



# EA GROUP

Environmental Analysis  
and Management

March 19, 2019

Ms. Deborah Wright  
**Shaker Heights City School District**  
15600 Parkland Drive  
Shaker Heights, Ohio 44120

RE: **Indoor Air Quality Assessment**  
Lower Level Classrooms, Onaway Elementary School  
OH42561

## **Description of Work**

EA Group, Mentor, Ohio was contracted by Shaker Heights City School District to perform an indoor air quality (IAQ) assessment in the lower level at Onaway Elementary School, which included short-term monitoring for general air quality parameters (temperature, relative humidity, carbon dioxide, carbon monoxide) and airborne particulates; and air sampling for fungal (mold) structures. The assessment was performed on March 6, 2019 by EA Group representative Christopher Hatfield.

## **General Observations**

Each classroom has a unit ventilator (univent) for heating (hot water) and air circulation/ventilation. Inspection of the units revealed return air intakes, at the base of each unit, to be clean. Ducted fresh air intakes were also clean and clear. Each room is also equipped with a wall-mounted air conditioning unit, with condensate lines routed to drains or sump pumps. Each room also has a powered exhaust vent, ducted to outdoors. Inspection of the rooms revealed no obvious evidence of water intrusion, water-damaged building materials, or suspect fungal growth. It is noted that tables and desks in each room had been wiped down and floors had been swept/vacuumed very shortly before monitoring was and air sampling was performed.

## **General Air Quality Parameters**

Temperature, relative humidity, carbon dioxide, and carbon monoxide were measured using a TSI<sup>®</sup> IAQ-CALC<sup>™</sup> monitor, which continuously and simultaneously measures and records these parameters. Short-term monitoring was performed in each of four designated classrooms and the corridor, in the first floor corridor, as an indoor control/comparison area, and outdoors. Monitoring results for these parameters are summarized in Table 1, attached.

## Temperature and Relative Humidity

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 55-2013, Thermal Environmental Conditions for Human Occupancy, suggests that for thermal comfort purposes, temperatures could range from approximately 67° F to 82° F, depending on relative humidity, season, clothing work, and activity level. Relative humidities above 65% can



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promote biological growth, and low relative humidities (below 20%) can result in eye, nose and throat irritations and drying of sinus cavities.

As shown in Table 1, average temperatures in the lower level areas were within the recommended range (below the recommended minimum in the first floor corridor). Average relative humidities were all below the recommended minimum, which is typical during the heating season with no supplemental humidification.

Carbon Dioxide and Carbon Monoxide

Carbon dioxide (CO<sub>2</sub>) is a normal constituent of the atmosphere, and is not considered an indoor air contaminant. Exhaled breath from the building occupants is an important CO<sub>2</sub> source. Indoor CO<sub>2</sub> concentrations can, under some test conditions, provide an indication of the adequacy of fresh air ventilation. ASHRAE Standard 62.1-2010 indicates that indoor CO<sub>2</sub> concentrations above 1000 parts per million (ppm) or 700 ppm above outside levels be considered potential fresh air exchange issues.

Carbon monoxide (CO) can come from a variety of sources, including combustion engines, petroleum or natural gas fired boiler/furnaces, and industrial activities. Levels of CO in the air in the survey areas were compared to the National Ambient Air Quality Standards (NAAQS), which mandate maximum contaminant levels for ambient outdoor air quality. Although it is not directly applicable to indoor air environments, this standard can be used for comparison purposes.

As shown in Table 1, average CO<sub>2</sub> concentrations in the monitored areas were below the ASHRAE-recommended maximum levels, and no CO was detected. Because monitoring was performed after normal school hours, higher CO<sub>2</sub> levels should be expected during periods of full occupancy due to respiration effects.

**Airborne Particulate Monitoring**

Airborne particulates were measured in the same indoor areas and outdoors using a TSI<sup>®</sup> AEROTRAK<sup>™</sup> Optical Particle Counter, which has a particle-size sensitivity of 0.3 to 5 microns (µm). Results are expressed in particles per cubic meter (pt/m<sup>3</sup>) of air, and are summarized in Table 2, attached.

Sources of airborne particulates indoors can include organic matter (e.g., pollen, mold spores), dust, and vehicle emissions from outdoors, fabric fibers (e.g., carpeting, clothing), paper fibers (e.g., copiers, printers, paper handling), and food preparation from indoors. There are no specific guidelines for airborne particulates for typical indoor occupancy and uses, rather comparisons to concentrations



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outside suspect areas or before and after filters in air handling units can be made to assess the efficiency of air filtration, or can be compared to ISO Clean Room Standards [used in semiconductor manufacturing, biotechnology, and other fields very sensitive to extraneous contamination] for general reference.

