	**Sample Condition**	Acceptable	**Sample Condition**	Acceptable
Debris Loading	1	**Debris Loading**	2	**Debris Loading**	1
Location	RM A101	**Location**	RM D101	**Location**	Field Blank

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	1	15	53	53	25%
Smuts/Periconia/Myxomycetes	1	15	53	53	25%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	2	15	53	106	50%
Hyphal Fragments*					
Total Raw Ct:	4	**Total sp/m^3:**	212		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores	1	15	53	53	50%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown	1	15	53	53	50%
Other Colorless					
Hyphal Fragments*					
Total Raw Ct:	2	**Total sp/m^3:**	106		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores					
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Hyphal Fragments*					
Total Raw Ct:	0	**Total sp/m^3:**	0		

Comments

No mold spores observed.

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

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:	327013	**Job Name:**	PGCPS	**Date Submitted:**	03/02/2021
Client:	ATI, Inc.	**Job Location:**	Phyllis Williams Elementary School	**Person Submitting:**	Sama W.
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	21-624	**Date Analyzed:**	03/04/2021
		P.O. Number:	Not Provided	**Report Date:**	03/04/2021
Attention:	Courtney McCall				

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, Christopher Dell

Technical Director Tristan Ward

MOLD SPORE DESCRIPTIONS

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.

Chaetomium

Chaetomium is a genus of ascomycete fungi. It is a cosmopolitan, dark colored fungus (grayish-green to brown) commonly isolated from soil, seeds, dung, wood, and straw materials. Indoors, it is very commonly found on damp sheetrock and paper or cellulose-containing materials. There are certain characteristics such as color, shape, and size of the Chaetomium ascopores, asci, and ascomata that are unique in identification of the different species. Wind, insects, and water aid dispersal of spores. Due to their large size, they settle out of the air after just a few minutes. As a consequence, airborne mold levels are usually low even in infested environments. Due to this, exposure levels are likely to be low as well. Health Effects: Chaetomium does produce a variety of mycotoxins called chaetoglobsins, whose health effects on humans are unknown. Due to its toxigenic nature, special precautions may be required during remediation.

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.

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.

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.

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) 327013

Mailing/Billing Information:
1. Client Name: ATI, Inc.
2. Address 1: 4221 Forbes Blvd.
3. Address 2: Lanham - MD - 20706
4. Address 3:
5. Phone #: 202-905-0335 Fax #:

Submittal Information:
1. Job Name: PGCPS -
2. Job Location: Phyllis Williams ES
3. Job #: 21-624 P.O. #:
4. Contact Person: Courtney McCall Cell: 703-395-5423
5. Collected by: Sama W. Cell: 240-413-3728

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 to contacts on file.

AFTER HOURS (must be pre-scheduled)
☐ 4 Hours ☐ Late Night
☐ Immediate Date Due:
☐ 24 Hours Time Due:
Comments:

NORMAL BUSINESS HOURS
☐ 4 Hours ☐ 3 Day
☐ Same Day ☐ 5 Day +
☒ Next Day Date Due: 03/04/21
~~☐ 2 Day~~ ~~☐ Results Required By Noon~~ (Additional fee may apply)

REPORT TO:
☒ Email: Courtney@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
☐ Asbestos Soil ASTM D7521 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)
☐ Vermiculite (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.
Lab use only (TEM Water samples °C)
If field data sheets are submitted, there is no need to complete bottom section.

Metals Analysis
☐ Pb Paint Chip ☐ % by Weight (QTY) ☐ mg/cm² (QTY)
☐ *Pb Dust Wipe (wipe type) (QTY)
☐ *Pb Air (QTY)
☐ Pb Soil/Solid (QTY)
☐ Pb TCLP (QTY)
☐ Drinking Water ☐ Pb (QTY) ☐ Cu (QTY)
☐ Waste Water ☐ Pb (QTY) ☐ Cu (QTY)
☐ Pb Furnace (Media) (QTY)
Fungal Analysis
Collection Apparatus for Spore Traps/~~Air Samples~~: AW-O-cel
Collection Media 21001
☒ *Spore-Trap 12 (QTY) ☐ Surface Vacuum Dust (QTY)
☐ *Surface Swab (QTY)
☐ *Surface Tape (QTY)
☐ Other (Specify) (QTY)

CLIENT ID #	SAMPLE LOCATION/ ID	DATE/ TIME	VOL (L)/ Wipe Area	ANALYSIS: TEM	PCM	PLM	LEAD	MOLD	MATRIX: AIR	BULK	DUST	WATER AND OTHER	SPORE TRAP	TAPE	SWAB	COMMENTS / SPECIAL INSTRUCTIONS
3156-9732	Outside.	03-02-21	75 L					✓					✓			
3156-9804	Main office	"	"					✓					✓			
3156-9731	Media Center	"	"					✓					✓			
3156-9778	Gym	"	"					✓					✓			
3156-9840	Cafetaria.	"	"					✓					✓			
3156-9829	Room - E-102	"	"					✓					✓			
3156-9805	Room - MS-101	"	"					✓					✓			
3156-9753	Room - NW-101	"	"					✓					✓			
3156-9748	Room - Art room	"	"					✓					✓			
3156-9744	Room - A-101	"	"					✓					✓			
3156-9737	Room - D-101	"	"					✓					✓			
3156-9781	Field Blank.	"	"					✓					✓			

