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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, Brandywine Elementary School  
IFB: 022-19  
ATI Project Number: 20-696

Dear Mr. Baylor:

Prince George's County Public Schools requested that ATI, Inc., conduct a proactive indoor air quality (IAQ) assessment at Brandywine Elementary 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:

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Mikal Frater  
Industrial Hygienist

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Nate Burgei, CIH, CSP  
Certified Industrial Hygienist

# Indoor Air Quality Assessment Report

Prince George's County Public Schools  
Brandywine Elementary School  
1401 Brandywine Road  
Brandywine, Maryland 20613

Prepared for:

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

**January 15, 2021**

Submitted by:



ATI Job # 20-696

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## Abbreviations and Acronyms

<b>AHU</b>	Air-Handling Unit
<b>AIHA</b>	American Industrial Hygiene Association
<b>ASHRAE</b>	American Society of Heating, Refrigerating and Air-Conditioning Engineers
<b>ASTM</b>	American Society for Testing and Materials
<b>CO</b>	Carbon Monoxide
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>EMLAP</b>	Environmental Microbiology Laboratory Accreditation Program
<b>HVAC</b>	Heating, Ventilating, And Air-Conditioning
<b>IAQ</b>	Indoor Air Quality
<b>NIST</b>	National Institute for Standards and Technology
<b>NVLAP</b>	National Voluntary Laboratory Accreditation Program
<b>RH</b>	Relative Humidity
<b>Rev.</b>	Revision

### Abbreviations involving scientific volume and measurements involving media or water sampling

<b>Spores/m<sup>3</sup></b>	Mold spores per cubic meter of air
<b>LPM</b>	Liters Per Minute
<b>NTE</b>	Not to exceed
<b>°F</b>	degree Fahrenheit
<b>PPM</b>	Parts Per Million

## 1 Executive Summary

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ATI conducted a proactive Indoor Air Quality (IAQ) assessment on January 6, 2021, at Brandywine Elementary School, located at 1401 Brandywine Road, Brandywine, MD 20613.

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 three 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 1,056 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

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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<sub>2</sub>), 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), in 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 EMSL laboratory reports are included in Appendix A.

3 Visual Observations

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

**Table 1: Visual Observations and Sampling Locations**

Sample Location	Observations
Parking Lot – Outdoors	<ul style="list-style-type: none"> <li>• Cloudy skies</li> <li>• Moderate foot and vehicle traffic observed</li> <li>• Light winds, about 12mph NW</li> </ul>
Main Office	<ul style="list-style-type: none"> <li>• Three occupants in the area during sampling</li> <li>• Many plastic barriers around desks</li> <li>• Plant on countertop, in good condition</li> <li>• No odors, stained ceiling tiles, or visible mold growth observed</li> <li>• Door to corridor OPEN during sampling</li> <li>• Three air diffusers in this space</li> <li>• One air return in this space</li> <li>• Trace dust accumulation in this space</li> <li>• Space is approximately 288 ft.<sup>2</sup></li> </ul>
Room 10	<ul style="list-style-type: none"> <li>• No odors, stained ceiling tiles, or visible mold growth observed</li> <li>• Four diffusers in this space</li> <li>• One return in this space</li> <li>• Emergency exit – outdoor access</li> <li>• Trace dust accumulation</li> <li>• One occupant in area during sampling</li> <li>• Space is approximately 936 ft.<sup>2</sup></li> </ul>
Cafeteria	<ul style="list-style-type: none"> <li>• No odors, stained ceiling tiles, or visible mold growth observed</li> <li>• One occupant in the area during sampling</li> <li>• Emergency exit – outdoor access</li> <li>• Two diffusers in this space</li> <li>• Three returns in this space</li> <li>• Doors to corridor OPEN during sampling</li> <li>• Door to kitchen OPEN during sampling</li> <li>• Light dust accumulation on stage</li> <li>• Space is approximately 2,785 ft.<sup>2</sup></li> </ul>
Gymnasium	<ul style="list-style-type: none"> <li>• One occupant in the area during sampling</li> <li>• No stained ceiling tiles, visible mold growth, or odor observed</li> <li>• Light dust accumulation in this space</li> <li>• Heat ON during samplings</li> <li>• Three air returns in this space</li> <li>• Four air diffusers in this space</li> <li>• Space is approximately 4,272 ft.<sup>2</sup></li> </ul>
Room 23	<ul style="list-style-type: none"> <li>• No odors or visible mold growth observed</li> <li>• Light dust accumulation</li> <li>• One occupant in area during sampling</li> </ul>

