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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 – September 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 September 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 7500.

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 of the eight samples indicate that the total concentrations of airborne fungal spores detected were less than spore concentrations reported on the exterior samples. With the exception of *Chaetomium* and *Stachybotrys* spores detected in the auditorium, the fungal genera identified were generally comparable with outdoor genera detected. *Chaetomium* and *Stachybotrys* spores were detected at a concentration of 470 spores per cubic meter (s/m^3) and 157 s/m^3 respectively in the sample collected from the auditorium (Sample #8), and no *Chaetomium* or *Stachybotrys* spores were detected in the exterior samples. The detected concentrations were relatively low and may indicate a normal variation between indoor and outdoor spore counts or a hidden or concealed long term moisture leak. Testing in this location conducted in October 2017 did not see a similar elevation in the spore data.

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

No formaldehyde levels above the laboratory detection limit or the 27 parts per billion (ppb) reference criteria (reference US Green Building Council – LEED Standard) were found.

Volatile Organic Compounds

Twenty-three (23) of the twenty five (25) volatile organic compounds (VOCs) analyzed for were not detected in any of the VOC samples collected. The remaining two VOCs are discussed below.

Hexane was detected in three locations; however, none of the levels exceeded the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Level for hexane [(600 parts per billion (ppb)]. The detections were identified in the following locations:

- Sample Location 3 – B112 Student Work Spaces (14 ppb, 49.35 μ/m^3)
- Sample Location 6 – First Floor Main Atrium, South Side (13 ppb, 45.82 μ/m^3)
- Sample Location 7 – Central Portion of 2nd Floor Main Atrium (23 ppb, 81.07 μ/m^3)

Xylenes was detected in one location, Sample Location 5 at 12 ppb (52.10 μ/m^3); however, the detected concentration did not exceed the ATSDR Minimal Risk Level for Xylenes of 2,000 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. The levels detected in this study were not deemed a concern.

Respirable Dust and Respirable Silica

Seven of the eight respirable dust levels were below the laboratory detection limit or the 0.15 mg/m^3 ambient exposure limit (reference EPA NAAQS). One sample, collected from Faculty Suite 133 (Sample #5), was found to have a respirable dust level of 0.45 μ/m^3 which is above the EPA NAAQS ambient exposure limit. Subsequent testing in this location conducted in October 2017 did not see a similar elevation in respirable dust levels.

Four of the eight respirable silica samples collected were below the laboratory detection. However, four samples were found to contain detectable levels of respirable silica at levels ranging from 6.7 μ/m^3 (Sample Location 6 – First Floor Main Atrium, South Side) to 13.0 μ/m^3 (Sample Location 7 – Second Floor Main Atrium, Central Portion); All eight samples analyzed were below the 25 $\mu g/m^3$ Action Level under OSHA.

Conclusions

Based on the results of the indoor air quality sampling conducted in September 2017, no indoor air quality concerns were identified for the parameters tested for with the exception of respirable dust and silica.

Based on these findings for respirable dust and silica, it appears that construction dust is being generated and impacting air quality in the occupied areas of the building. As good practice, it is recommended that the contractor implement additional control measures to reduce construction dust or contain it to work areas. Also of concern is the fact that silica concentrations were detected in some of our ambient air samples. OSHA regulations for silica are now in effect under 29 CFR 1926.1153. Contractors performing construction activities which may produce silica dust/exposure are required to implement specific control measures and perform exposure monitoring to verify that exposure levels are below OSHA prescribed action levels. ECS recommends follow-up with the general contractor regarding compliance with the new OSHA regulations on silica.

Respectfully,

ECS MID-ATLANTIC, LLC

Brian Wasserstein
Environmental Project Manager

Christopher Chapman
Director of Industrial Hygiene

Attachments: Results Tables
Laboratory Results
Limitations