



May 7, 2024

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

Re: Limited Indoor Air Quality Sampling with Airborne Fungal Sampling at First Flight Middle School
LRC Project – 24-2419

At your request, on May 3, 2024, 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 CO² 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 2293 Spores/m³ and was comprised of *Cladosporium* (56%), Basidiospores (13%), Ascospores (8%), Smuts (4%), *Penicillium/Aspergillus* group (6%), *Alternaria* (5%), Hyphal Elements (4%), and 2% 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/m³)	Total Airborne Spore Count 11/23	*Non-Fungal Background Particulate Level	Temperature °F	Relative Humidity %
01	Cafeteria	3573	213	Moderate	75	44
02	Gym	4747	387	Moderate-heavy	75	43
03	Room H 120	987	213	Low-moderate	73	53
04	Hall at J 122	4427	107	Moderate	73	50
05	Hall at A 103	1347	120	Low-moderate	75	49
06	CR A 105	53		Low	74	49
07	Hall at A 110	413	40	Low-moderate	74	54
08	Hall at K132	1120	213	Moderate	75	47
09	Hall at K 118	1093	93	Moderate	74	50
10	CR 126	160	80	Low-moderate	72	54
11	Media Center	573	573	Moderate	72	53
12	Hall at L 108	533	40	Low-moderate	73	54
13	CR L 102	307	107	Low-moderate	72	59
14	Hall at L 149	920	80	Low-moderate	75	50
15	CR 155	107	147	Low	74	50
16	Hall at M 120	347	67	Low-moderate	73	49
17	CR M 113	373	91	Low-moderate	74	48
18	Hall at Media	1520	173	Moderate	74	52
19	Hall at J 111	2013	80	Moderate	73	46
20	CR H 123	133		Low	75	46
21	Outdoor air	2293	1267	Moderate	91	50

*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 samples 6, 7, 10, 11, 12, 13, 15, 16, 17, and 20 taken indoors had a lower total fungal spore count than that found in the outdoor air. The types of fungal spores found in these indoor air samples were all common outdoor-type fungi present in low concentrations. Therefore, the results suggested a normal indoor fungal ecology in these areas sampled.

The total fungal spore counts in samples 3, 5, 8, 9, 14, 18, and 19 taken indoors were lower than that found in the outdoor air. The total fungal spore counts in samples 1, 2, and 4 were higher than the outdoor air sample. In addition, all of these the samples were comprised predominantly of *Cladosporium* and/or *Alternaria* spores. Therefore, the results suggested an altered indoor airborne fungal ecology in this group of samples. Some species of these fungi are considered allergenic and/or toxicogenic and should be handled with caution.

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	6412	233	113	10	1	0
Maximum	20599	1609	656	398	137	94
Average	14491	799	256	114	56	13

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	58663	3476	1141	3314	129	13

Carbon Monoxide and Carbon Dioxide

A TSI IAQ-Calc Indoor Air Quality Meter (Model 7545) was used to measure the concentrations of CO and CO₂. 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. CO₂ 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 CO₂ 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.

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.

Samples 1, 2, 3, 4, 5, 8, 9, 14, 18, and 19 showed a fungal amplification or altered indoor environment on this day. It is therefore recommended that further sampling be conducted along with a visual inspection and moisture measurements in an attempt to identify the source.

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