ati INC
Architecture | Engineering | Construction

9220 Rumsey Road, Suite 100, Columbia, MD 21045
T: 410.992.3424 | F: 410.992.1837

January 15, 2021

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

RE: Indoor Air Quality Assessment, Thomas Johnson Middle School
IFB: 022-19
ATI Project Number: 20-695

Dear Mr. Baylor:

Prince George's County Public Schools requested that ATI, Inc., conduct a proactive indoor air quality (IAQ) assessment at Thomas Johnson Middle School on January 6, 2021. 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.

Reviewed and approved by:

Mikal Frater
Industrial Hygienist

Nate Burgei, CIH, CSP
Certified Industrial Hygienist

Indoor Air Quality Assessment Report

Prince George's County Public Schools
Thomas Johnson Middle School
5401 Barker Place
Lanham, Maryland 20706

Prepared for:

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

January 15, 2021

Submitted by:

ATI Job # 20-695

Table of Contents

List of Tables

Appendices

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 January 6, 2021, at Thomas Johnson Middle School, located at 5401 Barker Place, Lanham, Maryland 20706.

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. Four of the tested spaces had temperatures less than the ASHRAE recommended winter range of 68-75°F.
2. The relative humidity in all tested spaces were less than the ASHRAE guidelines of <65%, yet four tested spaces 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 1,016 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 concentrations of *Aspergillus/Penicillium* and *Cladosporium* detected in four tested locations 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 January 6, 2021. 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 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 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. (AMA), 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. 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 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	• Cloudy skies • Light foot and vehicle traffic observed • Light winds, about 12mph NW
Main Office	• Four occupants in the area during sampling • Door to corridor and adjoining offices OPEN during sampling • No odors, stained ceiling tiles, or visible mold growth observed • Light foot traffic • Three air diffusers in this space; one air return • Space is approximately 832 ft.^{2}
Room 115	• No odors, stained ceiling tiles, or visible mold growth observed • One wall unit ON during sampling • Door to adjoining rooms OPEN during sampling • Trace dust accumulation • Two occupants in area during sampling • Space is approximately 1,078 ft.^{2}
Room 100B	• No odors, stained ceiling tiles, or visible mold growth observed • Two occupants in the area during sampling • One wall unit – heat ON during sampling • Door to corridor CLOSED during sampling • Space is approximately 1,616 ft.^{2}
Room 210	• One occupant in the area during sampling • No stained ceiling tiles, visible mold growth, or odor observed • Light dust accumulation in this space • Door to corridor CLOSED during sampling • One wall unit ON during sampling • Space is approximately 609 ft.^{2}
Room 218	• No stained ceiling tile, odors or visible mold growth observed • Two occupants in this space during sampling • Door to corridor CLOSED during sampling • Space is approximately 513 ft.^{2}
Gymnasium	• Two occupants in the area during sampling • Two oscillating fans blowing towards outside air • Emergency exit – outdoor access • Two air returns in this space • Eleven air diffusers in this space • Space is approximately 4,419 ft.^{2}
Cafeteria	• Seven occupants in area during sampling • Two large air diffusers

Sample Location	Observations
	• Twelve air returns; moderate dust accumulation on grid • Space is approximately 4,419 ft.^{2}
Library	• Two wall units – heat ON during sampling • Emergency exit – outdoor access • Two occupants in area during sampling • Doors to adjoining rooms OPEN during sampling • Light brown ceiling tile stain near light fixture and on both middle columns • No visible mold growth or odor observed • Space is approximately 2,571 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 January 6, 2021, assessment are summarized in Table 2. As indicated by the data in the table, temperatures in the school averaged between 61°F and 71°F, with four locations reporting less than the ASHRAE recommended winter range.

Table 2: Temperature

Sample Location	1/06/2021 °F			ASHRAE Standard °F
	Min	Max	Average	
Outdoors	41	41	41	N/A
Indoors				
Main Office	64	65	65	68-75°F
Room 115	66	66	66	68-75°F
Room 100B	70	71	71	68-75°F
Room 210	70	71	71	68-75°F
Room 218	71	71	71	68-75°F
Gymnasium	60	61	61	68-75°F
Cafeteria	65	65	65	68-75°F
Library	69	69	69	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 less than 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 20% and 36% with all tested locations measuring less than the ASHRAE maximum recommendation of 65% relative humidity, and four locations measuring less than 30% relative humidity.

