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November 15, 2023

Dare County Schools
Ian Adams
3020 S. Wrightsville Avenue
Nags Head, NC

Re: Limited Indoor Air Quality Sampling with Airborne Fungal Sampling at Manteo Middle School
LRC Project – 23-2215

At your request, on November 9, 2023, LRC Indoor Testing & Research, Inc. (LRC) performed a limited environmental fungal Indoor Air Quality (IAQ) sampling that included airborne fungal sampling at the property listed above.

LRC performs all water-damage and fungal investigations with sampling and recommendations in accordance with guidelines published in *Bioaerosols: Assessment and Control*, by the American Conference of Governmental Industrial Hygienists (ACGIH), in *Mold Remediation in Schools and Commercial Buildings* by the United States Environmental Protection Agency (USEPA), and in the currently recognized and accepted industry standards including the ANSI/IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration*, Fourth Edition (S500) and the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation*, Third Edition (S520).

Our inspection included the following:
1. Measure temperature and relative humidity indoors and outdoors.
2. Collect representative non-viable spore trap air samples indoors and one outdoors for comparison.
3. Collect representative Particle Counts, Carbon Dioxide and Carbon Monoxide counts at locations where air samples are collected.
4. Provide a written report describing the survey results and comparing those results to accepted guidelines and directives. This report includes a summary of data and Certificates of Laboratory Analysis.

BACKGROUND

This inspection was limited to the collection of non-viable spore trap air samples, particle counts, CO and CO^2 measurements that were collected from locations selected at random throughout the building. Descriptions in this report are based on looking at the structure from the front main entrance door. Moisture measurements and visual inspections were not conducted on this day.

SAMPLING METHODOLOGY

Air Samples:

Currently there are no regulations regarding acceptable airborne fungal levels. Airborne fungal spores are ubiquitous in the outdoor and indoor environment. The guidelines followed in this report for the assessment and/or remediation of airborne and surface fungi are published in *Bioaerosols: Assessment and Control*, by the American Conference of Governmental Industrial Hygienists (ACGIH), in *Mold Remediation in Schools and Commercial Buildings* by the United States Environmental Protection Agency (USEPA), in *Recognition, Evaluation, and Control of Indoor Mold* by the American Industrial Hygiene Association (AIHA), and in the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation*, Third Edition (S520). Airborne fungal assessments are performed by comparing results from volumetric samples taken indoors to samples taken outdoors. Airborne fungi levels in non-problem indoor environments generally are less than or approximately the same as that outdoors and also show a similar composition and/or taxonomic predominance. Problems are usually implicated in the indoor air when one or more fungal genera or species are present in a much greater concentration indoors compared to outdoors. Sampling results are shown in the Certificates of Laboratory Analysis attached to this report. Results are discussed below.

Temperature and Relative Humidity

Temperature and relative humidity readings were recorded by the Lighthouse Handheld 3016 Particle Counter. ASHRAE Standard 55 for thermal comfort suggested that the indoor temperature should be between 73°F to 79°F in the summer and 68°F to 75°F in the winter and that the indoor relative humidity should be between 20% to 65%.

The temperature and relative humidity are summarized in Table A below. The relative humidity met the current ASHRAE Standard to maintain indoor relative humidity below 65%.

SAMPLING RESULTS

Total Non-Viable Spore Air Sample Results:

Representative samples were taken for total airborne fungal spores with a calibrated Buck spore trap. Total airborne fungal spore sample volumes were 75-liters. The outdoor total fungal spore level (Sample 15) was measured at 3653 Spores/m^3 and was comprised of *Cladosporium* (36%), Curvularia (24%), Smuts (8%), Ascospores (6%), Basidiospores (6%), *Penicillium/Aspergillus* group (6%), Hyphal Elements (7%), and 1% or less of various other fungal spores. The air sample results are summarized below in Table A.

Table A – Air Sampling Results

Sample #	Location	Total Airborne Spore Count (Spores/m^3)	*Non-Fungal Background Particulate Level	Temperature ^oF	Relative Humidity %
01	Cafeteria	427	Moderate-heavy	73	54
02	Gym	600	Moderate	72	53
03	Art Room	600	Moderate-heavy	75	51
04	Hall at C27	560	Moderate	73	58
05	Library	1107	Moderate	73	51
06	Hall @ D14	880	Low-moderate	72	52
07	Hall @ E5	653	Low-moderate	72	53
08	CR E4	147	Low	73	51
09	CR 107	480	Moderate	72	52
10	2nd Floor Center	427	Low-moderate	73	49
11	Hall @ G9	453	Low-moderate	72	53
12	CR G6	480	Low-moderate	72	55
13	Hall @ F6	347	Low-moderate	71	52
14	CR F6	933	Moderate	71	50
15	Outdoor Air	3653	Moderate	70	42

*The Background Particulate Level refers to non-fungal debris seen in the air sample; such as skin cells, hair, fibers, dust, dirt, etc.

