January 5, 2018

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ECS Project No. 47:2199-A

Reference: Indoor Air Quality Monthly Testing Services, Corcoran Gallery of Art, 500 17th Street NW, Washington, DC – November 2017

Dear Mr. Janniello:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide George Washington University (GWU) with the results of monthly Indoor Air Quality testing conducted in November 2017 at the above-referenced property.

Methodology

The testing parameters and acceptable limits were determined in collaboration with GWU. From the suitable methods available, ECS selected the following sample methods based on sampling feasibility, schedule, cost objectives, and prior history of performance in similar projects.

PROPOSED SAMPLE METHODS

Testing Parameter	Method	Analysis	Reporting Time	Sample Locations	Acceptable Limit
Carbon Monoxide	Direct Read Instrument	Electrochemical sensor	Immediate	Target Indoors, Outdoors	9 parts per million (ppm)
Carbon Dioxide	Direct Read Instrument	Non-Dispersive Infrared Detector	Immediate	Target Indoors, Outdoors	1,000 ppm
Formaldehyde	Assay 571 passive badge	NIOSH 2016, high performance liquid chromatography	24 Hours	Target Indoors, Blank	0.027 ppm

Testing Parameter	Method	Analysis	Reporting Time	Sample Locations	Acceptable Limit
Volatile Organic Compound Scan	Assay 521 passive badge	OSHA 7, Gas Chromatography	24 Hours	Target Indoors, Blank	Reference specific parameters tested*
Mold	Non-viable Spore Trap Sampler	Optical Microscopy	24 Hours	Target Indoors, Outdoors	Compare to Outdoors
Respirable Dust	Indoor Air Sampler	NIOSH 0600	24 Hours	Target Indoors	0.150 mg/m3 (EPA NAAQS PM 10)
Silica Dust	Indoor Air Sampler	NIOSH 7500	24 Hours	Target Indoors	0.025 mg/m3 (OSHA Action Level)

*CARB RELs = California Air Resources Board Recommended Exposure Limit, acute or 8-hour

ECS collected air samples for fungal spore count analysis. For air sample collection, a high volume sampling pump and air cassettes were utilized in sampling for airborne fungal spores, hyphal fragments, insect fragments, and pollen. Analytical background levels on the slide of skin fragments, fibers, and other debris are also reported. Samples were collected with an air flow of 15 liters/minute verified by a pre-calibrated rotameter for 5 minutes.

Samples collected were shipped to Scientific Analytical institute, Inc. (SAI) located in Greensboro, North Carolina for analysis. SAI is an AIHA (American Industrial Hygiene Association) EMLAP (Environmental Microbiology Laboratory Accreditation Program) accredited laboratory. The samples were analyzed for total spore concentrations in accordance to the laboratory's quantification methods. The analytical results and chain of custody are attached in the Appendix of the report.

Formaldehyde and Volatile Organic Compound (VOC) sampling was conducted using passive indoor air quality samplers. Formaldehyde samples were analyzed by High Performance Liquid Chromatography using NIOSH Method 2016 by Assay Technology in Boardman, Ohio, an independent AIHA Accredited Laboratory. The VOC samples were analyzed by Gas Chromatograph in general accordance with OSHA Method 7 by Assay Technology. The VOC scan includes a panel of 25 common solvents, including: Acetone, Benzene, 1-Butanol, Butyl Acetate, Chloroform, Cyclohexanone, Ethyl Acetate, Ethyl Alcohol, Ethylbenzene, Heptane, Hexane, Isopropyl Alcohol, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Methyl Methacrylate, Methylene Chloride, Naphthalene, Perchloroethylene, 4-Phenyl Cyclohexene, Styrene, Tetrahydrofuran, Toluene, 1,1,1-Trichloroethane, Trichloroethylene, and m-, o-, and p-Xylenes.