Sample Location	Observations
	<ul style="list-style-type: none"> <li>• Light brown ceiling tile stain near return vent</li> <li>• One air return in this space</li> <li>• Four air diffusers in this space</li> <li>• Space is approximately 993 ft.<sup>2</sup></li> </ul>

## 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 64°F and 72°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	44	44	44	N/A
<b>Indoors</b>				
Main Office	64	65	65	68-75°F
Room 10	67	67	67	68-75°F
Cafeteria	63	64	64	68-75°F
Gymnasium	67	67	67	68-75°F
Room 23	71	72	72	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 27% and 39% with all tested locations measuring less than the ASHRAE maximum recommendation of 65% relative humidity, and three locations measuring less than 30% relative humidity.

**Table 3: Relative Humidity**

Sample Location	1/06/2021 (% RH)			ASHRAE Standard (% RH)
	Min	Max	Average	
Outdoors	53	54	54	N/A
<b>Indoors</b>				
Main Office	37	40	39	< 65
Room 10	28	28	28	< 65
Cafeteria	30	31	31	< 65
Gymnasium	29	29	29	< 65
Room 23	26	27	27	< 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 356 ppm, which calculates to a maximum indoor concentration of 1,056 ppm (700 + 356). 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	351	361	356	N/A
<b>Indoors</b>				
Main Office	616	616	616	1,056
Room 10	397	401	399	1,056
Cafeteria	398	401	400	1,056
Gymnasium	401	406	405	1,056
Room 23	423	426	425	1,056



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
<b>Inside</b>				
Main Office	<3	<3	<3	< 9
Room 10	<3	<3	<3	< 9
Cafeteria	<3	<3	<3	< 9
Gymnasium	<3	<3	<3	< 9
Room 23	<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 3,021 spores/m<sup>3</sup>, and all tested spaces had total spore concentrations less than the ambient total. One tested room, the Main Office, had a *Cladosporium* concentration of 689 spores/m<sup>3</sup> which was not detected in the outdoor ambient sample. Three locations, the Cafeteria, Room 10 and Room 23, had measured concentrations of *Aspergillus/Penicillium*, ranging from 106 spores/m<sup>3</sup> to 477 spores/m<sup>3</sup>, that exceeded the concentration measured in the ambient sample of only 53 spores/m<sup>3</sup>.

The *Cladosporium* and *Aspergillus/Penicillium* concentrations that were greater than the respective outdoor concentrations does not suggest significant indoor mold growth and does not suggest the presence is due to significant water damage. The measured concentrations are not unusual for occupied spaces..

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

## 6 Summary of Findings

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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 three 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 1,056 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.

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.**



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Mikal Frater  
Industrial Hygienist



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Nate Burgei, CIH, CSP  
Certified Industrial Hygienist

**Appendix A: Laboratory Report and Chain of Custody**

# CERTIFICATE OF ANALYSIS

## ASTM D7391-09 Spore Trap Analysis Report

**Chain of Custody:** 285317  
**Client:** ATI, Inc.  
**Address:** 9220 Rumsey Road  
 Suite 100  
 Columbia, MD 21045  
**Attention:** Mikal Frater

**Job Name:** PGGPS IAQ Brandywine Elementary School  
**Job Location:** 14101 Brandywine Road, Brandywine, MD 20613  
**Job Number:** 20-696  
**P.O. Number:** Not Provided