Table 3: Relative Humidity

Sample Location	1/06/2021 (% RH)			ASHRAE Standard (% RH)
	Min	Max	Average	
Outdoors	57	58	58	N/A
Indoors				
Main Office	33	35	34	< 65
Room 115	29	30	30	< 65
Room 100B	26	26	26	< 65
Room 210	22	22	22	< 65
Room 218	20	20	20	< 65
Gymnasium	35	36	36	< 65
Cafeteria	31	32	32	< 65
Library	26	26	26	< 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 316 ppm, which calculates to a maximum indoor concentration of 1,016 ppm (700 + 316). All tested locations indoors were less than the recommended maximum for the day of the assessment.

Table 4: Carbon Dioxide

Sample Location	1/06/2021 Concentration (parts per million)			ASHRAE Standard (ppm) NTE
	Min	Max	Average	
Outdoors	315	317	316	N/A
Indoors				
Main Office	464	466	465	1,016
Room 115	384	384	384	1,016
Room 100B	387	387	387	1,016
Room 210	408	415	412	1,016
Room 218	388	408	398	1,016
Gymnasium	379	381	380	1,016
Cafeteria	460	462	461	1,016
Library	377	387	382	1,016

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	1/06/2021 Concentration (parts per million)			ASHRAE Standard (ppm)
	Min	Max	Average	
Outdoors	<3	<3	<3	N/A
Inside				
Main Office	<3	<3	<3	< 9
Room 115	<3	<3	<3	< 9
Room 100B	<3	<3	<3	< 9
Room 210	<3	<3	<3	< 9
Room 218	<3	<3	<3	< 9
Gymnasium	<3	<3	<3	< 9
Cafeteria	<3	<3	<3	< 9
Library	<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 January 6, 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 results suggest the indoor concentrations were generally favorable compared to the outdoor concentrations. The total ambient, outdoor spore concentration was 2,014 spores/m^3, and all tested spaces had total spore concentrations less than the ambient total. One tested room, Room 115, had a *Cladosporium* concentration of 318 spores/m^3 which was greater than what was detected in the outdoor ambient samplewith 53 spores/m^3. Four locations, Room 210, Cafeteria, Gymnasium, and Room 215, measured concentrations of *Aspergillus/Penicillium* ranging from 53 spores/m^3 to 265 spores/m^3 that exceeded the undetected concentration in the ambient sample.

The *Cladosporium* and *Aspergillius/Penicillium* concentrations that were greater than the respective outdoor concentrations do not suggest significant mold growth, nor do they suggest that the presence is due to significant water damage. The measured concentrations are not unusual in occupied spaces.

The official laboratory report with spore trap samples collected on January 6, 2021, is presented in Appendix A.

6 Summary of Findings

1. Four of the tested spaces had temperatures less than the ASHRAE recommended winter range of 68-75°F.
2. The relative humidity in all tested spaces were less than the ASHRAE guidelines of <65%, yet four tested spaces 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 1,016 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 concentrations of *Aspergillus/Penicillium* and *Cladosporium* detected in five tested locations 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.

Mikal Frater
Industrial Hygienist

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:	285318	**Job Name:**	PGCPS IAQ - Thomas Johnson Middle School	**Date Submitted:**	01/07/2021
Client:	ATI, Inc.	**Job Location:**	5401 Barker Place, Lanham, MD	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-695	**Date Analyzed:**	01/14/2021
		P.O. Number:	Not Provided	**Report Date:**	01/14/2021
Attention:	Mikal Frater				

AMA Sample #	285318-1	**AMA Sample #**	285318-2	**AMA Sample #**	285318-3
Client ID	20-695-1	**Client ID**	20-695-2	**Client ID**	20-695-3
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	2	**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	4	15	53	212	10.5%
Basidiospores	32	15	53	1696	84.2%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	53	53	2.6%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes	1	15	53	53	2.6%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*	1	15	53	53	2.6%
Total Raw Ct:	38		**Total sp/m³:**	2014	

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					
Torula					
Nigrospora					
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	3	15	53	159	20%
Basidiospores	11	15	53	583	73.3%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	1	15	53	53	6.7%
Smuts/Periconia/Myxomycetes	Present	15	53	<53	
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*					
Total Raw Ct:	15		**Total sp/m³:**	795	