As shown in Table 2, total average airborne particulate concentrations in the indoor areas were much lower than outdoors, and comparable among the indoor areas. Although the levels of larger particulates in most of the indoor areas were amplified relative to outdoors, the levels were not unusually high for a school environment. Furthermore, levels in the four classrooms were lower than in either of the corridors. As an additional point of reference, airborne particulate concentrations were well within the ISO Class 9 standard.

**Air Sampling for Fungal (Mold) Structures**

Bioaerosol sampling was conducted in the same areas to assess total concentrations of airborne fungal (mold) structures (viable and non-viable spores, fragments, etc.). Samples were secured on 37-mm Air-O-Cell cassettes, which have a slit opening to control air flow and a sticky surface that captures both viable and non-viable fungal (mold) spores and non-viable fungal particles, as well as other airborne particulates. The cassettes are analyzed by microscopic methods, with results expressed as total fungal structures per cubic meter (FS/m<sup>3</sup>) of air. Results are summarized in Table 3, attached, and are detailed in the laboratory report in Appendix A.

As shown in Table 3, total fungal structure concentrations in the samples from the lower level were comparable to or lower than outdoors and the indoor control area, with no amplification of types commonly associated with water-damaged building materials (e.g., *Penicillium/Aspergillus*-type spores).

**Summary of Significant Findings and Recommendations**

No adverse indoor air quality conditions were identified through the monitoring and sampling performed.

Average temperatures in the lower level areas were within the recommended range (below the recommended minimum in the first floor corridor). Average relative humidities in all of the areas monitored were below the recommended minimum, which is typical during the heating season with no supplemental humidification. Average CO<sub>2</sub> concentrations were well below ASHRAE-recommended maximum levels, and no CO was detected.



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Total average airborne particulate concentrations in the indoor areas were much lower than outdoors, and comparable among the indoor areas. Although the levels of larger particulates in most of the indoor areas were amplified relative to outdoors, the levels were not unusually high for a school environment. Furthermore, levels in the four classrooms were lower than in either of the corridors. As an additional point of reference, airborne particulate concentrations were well within the ISO Class 9 standard.

The total fungal spore concentrations in the samples from the lower level were comparable to or lower than outdoors and the indoor control area, with no amplification of types commonly associated with water-damaged building materials.

**LIMITATIONS TO THIS REPORT**

1. EA Group's report reflects only the conditions that existed at the time of the assessment, and airborne contaminant levels may vary over time.
2. Any reports or remediation plans produced for the project site are limited to the portion(s) of the building identified in EA Group's Scope of Work Agreement.
3. Any exposure data recorded during the assessment may not be sufficiently broad to assess the suitability of the indoor air quality for all individuals, particularly those who are extremely sensitive to certain chemical or biological substances or who have immune system deficiencies.
4. EA Group makes use of guidelines and recommendations developed by the American Industrial Hygiene Association (AIHA) and the American Conference of Governmental and Industrial Hygienists (ACGIH) for the assessment of indoor fungi. At this time there are no governmental regulations or standards that apply to fungal exposures.
5. Any data, information, interpretations, or recommendations contained in EA Group's reports are presented solely as a basis and guide to the existing conditions as evaluated at the project site and limited to the portion(s) of the building identified in EA Group's Scope of Work Agreement. As with all indoor air quality evaluations, any opinions expressed herein are subject to revision in light of new information that may be developed in the future, and no warranties are expressed or implied.

This report has not been prepared for use by any party other than our Client. It may not contain sufficient information for the purposes of other parties or other uses. If any significant changes are made to site conditions, resident activities, equipment, etc. described in this report, any conclusions or



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recommendations contained herein may be invalid, unless the changes are reviewed by EA Group and the conclusions or recommendations are modified or approved in writing.

If there are any questions or concerns regarding the information provided, please contact the undersigned. Thank you for consulting EA Group.

