



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 High School**  
**LRC Project – 23-2216**

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 26) was measured at 5787 Spores/m<sup>3</sup> and was comprised of *Cladosporium* (28%), Smuts (15%), Ascospores (13%), *Curvularia* (12%), *Drechslera/Bipolaris* (12%), *Penicillium/Aspergillus* group (8%), Basidiospores (6%), and 1% or less of various other fungal spores. The air sample results are summarized below in Table A.

Sample #	Location	Total Airborne Spore Count (Spores/m <sup>3</sup> )	*Non-Fungal Background Particulate Level	Temperature °F	Relative Humidity %
01	Advancement Center	253	Low-moderate	72	55
02	Hall at 201	67	Low	70	54
03	C 201	213	Moderate	73	53
04	Hall at 205	213	Low-moderate	74	43

Sample #	Location	Total Airborne Spore Count (Spores/m <sup>3</sup> )	*Non-Fungal Background Particulate Level	Temperature °F	Relative Humidity %
05	Hall at 202	560	Moderate	75	57
06	D 200	413	Moderate	75	55
07	CR 208	493	Moderate	74	49
08	CR 208	280	Moderate	73	45
09	Hall at 209	427	Moderate-heavy	73	50
10	Hall at 216	280	Moderate	73	48
11	CR 218	560	Low-moderate	72	48
12	Hall at A 201	400	Low-moderate	73	51
13	Hall at Band Room	200	Low-moderate	74	48
14	Band Room	240	Moderate	74	53
15	Hall at A 103	267	Low-moderate	74	47
16	Gymnasium	400	Low-moderate	73	55
17	Cafeteria	160	Low-moderate	73	47
18	Hall at C 101	453	Moderate	75	47
19	Media Center	160	Low	75	49
20	Hall at D100	413	Moderate	75	45
21	CR D 101	253	Low-moderate	73	51
22	Hall at C104	307	Low-moderate	75	49
23	Hall at V 102	347	Moderate	74	48
24	CR C 106	293	Low-moderate	74	47
25	Auditorium	507	Moderate	73	51
26	Outdoor air	5787	Moderate	78	47

\*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-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**

	<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	13361	316	30	11	6	2
Maximum	55821	15292	720	376	139	36
Average	32829	2606	289	127	44	15

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**

	<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	55550	2580	628	249	54	10

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 or similar than that found in the outdoor air, however, in some tests the results mirrored the outdoor sample indicating that the areas had been exposed to the outdoors. 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