January 23, 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 – December 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 December 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

It should be noted that the B109 classroom and the B130b classroom were locked during the testing; therefore, the basement classroom sample (Sample #2) was collected from the B100E classroom and the screen printing studio sample (Sample #4) was collected from the B131a classroom. Additionally, the auditorium sample (Sample #8) was collected from the area of the auditorium behind the stage.

Mold

Fungal spore-trap air samples were collected from the eight locations within the subject building identified by GWU representatives as areas of interest. 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 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 #6, collected from the central portion of the first floor main atrium, and the Sample #7, collected from the central portion of the second floor main atrium were overloaded with debris. With the exception of *Aspergillus*/*Penicillium*-like spores detected in the Room B112 Student Work Spaces (Sample #3), the fungal genera identified were generally comparable with outdoor genera detected. *Aspergillus*/*Penicillium*-like spores were detected in Room B112 Student Work Spaces (Sample #3) at a concentration of 313 s/m^3.

The detected spore concentrations in Sample #3 were relatively low and probably indicate a normal variation between indoor and outdoor spore counts; however, the elevated *Aspergillus*/*Penicillium*-like spore levels may be indicative of 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 #6 and 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

All eight measured formaldehyde levels were below the laboratory detection limit and below the 27 ppb reference criteria (reference US Green Building Council – LEED Standard).

Volatile Organic Compounds

Twenty-one (21) of the twenty five (25) volatile organic compounds (VOCs) analyzed for were not detected in any of the VOC profile samples collected. The remaining four VOCs identified during this sampling event are discussed below.

Ethyl acetate was detected in two location at the concentrations listed below:

- Second floor main atrium (Sample #7) at 245.1 μ/m^3 (68 ppb);
- Auditorium (Sample #8) at 100.9 μ/m^3 (28 ppb).

Both detectable concentrations discussed above exceeded the Environmental Protection Agency (EPA) Regional Screening Level (RSL) for Resident Air for ethyl acetate of 73 μ/m^3. NIOSH lists a Recommended Exposure limit for ethyl acetate of 400 ppm. The second floor main atrium and auditorium were not open to the public during the December sampling event due to ongoing construction, and the detected level of ethyl acetate may be attributable to the use of sealants and cleaners as part of construction activities.

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

- First floor main atrium (Sample #6) at 199.1 μ/m^3 (81 ppb);
- Second floor main atrium (Sample #7) at 1,966.5 μ/m^3 (800 ppb).

None of the detected isopropyl alcohol levels exceeded the California OEHHA Acute REL for Isopropyl Alcohol of 3,200 µ/m3. Further, the detected levels of isopropyl alcohol may be attributable to the use of paints associated with the renovations occurring in the main atrium.

Acetone was detected in three locations at the concentrations below:

- First floor main atrium (sample #6), at 51 ppb (121.1 µ/m^3);
- Second floor main atrium (sample #7), at 36 ppb (85.5 µ/m^3);
- Auditorium (sample #8), at 110 ppb (261.3 µ/m^3).

None of the detected acetone levels exceeded the CDC Agency for Toxic Substances & Disease Registry (ATSDR) Minimal Risk Level (MRL) of 13,000 parts per million (ppm).

Hexane was detected in three locations at the concentrations below:

- First floor main atrium (sample #6), at 16 ppb (56.4 µ/m^3);
- Second floor main atrium (sample #7), at 130 ppb (458.2 µ/m^3);
- Auditorium (sample #8), at 55 ppb (193.9 µ/m^3).

None of the detected hexane levels exceeded the CDC ATSDR MRL for hexane of 600 ppb.

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, the detectable levels of ethyl acetate were only found in the sample collected from the second floor main atrium and auditorium back stage area, areas restricted to the public due to ongoing renovations. 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

Seven of the eight measured respirable dust levels were below the laboratory detection limit and the 0.15 mg/m^3 ambient exposure limit (reference EPA NAAQS). Respirable dust was measured at 0.13 mg/m^3 in the sample collected from the auditorium space (sample #8), which is below the ambient exposure limit (0.15 mg/m^3). 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 December 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 water gage between construction areas and occupied spaces. Further, ECS recommends the review and compliance of guidelines outlined in safety data sheets for chemicals used during construction. Use of HEPA filtration in the construction areas is also encouraged to reduce nuisance dust levels and also 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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