Sincerely,

**EA Group**

Patrick G. Herbert,  
President

**Table 1. Summary of General Air Quality Monitoring Results**  
**Shaker Heights City School District**  
**Onaway Elementary School - Lower Level**

**March 6, 2019 Monitoring**

Location	Avg Temp.	Avg R.H.	Avg CO <sub>2</sub>	Avg CO
Room 11	68.8	16.5 ↓	678	0
Room 10	73.2	11.4 ↓	546	0
Room 12	75.2	12.6 ↓	629	0
Room 9	72.5	9.6 ↓	480	0
Lower Level Corridor	72.3	11.9 ↓	545	0
Floor 1 Corridor [control]	66.1 ↓	14.8 ↓	596	0
Outdoors	25.5	36.7	484	0

Average Temperature in °F

Average Relative Humidity (R.H.) in %

All others in parts per million (ppm)

↑ = average of parameter above ASHRAE-recommended maximum<sup>1</sup>

↓ = average of parameter below ASHRAE-recommended minimum<sup>1</sup>

† = average CO<sub>2</sub> concentration exceeds ASHRAE recommended maximum  
 (1000 ppm or outdoors +700 ppm)

‡ = average CO concentration exceeds comparative NAAQS standard (9 ppm)

<sup>1</sup> ASHRAE Standard 55-2013, Thermal Environmental Conditions for Human Occupancy

**Table 2. Summary of Airborne Particulate Monitoring Results**  
**Shaker Heights City School District**  
**Onaway Elementary School - Lower Level**

**March 6, 2019 Monitoring**

**Average Cumulative Particle-Size Counts**

<b>Location</b>	<b>≥ 5.0µm</b>	<b>≥ 3.0µm</b>	<b>≥ 1.0µm</b>	<b>≥ 0.7µm</b>	<b>≥ 0.5µm</b>	<b>≥ 0.3µm</b>
Room 11	<i>45,371</i>	<i>108,127</i>	435,618	611,802	2,007,915	13,369,395
Room 10	17,244	41,555	233,781	366,997	1,515,124	11,512,509
Room 12	<i>48,481</i>	<i>115,407</i>	<i>495,478</i>	<i>698,305</i>	2,165,513	13,728,903
Room 9	<i>54,417</i>	<i>142,332</i>	<i>587,915</i>	<i>794,841</i>	2,117,032	11,556,114
Lower Level Corridor	<i>108,905</i>	<i>246,008</i>	<i>744,595</i>	<i>939,224</i>	2,266,362	12,375,552
Floor 1 Corridor [control]	<i>242,686</i>	<i>496,962</i>	<i>1,265,867</i>	<i>1,516,397</i>	<i>2,848,341</i>	13,670,251
Outdoors	21,696	61,979	444,594	679,930	2,596,043	28,740,493

**Average Particle-Size Counts**

<b>Location</b>	<b>≥ 5µm</b>	<b>3 - 5 µm</b>	<b>1 - 3 µm</b>	<b>0.7 - 1 µm</b>	<b>0.5-0.7 µm</b>	<b>0.3-0.5 µm</b>
Room 11	<i>45,371</i>	<i>62,756</i>	327,491	176,184	1,396,113	11,361,480
Room 10	17,244	24,311	192,226	133,216	1,148,127	9,997,385
Room 12	<i>48,481</i>	<i>66,926</i>	<i>380,071</i>	<i>202,827</i>	1,467,208	11,563,390
Room 9	<i>54,417</i>	<i>87,915</i>	<i>445,583</i>	206,926	1,322,191	9,439,082
Lower Level Corridor	<i>108,905</i>	<i>137,103</i>	<i>498,587</i>	194,629	1,327,138	10,109,190
Floor 1 Corridor [control]	<i>242,686</i>	<i>254,276</i>	<i>768,905</i>	<i>250,530</i>	1,331,944	10,821,910
Outdoors	21,696	40,283	382,615	235,336	1,916,113	26,144,450

Particle sizes in microns [micrometers, µm]  
 Results in particles per cubic meter of air (pt/m<sup>3</sup>)  
 Results in *italics* indicate concentration higher than outdoors

**Table 3. Summary of Air Sample Results for Fungal Structures**  
**Shaker Heights City School District**  
**Onaway Elementary School - Lower Level**

**March 6, 2019 Sampling**

Location	Outdoors	Room 11	Room 10	Room 12	Room 9	Lower Level Corridor	Floor 1 Corridor [control]
<b>Fungal Spore / Sample I.D.</b>	<b>42561-07</b>	<b>42561-01</b>	<b>42561-02</b>	<b>42561-03</b>	<b>42561-04</b>	<b>42561-05</b>	<b>42561-06</b>
Basidiospores	130	160	40	110	80	93	150
<i>Penicillium/Aspergillus</i> types	27	40	27	27	53	27	80
Ascospores				27	13	13	40
<i>Cladosporium</i>					13		
<b>Total Fungal Spores</b>	<b>160</b>	<b>200</b>	<b>67</b>	<b>160</b>	<b>160</b>	<b>130</b>	<b>270</b>
Hyphal Fragments				13		13	
Pollen							
Debris Rating	2+	2+	1+	2+	2+	2+	2+

Results expressed as fungal structures per cubic meter of air (FS/m<sup>3</sup>)

Debris Rating:

Background debris is indication of amount of non-biological particulate matter (dust) present on slide; graded from 1+ to 4+, with 4+ indicating largest amount. Counts with 4+ may be higher than reported.