The total fungal spore counts in the areas sampled indoors were lower than that found in the outdoor air. The types of fungal spores found in the indoor air samples were all common outdoor-type fungi present in low concentrations with no spikes in water loss fungi. Therefore, the results suggested a normal indoor fungal ecology in the areas sampled. Counts are somewhat higher in this school probably due to the school being occupied and doors being opened to the outdoors during testing.

The particulate in the indoor air samples was in the low to moderate-heavy range. The particulate that we see in the microscope at the magnification used is usually called ‘course particulate’ and consist of many things and can include the following: dirt, dust, mold, pollen, fiber, hair, skin cells, dust mites and other insects. Fine particulates (to include VOC’s – volatile organic compounds) are not seen with the magnification used for these samples.

Particle Count

A Lighthouse Handheld 3016 Particle Counter was used to measure the levels of airborne particulates. Airborne particles are solids suspended in the air. In a commercial setting, particle levels should be significantly less than outside readings due to better filtration and better dilution with outside air.

Particle Count:

Table B below summarizes the minimum, maximum, and average particle count in the building in each size category during the sampling period. Each time one liter of air was drawn into the Particle

Counter, and the Particle Counter calculated all particles that are greater than or equal to the particle size indicated in the size categories.

Table B – Indoor Particle Count Sampling Results

	0.3 micron	0.5 micron	1.0 micron	2.5 micron	5.0 micron	10.0 micron
Minimum	38654	1246	157	60	18	3
Maximum	44680	5079	3204	2080	658	99
Average	40937	2008	643	370	125	26

Table C below summarizes the average particle count in the outdoor air at the time of sampling. Each time one liter of air was drawn into the Particle Counter, and the Particle Counter calculated all particles that are greater than or equal to the particle size indicated in the size categories. In addition, temperature and relative humidity information were included.

Table C – Outdoor Particle Count Sampling Results

	0.3 micron	0.5 micron	1.0 micron	2.5 micron	5.0 micron	10.0 micron
Outdoor Air Average	60287	2699	600	200	34	2

Carbon Monoxide and Carbon Dioxide

A TSI IAQ-Calc Indoor Air Quality Meter (Model 7545) was used to measure the concentrations of CO and CO_2. CO is a dangerous gas caused by incomplete combustion. The level of CO in an indoor environment should be low (none detected to 4 parts per million [ppm] depending on fuel sources used indoors) or same as outdoors. CO_2 is commonly used as an indicator of ventilation adequacy. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 62.1 stated that the indoor concentration of CO_2 should be less than 700 ppm over the outdoor ambient air, which typically is around 400 ppm.

The average CO concentration indoors was similar to the CO concentration outdoors. In addition, the indoor CO concentrations were measured at low ppm in all locations. Therefore, the results suggested that the indoor CO concentrations were within normal ranges. Individual results area available upon request.

Therefore, the results suggested that the ventilation in the areas sampled was adequate.

CONCLUSIONS

Results as reported by LRC apply only to the day of this inspection. LRC cannot and does not warranty that other parts of the structure were completely free or that the structure will remain free in the future from hidden sources of moisture or fungal contamination.

This inspection was limited to indoor air quality parameters. The indoor air samples did not show a fungal amplification or an altered indoor fungal ecology on this day. Relative humidity was in

the recommended range. Particle counts were generally lower than that found in the outdoor air. Carbon Dioxide and Carbon Monoxide levels were within the normal recommended range. Total fungal spore counts in some air samples were higher than found in the other buildings and particle counts in some tests were higher than in other buildings. This is most likely due to the interior of this building being exposed to the outdoors during the collection of samples. The total numbers were still in the low range and the spores found indoors were similar to those found outdoors.

If you have any questions or concerns, please do not hesitate to contact us.

Sincerely,

Cathy A Richmond

Cathy Richmond, B.S.
LRC Indoor Testing & Research

Tony Richmond

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