



EA GROUP

Environmental Analysis
and Management

March 13, 2020

Mr. David Boyer
Shaker Heights City School District
15600 Parkland Drive
Cleveland, Ohio 44120

RE: **Follow-Up Air Quality Assessment**
Art Room, Boulevard Elementary School, 14900 Drexmore Road, Shaker Heights, Ohio
OH43374

Description of Work

EA Group, Mentor, Ohio was contracted by Shaker Heights City School District to perform a follow-up indoor air quality assessment of the Art Room at Boulevard Elementary School to assess current conditions following water damage remediation and materials removal. Assessment activities 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, which were performed on February 19, 2020 by EA Group representative Craig Brown.

General Observations

On the day of the assessment, a dehumidifier was noted to be operating in the Art Room.

General Air Quality Parameters

Temperature, relative humidity, carbon dioxide, and carbon monoxide were measured using a TSI[®] IAQ-CALC[™] monitor, which continuously and simultaneously measures and records these parameters. Short-term monitoring was performed in three areas of the Art Room (by desk, by cabinet, and by closet wall), in the Basement Staff Lounge, as a control location for comparison, 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 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 indoor temperatures were within the ASHRAE-recommended range. Average indoor relative humidities were below the ASHRAE-recommended minimum in all areas



March 13, 2020

Shaker Heights City School District

Follow-Up Air Quality Assessment

Art Room, Boulevard Elementary School, 14900 Drexmore Road, Shaker Heights, Ohio
OH43374

Page 2

monitored, which is typical for indoor environments during the heating season, and due to the fact that a dehumidifier has been used in the Art Room.

Carbon Dioxide and Carbon Monoxide

Carbon dioxide (CO₂) is a normal constituent of the atmosphere, and is not considered an indoor air contaminant. Exhaled breath from the building occupants is an important CO₂ source. Indoor CO₂ concentrations can, under some test conditions, provide an indication of the adequacy of fresh air ventilation. ASHRAE Standard 62.1-2010 indicates that indoor CO₂ 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 CO₂ concentrations in the monitored areas were below the ASHRAE-recommended maximum levels, comparable among the areas, and only slightly higher than outdoors. No CO was detected.

Monitoring for Airborne Particulates

Short-term monitoring for airborne particulates was performed in the same areas using a TSI® AEROTRAK™ Optical Particle Counter, which has a particle-size sensitivity of 0.3 to 5 microns (μ). Results are expressed in particles per cubic meter (pt/m³) of air, and are summarized in Table 2, attached.

Sources of airborne particulates indoors 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 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.



March 13, 2020

Shaker Heights City School District

Follow-Up Air Quality Assessment

Art Room, Boulevard Elementary School, 14900 Drexmore Road, Shaker Heights, Ohio
OH43374

Page 3

As shown in Table 2, total average particle concentrations in most of the indoor areas monitored were lower than outdoors, including across all particle size ranges, and comparable among the indoor areas. Concentrations of some particle size ranges were only slightly higher than outdoors for the Basement Staff Lounge, which would not be unusual given the room use. As an additional point of reference, airborne particulate concentrations in all indoor areas were within the ISO Class 9 standard, many being within ISO Class 8 standards.

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/m³) of air. Results are summarized in Table 3, attached, and detailed in the laboratory report in Appendix A.

As shown in Table 3, total fungal structure concentrations in the indoor samples were relatively low, with no obvious amplification of any individual type of spore. Results for the Art Room were orders of magnitude lower than during previous sampling events.

Summary of Findings

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

Average temperatures and average relative humidities were comparable among the areas monitored. Although average relative humidities in all of the areas monitored were below the ASHRAE-recommended minimum, this is typical for indoors during the heating season, particularly with dehumidification occurring. Average CO₂ concentrations were well below the ASHRAE-recommended maximum levels, and no CO was detected.

Total average particle concentrations in the majority of the indoor areas monitored were much lower than outdoors, including across all particle size ranges, and comparable among the indoor areas. As an additional point of reference, airborne particulate concentrations in all indoor areas were within the ISO Class 9 standard, frequently meeting ISO Class 8 standards.



March 13, 2020

Shaker Heights City School District

Follow-Up Air Quality Assessment

Art Room, Boulevard Elementary School, 14900 Drexmore Road, Shaker Heights, Ohio
OH43374

Page 4

Total fungal structure concentrations in the indoor samples were relatively low, with no obvious amplification of any individual type of spore. Concentrations within the Art Room were orders of magnitude lower than prior to remediation and removal activities.

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 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.