**Date Submitted:** 01/07/2021  
**Person Submitting:** Mikal Frater  
**Date Analyzed:** 01/13/2021  
**Report Date:** 01/13/2021

**AMA Sample #** 285317-1  
**Client ID** 20-696-1  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 75  
**Sample Condition** Acceptable  
**Debris Loading** 2  
**Location** Parking Lot

**AMA Sample #** 285317-2  
**Client ID** 20-696-2  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 0  
**Sample Condition** Acceptable  
**Debris Loading** 1  
**Location** Field Blank

**AMA Sample #** 285317-3  
**Client ID** 20-696-3  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 75  
**Sample Condition** Acceptable  
**Debris Loading** 2  
**Location** Main Office

	Raw Ct	Trav/Flds	A.S.	sp/m <sup>3</sup>	%		Raw Ct	Trav/Flds	A.S.	sp/m <sup>3</sup>	%		Raw Ct	Trav/Flds	A.S.	sp/m <sup>3</sup>	%	
Alternaria						Alternaria						Alternaria						
Ascospores	5	15	53	265	8.8%	Ascospores						Ascospores						
Basidiospores	51	15	53	2703	89.5%	Basidiospores						Basidiospores	11	15	53	583	40.7%	
Bipolaris/Drechslera/Helm.						Bipolaris/Drechslera/Helm.						Bipolaris/Drechslera/Helm.						
Chaetomium						Chaetomium						Chaetomium						
Cladosporium						Cladosporium						Cladosporium	13	15	53	689	48.1%	
Curvularia						Curvularia						Curvularia						
Penicillium / Aspergillus	1	15	53	53	1.8%	Penicillium / Aspergillus						Penicillium / Aspergillus	1	15	53	53	3.7%	
Smuts/Periconia/Myxomycetes						Smuts/Periconia/Myxomycetes						Smuts/Periconia/Myxomycetes	1	15	53	53	3.7%	
Stachybotrys/Memnoniella						Stachybotrys/Memnoniella						Stachybotrys/Memnoniella						
Ulocladium						Ulocladium						Ulocladium						
Unknown						Unknown						Unknown						
Other Colorless						Other Colorless						Other Colorless	1	15	53	53	3.7%	
Rusts						Rusts						Rusts	Present	15	53	<53		
Hyphal Fragments*						Hyphal Fragments*						Hyphal Fragments*						
<b>Total Raw Ct:</b>	57					<b>Total Raw Ct:</b>	0					<b>Total Raw Ct:</b>	27					
<b>Total sp/m<sup>3</sup>:</b>				3021		<b>Total sp/m<sup>3</sup>:</b>	0			0		<b>Total sp/m<sup>3</sup>:</b>				1431		

Comments

Comments

No mold spores observed.

Comments

# CERTIFICATE OF ANALYSIS

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 Suite 100  
 Columbia, MD 21045  
**Attention:** Mikal Frater

**Job Name:** PGCPs IAQ Brandywine Elementary School  
**Job Location:** 14101 Brandywine Road, Brandywine, MD 20613  
**Job Number:** 20-696  
**P.O. Number:** Not Provided

**Date Submitted:** 01/07/2021  
**Person Submitting:** Mikal Frater  
**Date Analyzed:** 01/13/2021  
**Report Date:** 01/13/2021

**AMA Sample #** 285317-4  
**Client ID** 20-696-4  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 75  
**Sample Condition** Acceptable  
**Debris Loading** 1  
**Location** RM 10

**AMA Sample #** 285317-5  
**Client ID** 20-696-5  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 75  
**Sample Condition** Acceptable  
**Debris Loading** 2  
**Location** Cafeteria