**EA GROUP**

Environmental Analysis  
and Management

**APPENDIX A**

Laboratory Analytical Report(s)



Report for:

**Mr. Tim Bowen**  
**EA Group**  
7118 Industrial Park Blvd.  
Mentor, OH 44060

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Regarding: Project: OH42561; IAQ Assessment  
EML ID: 2112513

Approved by:

Operations Manager  
Joshua Cox

Dates of Analysis:  
Spore trap analysis: 03-12-2019

Service SOPs: Spore trap analysis (EM-MY-S-1038)  
AIHA-LAP, LLC accredited service, Lab ID #102297

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All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. Due to the nature of the analyses performed, field blank correction of results is not applied. The results relate only to the samples as received. Sample air volume is supplied by the client.

EMLab P&K ("the Company") shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

EMLab P&K's LabServe® reporting system includes automated fail-safes to ensure that all AIHA-LAP, LLC quality requirements are met and notifications are added to reports when any quality steps remain pending.

Client: EA Group  
 C/O: Mr. Tim Bowen  
 Re: OH42561; IAQ Assessment

Date of Sampling: 03-06-2019  
 Date of Receipt: 03-08-2019  
 Date of Report: 03-12-2019

**SPORE TRAP REPORT: NON-VIABLE METHODOLOGY**

Location:	42561-01: Lower Level Room 11				42561-02: Lower Level Room 10				42561-03: Lower Level Room 12				42561-04: Lower Level Room 9			
Comments (see below)	None				None				None				None			
Lab ID-Version‡:	9995462-1				9995463-1				9995464-1				9995465-1			
Analysis Date:	03/12/2019				03/12/2019				03/12/2019				03/12/2019			
Sample volume (liters)	75				75				75				75			
Background debris (1-4+)††	2+				1+				2+				2+			
	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%
Hyphal fragments									1	13	13	n/a				
Pollen																
<b>§ TOTAL FUNGAL SPORES</b>	15	200	n/a	100	5	67	n/a	100	12	160	n/a	100	12	160	n/a	100
Ascospores									2	27	13	17	1	13	13	8
Basidiospores	12	160	13	80	3	40	13	60	8	110	13	67	6	80	13	50
Chaetomium																
Cladosporium													1	13	13	8
Penicillium/Aspergillus types	3	40	13	20	2	27	13	40	2	27	13	17	4	53	13	33
Pithomyces																
Rusts																
Smuts, Periconia, Myxomycetes																
Stachybotrys																
Stemphylium																
Torula																
Ulocladium																
Zygomycetes																

**Comments:**

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.

The analytical sensitivity/limit of detection is the Count/m<sup>3</sup> divided by the raw count, expressed in Count/m<sup>3</sup>.

\*The detection limit/limit of detection (DL) per cubic meter (m<sup>3</sup>) has been rounded to two significant figures to reflect analytical precision.

††Background debris indicates the amount of non-biological particulate matter present on the trace (dust in the air) and the resulting visibility for the analyst. It is rated from 1+ (low) to 4+ (high). Counts from areas with 4+ background debris should be regarded as minimal counts and may be higher than reported. It is important to account for samples volumes when evaluating dust levels.

‡ A "Version" indicated by "-x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

§ Total Fungal Spores has been rounded to two significant figures to reflect analytical precision.

Client: EA Group  
 C/O: Mr. Tim Bowen  
 Re: OH42561; IAQ Assessment

Date of Sampling: 03-06-2019  
 Date of Receipt: 03-08-2019  
 Date of Report: 03-12-2019

**SPORE TRAP REPORT: NON-VIABLE METHODOLOGY**

Location:	42561-05: Lower Level Hallway				42561-06: 1st Floor, Hallway				42561-07: Outside			
Comments (see below)	None				None				None			
Lab ID-Version‡:	9995466-1				9995467-1				9995468-1			
Analysis Date:	03/12/2019				03/12/2019				03/12/2019			
Sample volume (liters)	75				75				75			
Background debris (1-4+)††	2+				2+				2+			
	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%
Hyphal fragments	1	13	13	n/a								
Pollen												
<b>§ TOTAL FUNGAL SPORES</b>	10	130	n/a	100	20	270	n/a	100	12	160	n/a	100
Ascospores	1	13	13	10	3	40	13	15				
Basidiospores	7	93	13	70	11	150	13	55	10	130	13	83
Chaetomium												
Cladosporium												
Penicillium/Aspergillus types	2	27	13	20	6	80	13	30	2	27	13	17
Pithomyces												
Rusts												
Smuts, Periconia, Myxomycetes												
Stachybotrys												
Stemphylium												
Torula												
Ulocladium												
Zygomycetes												

**Comments:**

Spore types listed without a count or data entry were not detected during the course of the analysis for the respective sample, indicating a raw count of <1 spore.

