



November 16, 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 Elementary School  
LRC Project – 23-2214**

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 non-viable spore trap air samples, particle counts, CO and CO<sup>2</sup> 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 street front. 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 21) was measured at 5493 Spores/m<sup>3</sup> and was comprised of *Cladosporium* (67%), Ascospores (16%), *Penicillium/Aspergillus* group (6%), Smuts (4%), Basidiospores (3%), Hyphal Elements (3%), and 1% or less of various other fungal spores. The air sample results are summarized below in Table A.

**Table A – Air Sampling Results**

<b>Sample #</b>	<b>Location</b>	<b>Total Airborne Spore Count (Spores/m<sup>3</sup>)</b>	<b>*Non-Fungal Background Particulate Level</b>	<b>Temperature °F</b>	<b>Relative Humidity %</b>
01	Main Hall at Entrance	533	Moderate-heavy	74	50
02	Hall at B110/109	440	Moderate-heavy	74	59

Sample #	Location	Total Airborne Spore Count (Spores/m <sup>3</sup> )	*Non-Fungal Background Particulate Level	Temperature °F	Relative Humidity %
03	Hall at B 103	880	Moderate-heavy	74	52
04	CR B 105	160	Low-moderate	73	53
05	CR B 111	133	Low	73	52
06	Hall at B 116	440	Low-moderate	73	55
07	Hall at B 119	507	Moderate	74	52
08	Cafeteria B 123	93	Low-moderate	74	50
09	B 116	0	Low	74	50
10	Hall at B 217	93	Low-moderate	73	51
11	Hall at B 209	67	Low-moderate	75	49
12	Hall at 206	40	Low	74	50
13	CR B 207	80	Low-moderate	73	52
14	Hall at 219	320	Low-moderate	73	54
15	CR B220	80	Low	73	52
16	Hall at D 115	200	Low	74	45
17	CR D 128	40	Low	71	48
18	CR D 131	93	Low	74	47
19	Media	80	Low	74	40
20	Gymnasium	120	Low-moderate	73	48
21	Outdoor Air	5493	Moderate	72	60

\*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.

The particulate in the indoor air samples was in the low to low-moderate 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**

	<b>0.3 micron</b>	<b>0.5 micron</b>	<b>1.0 micron</b>	<b>2.5 micron</b>	<b>5.0 micron</b>	<b>10.0 micron</b>
Minimum	8990	224	28	11	6	0
Maximum	41352	1569	1562	931	300	54
Average	24434	889	263	144	49	11

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.

**Table C – Outdoor Particle Count Sampling Results**

	<b>0.3 micron</b>	<b>0.5 micron</b>	<b>1.0 micron</b>	<b>2.5 micron</b>	<b>5.0 micron</b>	<b>10.0 micron</b>
Outdoor Air Average	65040	3666	1014	352	51	6

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<sub>2</sub>. 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<sub>2</sub> 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<sub>2</sub> 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. Therefore, the results suggested that the ventilation in the areas sampled was adequate. Individual test results are available upon request.

## 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, counts in the B Hallway and CR B105 were generally higher than the rest of the school. Those areas may be exposed to the outdoors or have an open damper in the HVAC system serving that area of the building. Carbon Dioxide and Carbon Monoxide levels were within the normal recommended range.

This inspection was limited to indoor air quality.

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

Sincerely,



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



Tony Richmond, BBA, CAI, WRT  
LRC Indoor Testing & Research