**AMA Sample #** 285317-6  
**Client ID** 20-696-6  
**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/m <sup>3</sup>	%
Alternaria					
Ascospores	1	15	53	53	7.1%
Basidiospores	4	15	53	212	28.6%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	Present	15	53	<53	
Curvularia					
Penicillium / Aspergillus	9	15	53	477	64.3%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Rusts					
Hyphal Fragments*					
<b>Total Raw Ct:</b>	14		<b>Total sp/m<sup>3</sup>:</b>	742	

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m <sup>3</sup>	%
Alternaria					
Ascospores	4	15	53	212	10.8%
Basidiospores	25	15	53	1325	67.6%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium					
Curvularia					
Penicillium / Aspergillus	7	15	53	371	18.9%
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless	1	15	53	53	2.7%
Rusts					
Hyphal Fragments*					
<b>Total Raw Ct:</b>	37		<b>Total sp/m<sup>3</sup>:</b>	1961	

Comments

	Raw Ct	Trav/Flds	A.S.	sp/m <sup>3</sup>	%
Alternaria					
Ascospores	3	15	53	159	13%
Basidiospores	18	15	53	954	78.3%
Bipolaris/Drechslera/Helm.					
Chaetomium					
Cladosporium	2	15	53	106	8.7%
Curvularia					
Penicillium / Aspergillus					
Smuts/Periconia/Myxomycetes					
Stachybotrys/Memnoniella					
Ulocladium					
Unknown					
Other Colorless					
Rusts					
Hyphal Fragments*					
<b>Total Raw Ct:</b>	23		<b>Total sp/m<sup>3</sup>:</b>	1219	

Comments

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**Job Number:** 20-696  
**P.O. Number:** Not Provided

**Date Submitted:** 01/07/2021  
**Person Submitting:** Mikal Frater  
**Date Analyzed:** 01/13/2021  
**Report Date:** 01/13/2021

**AMA Sample #** 285317-7  
**Client ID** 20-696-7  
**Analyst ID** TLW  
**Collection Apparatus** Air-O-Cell  
**Sample Volume (L)** 75  
**Sample Condition** Acceptable  
**Debris Loading** 1  
**Location** RM 23

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

**Comments**

# CERTIFICATE OF ANALYSIS

## ASTM D7391-09 Spore Trap Analysis Report

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**Job Number:** 20-696  
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### 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.



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 evaluation 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.



# CERTIFICATE OF ANALYSIS

## ASTM D7391-09 Spore Trap Analysis Report

**Chain of Custody:** 285317  
**Client:** ATI, Inc.  
**Address:** 9220 Rumsey Road  
 Suite 100  
 Columbia, MD 21045  
**Attention:** Mikal Frater

**Job Name:** PGCPSS IAQ Brandywine Elementary School  
**Job Location:** 14101 Brandywine Road, Brandywine, MD 20613  
**Job Number:** 20-696  
**P.O. Number:** Not Provided

**Date Submitted:** 01/07/2021  
**Person Submitting:** Mikal Frater  
**Date Analyzed:** 01/13/2021  
**Report Date:** 01/13/2021

### 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

This report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently identical or similar products. As a mutual protection to clients, the public, and these Laboratories, this report is submitted and accepted for the exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from us. Sample types, locations, and collection protocols are based upon the information provided by the persons submitting them and, unless collected by personnel of these Laboratories, we expressly disclaim any knowledge and liability for the accuracy and completeness of this information. Residual sample material will be discarded in accordance with the appropriate regulatory guidelines, unless otherwise requested by the client.



# 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 number 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. Basidiospores 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 occasionally 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.

## 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 marneffeii (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 naturally 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. marneffeii) that causes lethal systemic infection (Penicilliosis) in immunocompromised individuals.

## Rusts

Rusts are of the order Uredinales. Certain species produce spores that are often reddish in color and resemble the corrosion process known as rust. This is how this group derived its common name-Rusts. The spores are airborne and can travel long distances. Some spores slightly resemble Smuts. Rusts are plant parasites and may require two or more different plant hosts to complete their life cycle. Their complex life cycle includes production of five different spore stages. Their infection rate is enhanced by wet weather. Health Effects: Rusts can cause allergen type I allergies (hay fever, asthma). No human infection and known toxins have been reported.