The analytical sensitivity/limit of detection is the Count/m<sup>3</sup> divided by the raw count, expressed in Count/m<sup>3</sup>.

\*The detection limit/limit of detection (DL) per cubic meter (m<sup>3</sup>) has been rounded to two significant figures to reflect analytical precision.

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‡ A "Version" indicated by "-x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

§ Total Fungal Spores has been rounded to two significant figures to reflect analytical precision.

New Jersey: 3000 Lincoln Drive East, Suite A, Marlton, NJ 08053 \* (866) 874-1984  
 Phoenix, AZ: 1501 West Knudsen Drive, Phoenix, AZ 85027 \* (800) 651-4802  
 SF, CA: 6000 Shoreline Court, Suite 205, South San Francisco, CA 94080 \* (666) 898-6653

Weather	Fog	Rain	Snow	Wind	Clear
None	<input type="checkbox"/>				
Light	<input type="checkbox"/>				
Moderate	<input type="checkbox"/>				
Heavy	<input type="checkbox"/>				
Level	<input type="checkbox"/>				

**CONTACT INFORMATION**

Company: *EA Group*  
 Contact: *Tim Bova*  
 Phone: *440-957-3574*

Address: *718 Industrial Park Blvd, Warkent, OH*  
 Special Instructions:

**PROJECT INFORMATION**

Project ID: *DH42581*  
 Project Description: *Asp Assessment*  
 Project Zip Code: *44120*  
 PO Number:

Sampling Date & Time: *3-6-19*  
 Sampled By: *C. Hatfield*

Sample ID	Description	Sample Type (Below)	TAT (Above)	Total Volume / Area (as applicable)	Notes (Time of day, Temp, RH, etc.)
<i>02</i>	<i>Lower Level Room 11</i>	<i>ST</i>	<i>STD</i>	<i>75L</i>	
<i>03</i>	<i>↓</i>				
<i>04</i>	<i>↓</i>				
<i>05</i>	<i>↓</i>				
<i>06</i>	<i>1st Floor Hallway</i>				
<i>07</i>	<i>Outside</i>				

**TURN AROUND TIME CODES (TAT)**

Rushes received after 2 pm or on weekends, will be considered received the next business day. Please alert us in advance of weekend analysis needs.



002112513

REQUEST (Use one)	Non-Culturable	Cu.
Spore Trap	Spore Trap Analysis - Other particles	BioCassette™, Andersen, SAS, Swab, Water, Bulk, Dust, Soil, Contact Plates
Trap	Spore Trap Analysis - Other particles	
Swab	Direct Microscopic Exam (Qualitative)	
Bulk	Quantitative Spore Count (Disk Exam)	
	1-Media Surface Fungi (Genus ID + Asp, spp.)	
	2-Media Surface Fungi (Genus ID + Asp, spp.)	
	3-Media Surface Fungi (Genus ID + Asp, spp.)	
	Culturable Air Fungi (Genus ID + Asp, spp.)	
	Green Stain & Counts (Culturable Air & Surface Bacteria)	
	Legionella culture	
	Total Coliform, E. coli (Presence/Absence)	
	Membrane Filtration (specify organism):	
	MPN Bacteria (specify organism):	
	General Tray - Sorvage Screen	
	Asbestos Analysis - PCM Airborne Fiber Count (NIOSH 7409)	
	Asbestos Analysis - PLM (EPA method 600/R-93-116)	
	PCR (specify test):	

RECEIVED BY	DATE & TIME	RECEIVED BY	DATE & TIME
<i>[Signature]</i>	<i>3/6/19 1940</i>	<i>[Signature]</i>	<i>3/6 1940</i>
<i>[Signature]</i>	<i>3/7/19 1700</i>	<i>[Signature]</i>	<i>3/8/19</i>

By submitting this Chain of Custody, you agree to be bound by the terms and conditions set forth at: <http://www.emlab.com/chain-of-custody-terms.html>

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