The Respirable Dust and Crystalline Silica samples were collected using indoor air sampling pumps fitted with pre-weighed poly-vinyl chloride filters. Respirable dust was determined by

gravimetric analysis by NIOSH Method 600 by SAI in Greensboro, North Carolina, an independent AIHA Accredited Laboratory. Crystalline silica concentrations was measured by X-Ray diffraction analysis using NIOSH Method 0600, Modified from NIOSH Method 7500 & OSHA ID-142.

Environmental conditions, including temperature and relative humidity (RH), were recorded using a Fluke brand meter. The purpose of these measurements was to evaluate if interior temperature and RH were sufficient to support mold growth and also to measure general indoor comfort parameters related to temperature/relative humidity. The relative humidity is the ratio of the amount of moisture contained in the air to the maximum amount of moisture the air can contain at a specific temperature. Additionally, a calibrated Air Quality Meter was used to collect measurements of carbon dioxide and carbon monoxide as general indicators of overall IAQ. Sample locations were identified by GWU representatives as areas of interest. Chemical and biological sampling was performed in occupied areas of the facility. Biological samples were also collected outdoors for comparison purposes. As required by the sample method(s), blank samples were also submitted with each set of chemical samples.

Results

Mold

Fungal spore-trap air samples were collected from the eight locations within the subject building identified by GWU representatives as areas of interest. It should be noted that the auditorium sample (Sample #8) was collected from the area of the auditorium behind the stage. Two representative exterior samples were collected for comparison. The appended table summarizes the results of sample analysis reported in spore counts per cubic meter of air.

The analytical results for most of the eight samples indicate that the total concentrations of airborne fungal spores detected were less than total spore concentrations reported on the exterior samples.

Sample #7, collected from the central portion of the second floor main atrium, was overloaded with debris, and Sample #1, collected from the sub-basement wood shop, had similar total concentrations of airborne spores to the representative exterior sample collected after the indoor survey. With the exception of *Chaetomium* spores detected in the Room B109 Etching Studio (Sample #2) and *Aspergillus/Penicillium*-like spores detected in the sub-basement wood shop (Sample #1) and the central portion of the first floor main atrium (Sample #6), the fungal genera identified were generally comparable with outdoor genera detected. *Chaetomium* spores were detected in the Room B109 Etching Studio at a concentration of 78 spores per cubic meter (s/m^3). *Aspergillus/Penicillium*-like spores were detected in the sub-basement wood shop (Sample #1) and the central portion of the first floor main atrium (Sample #6) at concentrations of 392 s/m^3 and 862 s/m^3, respectively.

The detected spore concentrations in Sample #2 were relatively low and probably indicate a normal variation between indoor and outdoor spore counts. The detected spore concentrations in Samples #1 and #6 were elevated and could potentially indicate a hidden moisture source or possibly a transient elevation related to an isolated event (such as a water spill or minor hose leak) which could have triggered this elevation. The results for Sample #7 may be indicative of elevated dust levels produced by construction activities.

There are currently no accepted regulatory standards or guidelines with respect to acceptable fungal levels inside buildings. It is important to note however that spore trap measurements can fluctuate rapidly and the readings reported should not be used as a definitive indication that mold and or health hazards related to mold are present or absent.

Carbon Monoxide and Carbon Dioxide

Carbon monoxide and carbon dioxide were measured onsite utilizing a calibrated Air Quality meter. No readings exceeded the US EPA NAAQS or limits recommended in the Occupational Safety and Health Administration (OSHA) Technical manual for carbon dioxide. The appended table summarizes the results

Formaldehyde

Seven of the eight measured formaldehyde levels were below the laboratory detection limit. Formaldehyde was detected in the Room B130 Screen Printing Studio at a concentration of 22 parts per billion (ppb); however, the measured concentration is below the 27 ppb reference criteria (reference US Green Building Council – LEED Standard).

Volatile Organic Compounds

Twenty (20) of the twenty five (25) volatile organic compounds (VOCs) analyzed for were not detected in any of the VOC samples collected. The remaining five VOCs are discussed below.