	Print Name	Signature	Date	Time	Shipping Information
Relinquished by:	Don Sama W.		03-02-21	3.30 PM.	☐ UPS ☒ In-Person ☐ Other ☐ FedEx ☐ Drop Box ☐ USPS ☐ Courrier
Received by:			3/2/21	1700	

Appendix B: Instrument Calibration Records

Certificate of Calibration

(✓) Buck™ BioAire Pump Calibration Rotameter
( ) Buck™ BioSlide Pump Calibration Rotameter

Serial number: R15042
Date Calibrated: 11/12/2020 **Calibration Due Date:** 11/12/2021

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

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	71.33 (21.9)	°F (°C)
RELATIVE HUMIDITY	53.9	%RH
BAROMETRIC PRESSURE	28.81 (975.6)	inHg (hPa)

MODEL	7575-X
SERIAL NUMBER	7575X1711004

☒ AS LEFT ☐ AS FOUND

☒ IN TOLERANCE ☐ 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)	71.1 (21.7)	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	28.82 (976.0)	28.82 (976.0)	28.24~29.40 (956.3~995.6)				

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	07-21-20	01-31-21	DC Voltage	E003493	06-17-20	06-30-21

CALIBRATED

August 31, 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	75.8 (24.3)	°F (°C)
RELATIVE HUMIDITY	48	%RH
BAROMETRIC PRESSURE	28.72 (972.6)	inHg (hPa)

MODEL	982
SERIAL NUMBER	P17100006

☐ AS LEFT ☐ IN TOLERANCE
☒ AS FOUND ☒ 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	3020.5	* 2874.5	2929.9~3111.1
2	504	460	454~554	5	5037	* 4771.8	4885.9~5188.1
3	1008	964	958~1058				

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

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	35.3	* 30.8	32.3~38.3	2	100.7	* 87.7	97.7~103.7

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

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	32.0 (0.0)	32.6 (0.3)	31.0~33.0 (−0.5~0.6)	2	139.8 (59.9)	140.6 (60.3)	138.8~140.8 (59.4~60.5)

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

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	10.0	10.5	7.0~13.0	4	70.0	69.6	67.0~73.0
2	30.0	30.4	27.0~33.0	5	90.0	88.9	87.0~93.0
3	50.0	50.4	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	Measurement Variable	System ID	Last Cal.	Cal. Due
5000 CO_2	T-0660	07-15-20	07-15-28	200 CO	149848	03-24-20	03-24-28
N2	CT308798	06-28-20	06-28-28	Air	T608955	06-17-20	06-17-28
Flow	E003341	09-03-19	09-30-20	Flow	E003980	04-22-20	04-30-21
Flow	E003525	01-06-20	01-31-21	Flow	E003342	09-03-19	09-30-20
2000 C4H8	EB0054467	08-13-19	08-12-22	100 C4H8	CC507339	03-24-20	03-24-28
Temperature	E010657	02-14-20	02-28-21	Temperature	E010658	02-14-20	02-28-21
Temperture	E010655	01-21-20	01-31-21	Humidity	E003539	08-21-20	02-28-21

ChaoVang
VERIFIED

August 31, 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	71.33 (21.9)	°F (°C)
RELATIVE HUMIDITY	53.9	%RH
BAROMETRIC PRESSURE	28.81 (975.6)	inHg (hPa)

MODEL	982
SERIAL NUMBER	P17100006

☒ 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	32.0 (0.0)	32.6 (0.3)	31.0~33.0 (−0.5~0.6)	2	139.8 (59.9)	140.6 (60.3)	138.8~140.8 (59.4~60.5)

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

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	10.0	10.5	7.0~13.0	4	70.0	69.6	67.0~73.0
2	30.0	30.4	27.0~33.0	5	90.0	88.9	87.0~93.0
3	50.0	50.4	47.0~53.0				

CO_2 GAS VERIFICATION — SYSTEM G-101 — *Unit: ppm*

#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE
1	0	0	0~50	4	3020	3025	2929~3110
2	504	501	454~554	5	5037	5026	4886~5188
3	1008	1027	958~1058				

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 CO_2	T-0660	07-15-20	07-15-28
N_2	CT308798	06-28-20	06-28-28
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	08-21-20	02-28-21
200 CO	149848	03-24-20	03-24-28
Air	T608955	06-17-20	06-17-28
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

Bao Yang
CALIBRATED

August 31, 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	71.24 (21.8)	°F (°C)
RELATIVE HUMIDITY	54.8	%RH
BAROMETRIC PRESSURE	28.74 (973.2)	inHg (hPa)

MODEL	7575-X
SERIAL NUMBER	7575X1711004

☐ 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)	70.5 (21.4)	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	28.75 (973.6)	28.84 (976.6)	28.17~29.33 (953.9~993.2)				

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	07-21-20	01-31-21	DC Voltage	E003493	06-17-20	06-30-21

VERIFIED

August 31, 2020
DATE

Doc. ID: CERT_GEN_WCC

TSI P/N 2300157