## 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, flowering 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.



# 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

(Please Refer To This  
 Number For Inquires)

285317

## CHAIN OF CUSTODY

### Mailing/Billing Information:

- Client Name: ATI .inc
- Address 1: 4221 FORBES BLVD, SUITE 250
- Address 2: LANHAM, MD 20706
- Address 3: \_\_\_\_\_
- Phone #: \_\_\_\_\_ Fax #: \_\_\_\_\_

### Submittal Information:

- Job Name: PGCPS 1AQ BRANDYWINE ES
- Job Location: H101 BRANDYWINE RD, BRANDYWINE, MD 20613
- Job #: 20-696 P.O. #: \_\_\_\_\_
- Contact Person: MIKAL FRATER Cell: (848) 702-8621
- 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.

<b>AFTER HOURS (must be pre-scheduled)</b> <input type="checkbox"/> 4 Hours <input type="checkbox"/> Immediate Date Due: _____ <input type="checkbox"/> 24 Hours Time Due: _____ Comments: _____		<b>NORMAL BUSINESS HOURS</b> <input type="checkbox"/> 4 Hours <input type="checkbox"/> Same Day <input type="checkbox"/> Next Day <input type="checkbox"/> 2 Day <input type="checkbox"/> 3 Day <input checked="" type="checkbox"/> 5 Day + Date Due: <u>1/14/21</u> <input type="checkbox"/> Results Required By Noon		<b>REPORT TO:</b> <input checked="" type="checkbox"/> Email: <u>MIKAL@ATIINC.COM</u> <input type="checkbox"/> Email 2: _____ <input type="checkbox"/> 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  
 If field data sheets are submitted, there is no need to complete bottom section.

### 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)

### 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 1 (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		DATE/TIME	VOL (L)/Wipe Area	ANALYSIS										CLIENT CONTACT				
	SAMPLE LOCATION/ID				TEM	PCM	PLM	LEAD	MOLD	PAH	BULK	DUST	WATER ANY OTHER	SPORE TRAP	TAPE	SWAB	(LABORATORY STAFF ONLY)		
20-696	1	PARKING LOT	1/6/21	75L															
20-696	2	FIELD BLANK	1/6/21																
20-696	3	MAIN OFFICE	1/6/21	75L															
20-696	4	ROOM 10	1/6/21	75L															
20-696	5	CAFETERIA	1/6/21	75L															
20-696	6	GYMNASIUM	1/6/21	75L															
20-696	7	ROOM 23	1/6/21	75L															

Relinquished by:	Print Name: <u>MIKAL FRATER</u>	Signature: <u>Mikal Frater</u>	Date: <u>1/7/2021</u>	Time: <u>1:30 PM</u>	Shipping Information <input type="checkbox"/> UPS <input checked="" type="checkbox"/> In-Person <input type="checkbox"/> Other <input type="checkbox"/> FedEx <input type="checkbox"/> Drop Box <input type="checkbox"/> USPS <input type="checkbox"/> Courier Airbill/Tracking No: _____
Received by:					
Relinquished by:					
Received for Lab by:			<u>1/7/21</u>	<u>1530</u>	

**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  $\pm 5\%$  of the actual flow rate.

AMBIENT CONDITIONS: Temperature  $74 \pm 3^{\circ}$  F Relative Humidity  $50 \pm 10\%$

Description	MFR.	Model	Serial #
Primary Calibrator	A.P. Buck Inc.	M30B	<input type="checkbox"/> A40020 <input checked="" type="checkbox"/> A40021

QA Approval By: *Moreni Mank*

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





# 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			MODEL	982
TEMPERATURE	74.0 (23.3)	°F (°C)	SERIAL NUMBER	P17100007
RELATIVE HUMIDITY	34	%RH		
BAROMETRIC PRESSURE	29.20 (988.8)	inHg (hPa)		