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	285318	**Job Name:**	PGCPS IAQ - Thomas Johnson Middle School	**Date Submitted:**	01/07/2021
Client:	ATI, Inc.	**Job Location:**	5401 Barker Place, Lanham, MD	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-695	**Date Analyzed:**	01/14/2021
		P.O. Number:	Not Provided	**Report Date:**	01/14/2021
Attention:	Mikal Frater				

AMA Sample #	285318-4	**AMA Sample #**	285318-5	**AMA Sample #**	285318-6
Client ID	20-695-4	**Client ID**	20-695-5	**Client ID**	20-695-6
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	1	**Debris Loading**	1	**Debris Loading**	1
Location	RM 115	**Location**	RM 100B	**Location**	RM 210

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores	4	15	53	212	36.4%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	6	15	53	318	54.5%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	1	15	53	53	9.1%
Torula					
Nigrospora					
Hyphal Fragments*					
Total Raw Ct:	11	**Total sp/m^3:**	583		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores	2	15	53	106	40%
Basidiospores	3	15	53	159	60%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*					
Total Raw Ct:	5	**Total sp/m^3:**	265		

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores	1	15	53	53	11.1%
Basidiospores	2	15	53	106	22.2%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	5	15	53	265	55.6%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula	1	15	53	53	11.1%
Nigrospora					
Hyphal Fragments*					
Total Raw Ct:	9	**Total sp/m^3:**	477		

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody: 285318
Client: ATI, Inc.
Address: 9220 Rumsey Road
Suite 100
Columbia, MD 21045
Attention: Mikal Frater

Job Name: PGCPS IAQ - Thomas Johnson Middle School
Job Location: 5401 Barker Place, Lanham, MD
Job Number: 20-695
P.O. Number: Not Provided

Date Submitted: 01/07/2021
Person Submitting: Mikal Frater
Date Analyzed: 01/14/2021
Report Date: 01/14/2021

AMA Sample #	285318-7
Client ID	20-695-7
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	RM 218

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	4	15	53	212	23.5%
Basidiospores	12	15	53	636	70.6%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	1	15	53	53	5.9%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*					

Total Raw Ct: 17 **Total sp/m³:** 901

Comments

AMA Sample #	285318-8
Client ID	20-695-8
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Gymnasium

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	1	15	53	53	8.3%
Basidiospores	7	15	53	371	58.3%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	1	15	53	53	8.3%
Curvularia					
Penicillium / Aspergillus	1	15	53	53	8.3%
Smuts/Periconia/Myxomycetes	2	15	53	106	16.7%
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*					

Total Raw Ct: 12 **Total sp/m³:** 636

Comments

AMA Sample #	285318-9
Client ID	20-695-9
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Cafeteria

	Raw Ct	Trav/Flds	A.S.	sp/m³	%
Alternaria					
Ascospores	2	15	53	106	8.3%
Basidiospores	14	15	53	742	58.3%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	3	15	53	159	12.5%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	4	15	53	212	16.7%
Torula					
Nigrospora	1	15	53	53	4.2%
Hyphal Fragments*					

Total Raw Ct: 24 **Total sp/m³:** 1272

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody: 285318
Client: ATI, Inc.
Address: 9220 Rumsey Road
Suite 100
Columbia, MD 21045
Attention: Mikal Frater

Job Name: PGCPS IAQ - Thomas Johnson Middle School
Job Location: 5401 Barker Place, Lanham, MD
Job Number: 20-695
P.O. Number: Not Provided

Date Submitted: 01/07/2021
Person Submitting: Mikal Frater
Date Analyzed: 01/14/2021
Report Date: 01/14/2021

AMA Sample #	285318-10
Client ID	20-695-10
Analyst ID	TLW
Collection Apparatus	Air-O-Cell
Sample Volume (L)	75
Sample Condition	Acceptable
Debris Loading	1
Location	Library

	Raw Ct	Trav/Flds	A.S.	sp/m^3	%
Alternaria					
Ascospores					
Basidiospores	7	15	53	371	100%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Torula					
Nigrospora					
Hyphal Fragments*					
Total Raw Ct:	7		**Total sp/m^3:**		371

Comments

AMA Analytical Services, Inc.
Focused On Results.