March 13, 2020

Shaker Heights City School District

Follow-Up Air Quality Assessment

Art Room, Boulevard Elementary School, 14900 Drexmore Road, Shaker Heights, Ohio
OH43374

Page 5

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

Sincerely,

EA Group

Timothy S. Bowen,
Vice President/Technical Director

**Table 1. Summary of General Air Quality Monitoring Results
Shaker Heights City School District
Follow-Up Air Quality Assessment, Art Room, Boulevard Elementary School, Shaker Heights, Ohio**

February 19, 2020 Monitoring

Location	Avg Temp.	Avg R.H.	Avg CO ₂	Avg CO
Art Room at Desk	74.5	15.5 ↓	517	0
Art Room at Cabinet	73.9	15.0 ↓	539	0
Art Room at Closet Wall	74.8	14.4 ↓	531	0
Basement Staff Lounge (control)	75.7	16.3 ↓	491	0
Outdoors	27.5	44.8	317	0

Average Temperature in °F

Average Relative Humidity (R.H.) in %

All others in parts per million (ppm)

↑ = average of parameter above ASHRAE-recommended maximum¹

↓ = average of parameter below ASHRAE-recommended minimum¹

† = average CO₂ concentration exceeds ASHRAE recommended maximum
(1000 ppm or outdoors +700 ppm)

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

¹ ASHRAE Standard 55-2013, Thermal Environmental Conditions for Human Occupancy

Table 2. Summary of Airborne Particulate Monitoring Results
Shaker Heights City School District
Follow-Up Air Quality Assessment, Art Room, Boulevard Elementary, Shaker Heights, Ohio

February 19, 2020 Monitoring

Average Cumulative Particle-Size Counts

Location	≥ 5.0µm	≥ 3.0µm	≥ 1.0µm	≥ 0.7µm	≥ 0.5µm	≥ 0.3µm
Art Room at Desk	27,279	74,700	346,078	496,608	1,594,134	11,604,024
Art Room at Cabinet	27,633	74,276	335,689	483,251	1,553,357	11,549,894
Art Room at Closet Wall	33,498	81,908	335,124	478,022	1,540,072	11,406,503
Basement Staff Lounge (control)	44,170	<i>125,018</i>	<i>586,431</i>	<i>822,120</i>	2,091,519	11,472,226
Outdoors	47,421	104,665	403,534	574,841	2,107,067	18,914,987

Average Particle-Size Counts

Location	≥ 5µm	3 - 5 µm	1 - 3 µm	0.7 - 1 µm	0.5-0.7 µm	0.3-0.5 µm
Art Room at Desk	27,279	47,421	271,378	150,530	1,097,526	10,009,890
Art Room at Cabinet	27,633	46,643	261,413	147,562	1,070,106	9,996,537
Art Room at Closet Wall	33,498	48,410	253,216	142,898	1,062,050	9,866,431
Basement Staff Lounge (control)	44,170	<i>80,848</i>	<i>461,413</i>	<i>235,689</i>	1,269,399	9,380,707
Outdoors	47,421	57,244	298,869	171,307	1,532,226	16,807,920

Particle sizes in microns [micrometers, µm]
 Results in particles per cubic meter of air (pt/m³)
 Results in *italics* indicate concentration higher than outdoors

Table 3. Summary of Air Sample Results for Fungal Structures
Shaker Heights City School District
Follow-Up Air Quality Assessment, Art Room, Boulevard Elementary, Shaker Heights, Ohio

February 19, 2020 Sampling

Location	Outdoors	Art Room (at Desk)	Art Room (at Cabinet)	Art Room (at Closet Wall)	Basement Staff Lounge (Control)
Fungal Spore / Sample I.D.	021920-05A	021920-01A	021920-02A	021920-03A	021920-04A
<i>Cladosporium</i>	13	13			
<i>Penicillium/Aspergillus</i> types	13	27			
Ascospores				27	
Basidiospores		27			
other Brown		13	13		
Total Fungal Spores	27	80	13	27	<13
Hyphal Fragments	13	13			
Pollen					
Debris Rating	2+	2+	2+	2+	2+

Results expressed as fungal structures per cubic meter of air (FS/m³)

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

Regarding: Project: OH43374; Shaker Hts. Blvd Elem.
EML ID: 2360438

Approved by:



Operations Manager
Joshua Cox

Dates of Analysis:

Spore trap analysis: 02-24-2020

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

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.

Eurofins 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.

Eurofins 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: OH43374; Shaker Hts. Blvd Elem.

Date of Sampling: 02-19-2020
 Date of Receipt: 02-21-2020
 Date of Report: 02-24-2020

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	OH43374-0219250-01A: Art Rm @ Desk				OH43374-0219250-02A: Art Rm @ Cabinet				OH43374-0219250-03A: Art Rm @ Closet Wall			
Comments (see below)	None				None				None			
Lab ID-Version‡:	11246456-1				11246457-1				11246458-1			
Analysis Date:	02/24/2020				02/24/2020				02/24/2020			
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												
§ TOTAL FUNGAL SPORES	6	80	n/a	100	1	13	n/a	100	2	27	n/a	100
Ascospores									2	27	13	100
Basidiospores	2	27	13	33								
Chaetomium												
Cladosporium	1	13	13	17								
Other brown	1	13	13	17	1	13	13	100				
Penicillium/Aspergillus types	2	27	13	33								
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/m³ divided by the raw count, expressed in Count/m³.

*The detection limit/limit of detection (DL) per cubic meter (m³) 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: OH43374; Shaker Hts. Blvd Elem.