Isopropyl alcohol (isopropanol) was detected in five locations at the concentrations below:

- Sub-basement wood shop (Sample #1) at 39.3 micrograms per cubic meter (μ/m^3) (16 ppb);
- Room B109 basement etching studio (Sample #2) at 589.9 μ/m^3 (240 ppb);
- Room B112 student work spaces (Sample #3) at 49.2 μ/m^3 (20 ppb);
- First floor main atrium (Sample #6) at 49.2 μ/m^3 (20 ppb);
- Second floor main atrium (Sample #7) at 90.9 μ/m^3 (37 ppb);

None of the detected isopropyl alcohol levels exceeded the California OEHHA Acute REL for Isopropyl Alcohol of 3,200 μ/m^3. Further, the detected levels of isopropyl alcohol may be attributable to the use of paints and inks associated with the artwork produced in the basement and sub-basement.

Ethyl alcohol (ethanol) was detected in one location, Room B130 Screen Printing Studio (sample #4), at 301.5 µ/m^3 (160 ppb). The National Institute of Occupational Safety and Health (NIOSH) lists a Recommended Exposure limit for ethanol of 1,000 ppm. Based on the level reported, the detected level of ethyl alcohol (commonly referred to as ethanol or grain alcohol) is not presumed to be a health risk. Further, the detected level of ethyl alcohol may be attributable to the use of paints and inks associated with the artwork produced in the screen printing studio.

Acetone was detected in one location, the second floor main atrium (sample #7), at 100 ppb (237.6 µ/m^3). However, the level did not exceed the CDC Agency for Toxic Substances & Disease Registry Minimal Risk Level (MRL) of 13,000 parts per million (ppm).

Methyl Ethyl Ketone was detected in one location, the second floor main atrium (sample #7), at 147.5 µ/m^3 (50 ppb). However, the level did not exceed the EPA Regional Screening Level for Resident Air of 5,200 µ/m^3.

Tetrahydrofuran was detected in one location, the second floor main atrium (sample #7), at 103.2 µ/m^3 (35 ppb). However, the level did not exceed the EPA Regional Screening Level for Resident Air of 2,100 µ/m^3.

ECS also notes that it is common to have some level of VOCs in building air produced or related to normal activities within the building including VOCs produced by printers, copiers, off gassing of building finishes, cleaning agents etc. Additionally, detectable levels of methyl ethyl ketone, tetrahydrofuran, and acetone were only found in the sample collected from the second floor main atrium, an area considered to be a construction zone and restricted to the public. ECS believes it likely that the chemicals detected were generated by construction activities. Based on the levels reported and the fact that the area is isolated from faculty and students, the levels detected in this study were not deemed a concern.

Respirable Dust and Respirable Silica

All eight measured respirable dust levels were below the laboratory detection limit and the 0.15 mg/m^3 ambient exposure limit (reference EPA NAAQS). Additionally, all eight respirable silica samples collected were below the laboratory detection and the 25 µg/m^3 Action Level under OSHA.

Conclusions

Based on the results of the indoor air quality sampling conducted in November 2017, no indoor air quality concerns were identified. However as good practice, ECS recommends that construction work areas are physically isolated (using wood and/or plastic sheeting) from occupied areas. Construction areas should also be maintained at negative pressure in relation to occupied spaces to control emissions of dust or chemicals produced as a result of

construction activities. In general, ECS recommends negative pressure differential of 0.02 inches of water between construction areas and occupied spaces. Use of HEPA filtration in the construction areas is also encouraged reduce nuisance dust levels and to reduce the potential of fugitive emissions impacting occupied areas.

Respectfully,

ECS MID-ATLANTIC, LLC

Brian Wasserstein
Environmental Project Manager

Christopher Chapman
Director of Industrial Hygiene

Attachments: Results Tables
Laboratory Results
Limitations

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