AS LEFT                       IN TOLERANCE  
 AS FOUND                       OUT OF TOLERANCE

## - CALIBRATION VERIFICATION RESULTS -

GAS CO <sub>2</sub> 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	Measurement Variable	System ID	Last Cal.	Cal. Due
5000 CO <sub>2</sub>	14A044095	04-06-20	04-06-25	200 CO	149886	04-30-20	03-24-28
N <sub>2</sub>	T-0608	05-19-20	05-19-28	Air	T17939	04-09-20	04-09-28
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
Temperature	E010655	01-21-20	01-31-21	Humidity	E003539	02-26-20	08-31-20

*Chimera Use*  
VERIFIED

June 15, 2020

DATE

Doc ID CERT\_GEN\_WCC



# 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			<b>MODEL</b>	<b>982</b>
TEMPERATURE	70.41 (21.3)	°F (°C)	<b>SERIAL NUMBER</b>	<b>P17100007</b>
RELATIVE HUMIDITY	50.3	%RH		
BAROMETRIC PRESSURE	29.15 (987.1)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

## - CALIBRATION VERIFICATION RESULTS -

TEMPERATURE VERIFICATION				SYSTEM T-101				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	22.1 (9.0)	31.9 (-0.1)	31.1-33.1 (-0.5-0.6)	2	140.0 (60.0)	140.5 (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	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E010657	02-14-20	02-28-21	Temperature	E010658	02-14-20	02-28-21
Temperature	E010655	01-21-20	01-31-21	Humidity	E003539	02-26-20	08-31-20
5000 CO2	14A044095	04-06-20	04-06-25	200 CO	149886	04-30-20	03-24-28
N2	T-0608	05-19-20	05-19-28	Air	117939	04-09-20	04-09-28
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

ChaoVang

CALIBRATED

June 16, 2020

DATE

D:\CHD-CERT\_GEN\_WCC



# 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			MODEL	7575-X
TEMPERATURE	70.72 (21.5)	°F (°C)	SERIAL NUMBER	7575X1711006
RELATIVE HUMIDITY	39.0	%RH		
BAROMETRIC PRESSURE	29.15 (987.1)	inHg (hPa)		

<input checked="" type="checkbox"/> AS LEFT	<input checked="" type="checkbox"/> IN TOLERANCE
<input type="checkbox"/> AS FOUND	<input type="checkbox"/> OUT OF TOLERANCE

## - CALIBRATION VERIFICATION RESULTS -

THERMO COUPLE				SYSTEM PRESSURE01-02				Unit: °F (°C)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	70.9 (21.6)	70.8 (21.6)	68.9-72.9 (20.5-22.7)					

BAROMETRIC PRESSURE				SYSTEM PRESSURE01-02				Unit: inHg (hPa)
#	STANDARD	MEASURED	ALLOWABLE RANGE	#	STANDARD	MEASURED	ALLOWABLE RANGE	
1	29.22 (989.5)	29.23 (989.8)	28.64-29.80 (969.9-1009.1)					

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

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

*Chao Yang*

June 15, 2020

CALIBRATED

DATE

Doc ID: CERT\_GEN\_WCC





# CERTIFICATE OF CALIBRATION AND TESTING

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ENVIRONMENT CONDITIONS			MODEL	7575-X
TEMPERATURE	70.68 (21.5)	°F (°C)	SERIAL NUMBER	7575X1711006
RELATIVE HUMIDITY	38.0	%RH		
BAROMETRIC PRESSURE	29.16 (987.5)	inHg (hPa)		

- |  |  |
|--|--|
| <input type="checkbox"/> AS LEFT             | <input checked="" type="checkbox"/> IN TOLERANCE |
| <input checked="" type="checkbox"/> AS FOUND | <input type="checkbox"/> 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.

<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>	<u>Measurement Variable</u>	<u>System ID</u>	<u>Last Cal.</u>	<u>Cal. Due</u>
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

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