CERTIFICATE OF ANALYSIS

ASTM D7391-09 Spore Trap Analysis Report

Chain of Custody:	285318	**Job Name:**	PGCPS IAQ - Thomas Johnson Middle School	**Date Submitted:**	01/07/2021
Client:	ATI, Inc.	**Job Location:**	5401 Barker Place, Lanham, MD	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-695	**Date Analyzed:**	01/14/2021
		P.O. Number:	Not Provided	**Report Date:**	01/14/2021
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:	285318	**Job Name:**	PGCPS IAQ - Thomas Johnson Middle School	**Date Submitted:**	01/07/2021
Client:	ATI, Inc.	**Job Location:**	5401 Barker Place, Lanham, MD	**Person Submitting:**	Mikal Frater
Address:	9220 Rumsey Road Suite 100 Columbia, MD 21045	**Job Number:**	20-695	**Date Analyzed:**	01/14/2021
		P.O. Number:	Not Provided	**Report Date:**	01/14/2021
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

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.

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.

Nigrospora

Nigrospora is a ubiquitous, filamentous, dark colored fungus commonly isolated from soil, decaying plants, and seeds. Indoors, it is considered a laboratory contaminant. Colonies grow rapidly, initially white and woolly, later turning gray with black areas, and eventually turning black (both front and reverse). Its conidia are black, solitary, unicellular, slightly flattened horizontally, and have a thin equatorial germ slit. Health Effects: This mold may be a potential allergen. It is uncertain whether it is pathogenic to humans.

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.

Torula

Torula is a cosmopolitan, dark-walled fungus often found growing outside in soil, dead herbaceous stems, wood, grasses, and seeds. It can grow indoors on cellulose containing materials. It is frequently found in temperate regions. Torula spores are colored in shades of brown, from pale brown to reddish brown. Spores are formed in simple or branched chains, one to several cells long that are often detached. A cup-like indentation at the point of detachment is characteristic of these spores. Health Effects: Torula is an allergen, which may cause hay fever and asthma. It has not been reported to be pathogenic to humans or produce toxins.

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) 285318

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: PGCPS IAQ - THOMAS JOHNSON MS
2. Job Location: 5401 BARKER PLACE LANHAM, MD
3. Job #: 20-695 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
☐ Same Day ● 5 Day + Date Due: 1/14/21
☐ Next Day
☐ 2 Day
☐ Results Required By Noon

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 10 (QTY) ☐ Surface Vacuum Dust____ (QTY)
☐ *Surface Swab____(QTY) ☐ Culturable ID Genus (Media____)____(QTY)
☐ *Surface Tape____ (QTY) ☐ Culturable ID Species (Media____)____ (QTY)
☐ Other (Specify____)____ (QTY

CLIENT ID #	SAMPLE INFORMATION SAMPLE LOCATION/ ID	DATE/ TIME	VOL (L)/ Wipe Area	ANALYSIS: TEM	PCM	PLM	LEAD	MATRIX: MOLD	AIR	BULK	DUST	WATER AND OTHER	SPORE TRAP	TAPE	SWAB	CLIENT CONTACT (LABORATORY STAFF ONLY)
20-695 ①	PARKING LOT	1/6/21	75L					✓					✓			Date/Time: Contact:By:
20-695 ②	FIELD BLANK	—	—					✓					✓			
20-695 ③	MAIN OFFICE	1/6/21	75L					✓					✓			
20-695 ④	ROOM 115	1/6/21	75L					✓					✓			
20-695 ⑤	ROOM 100B	1/6/21	75L					✓					✓			Date/Time: Contact:By:
20-695 ⑥	ROOM 210	1/6/21	75L					✓					✓			
20-695 ⑦	ROOM 218	1/6/21	75L					✓					✓			
20-695 ⑧	GYMNASIUM	1/6/21	75L					✓					✓			
20-695 ⑨	CAFETERIA	1/6/21	75L					✓					✓			Date/Time: Contact:By:
20-695 ⑩	LIBRARY	1/6/21	75L					✓					✓			

	Print Name	Signature	Date	Time
Relinquished by:	MIKAL FRATER	Mikal Frater	1/7/2021	1:30 PM
Received by:				
Relinquished by:				
Received for Lab by:			1/7/21	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: R15046
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: Moran 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	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

Chimouva 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

ChaoVang
CALIBRATED

June 15, 2020
DATE

DOC ID: CERT_GEN_V02

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	70.68 (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

ChaoVang
VERIFIED

June 15, 2020
DATE

Doc ID: CERT_GEN_WCC

TSI P/N 2300157