Date of Sampling: 02-19-2020
 Date of Receipt: 02-21-2020
 Date of Report: 02-24-2020

SPORE TRAP REPORT: NON-VIABLE METHODOLOGY

Location:	OH43374-0219250-04A: Basement Staff Lounge				OH43374-0219250-05A: Outside			
Comments (see below)	A				None			
Lab ID-Version‡:	11246459-1				11246460-1			
Analysis Date:	02/24/2020				02/24/2020			
Sample volume (liters)	75				75			
Background debris (1-4+)††	2+				2+			
	raw ct.	Count/m3	DL/m3*	%	raw ct.	Count/m3	DL/m3*	%
Hyphal fragments					1	13	13	n/a
Pollen								
§ TOTAL FUNGAL SPORES		< 13	n/a	100	2	27	n/a	100
Ascospores								
Basidiospores								
Chaetomium								
Cladosporium					1	13	13	50
Other brown								
Penicillium/Aspergillus types					1	13	13	50
Rusts								
Smuts, Periconia, Myxomycetes								
Stachybotrys								
Stemphylium								
Torula								
Ulocladium								
Zygomycetes								

Comments: A) No spores detected.

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/m³ divided by the raw count, expressed in Count/m³.

*The detection limit/limit of detection (DL) per cubic meter (m³) 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: OH43374; Shaker Hts. Blvd Elem.

Date of Sampling: 02-19-2020
 Date of Receipt: 02-21-2020
 Date of Report: 02-24-2020

MoldRANGE™: Extended Outdoor Comparison
Outdoor Location: OH43374-0219250-05A, Outside

Fungi Identified	Outdoor data	Typical Outdoor Data for: February in Ohio† (n‡=1078)						Typical Outdoor Data for: The entire year in Ohio† (n‡=18653)					
		very low	low	med	high	very high	freq %	very low	low	med	high	very high	freq %
Generally able to grow indoors*													
Alternaria	-	7	7	13	20	27	10	13	13	44	120	210	52
Bipolaris/Drechslera group	-	-	-	-	-	-	1	7	7	13	27	50	10
Chaetomium	-	7	7	13	33	45	3	7	7	13	27	51	4
Cladosporium	13	24	27	67	210	370	62	53	130	750	2,800	5,100	88
Curvularia	-	-	-	-	-	-	1	7	10	13	53	89	15
Nigrospora	-	7	11	13	27	40	4	7	10	20	53	80	20
Other brown	-	7	7	13	27	40	15	7	10	13	40	53	19
Penicillium/Aspergillus types	13	27	40	80	210	370	60	33	53	140	400	750	59
Stachybotrys	-	-	-	-	-	-	2	7	10	13	40	100	1
Torula	-	-	-	-	-	-	1	7	10	18	44	73	10
Seldom found growing indoors**													
Ascospores	-	15	27	67	320	620	49	53	110	550	1,900	3,700	84
Basidiospores	-	27	44	120	640	1,900	78	80	240	1,800	7,900	15,000	94
Rusts	-	12	13	13	37	53	2	7	13	27	73	130	24
Smuts, Periconia, Myxomycetes	-	7	11	13	40	53	29	13	13	40	130	240	63
§ TOTAL SPORES/m3	27												

†The 'Typical Outdoor Data' represents the typical outdoor spore levels for the location and time frame indicated. The last column represents the frequency of occurrence. The very low, low, med, high, and very high values represent the 10, 20, 50, 80, and 90 percentile values of the spore type when it is detected. For example, if the frequency of occurrence is 63% and the low value is 53, it would mean that the given spore type is detected 63% of the time and, when detected, 20% of the time it is present in levels above the detection limit and below 53 spores/m3. These values are updated periodically, and if enough data is not available to make a statistically meaningful assessment, it is indicated with a dash.

§ Total Spores/m3 has been rounded to two significant figures to reflect analytical precision.

* The spores in this category are generally capable of growing on wet building materials in addition to growing outdoors. Building related growth is dependent upon the fungal type, moisture level, type of material, and other factors. *Cladosporium* is one of the predominant spore types worldwide and is frequently present in high numbers. *Penicillium/Aspergillus* species colonize both outdoor and indoor wet surfaces rapidly and are very easily dispersed. Other genera are usually present in lesser numbers.

** These fungi are generally not found growing on wet building materials. For example, the rusts and smuts are obligate plant pathogens. However, in each group there are notable exceptions. For example, agents of wood decay are members of the basidiomycetes and high counts of a single morphological type of basidiospore on an inside sample should be considered significant.

‡n = number of samples used to calculate data.

Interpretation of the data contained in this report is left to the client or the persons who conducted the field work. This report is provided for informational and comparative purposes only and should not be relied upon for any other purpose. "Typical outdoor data" are based on the results of the analysis of samples delivered to and analyzed by Eurofins EMLab P&K and assumptions regarding the origins of those samples. Sampling techniques, contaminants infecting samples, unrepresentative samples and other similar or dissimilar factors may affect these results. In addition, Eurofins EMLab P&K may not have received and tested a representative number of samples for every region or time period. Eurofins EMLab P&K 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.

