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November 13, 2022

Granville County Schools
Bill Graham
101 Delacroix Street
Oxford, NC 27565

Re: Limited Fungal Indoor Environmental Quality Investigation with Airborne and Surface Fungal Sampling at 2173 Brassfield Road, Creedmoor, NC
LRC Project – 22-2161

At your request, on November 4, 8, and 11, 2022, LRC Indoor Testing & Research, Inc. (LRC) performed a limited environmental fungal Indoor Environmental Quality (IEQ) sampling that included airborne and surface fungal sampling at the property listed above. This project was requested to characterize the types and levels of airborne and surface fungi in the structure.

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. Visual inspection of Rooms 123, 124 and the 100 Hallway.
2. Collect representative moisture measurements in inspected areas.
3. Measure temperature and relative humidity indoors and outdoors.
4. Collect representative non-viable spore trap air samples indoors and one outdoors for comparison.
5. Collect representative non-viable surface tape lift samples of representative visible or suspect fungal growth if deemed necessary.
6. Provide a written report describing the survey results and comparing those results to accepted guidelines and directives. This report includes a summary of data, Certificates of Laboratory Analysis and a remediation protocol, if needed, based on the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation,* Third Edition (S520).

VISUAL INSPECTIONS, MOISTURE MEASUREMENTS, AND RELATIVE HUMIDITY

A calibrated moisture meter was used to measure moisture levels on representative hard surfaces. Typically, moisture contents approaching 17% and greater represent excessive moisture on hard surfaces (wood) in conditioned spaces; however, in non-conditioned spaces wood and semi-porous materials may approach these threshold levels naturally due to seasonal changes in temperature and humidity.

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% but was at the high end of the recommendations..

Table A – Temperature and Relative Humidity by Location

Location	Temperature	Relative Humidity
11/4/2022 Indoors	71°F	62 to 63%
11/8/2022 Indoors	54 to 68°F	43 to 63%
11/11/2022 Indoors	77°F	42 to 43%

General Observations:

The subject property is a one-story slab on grade structure used as a middle school. This report is a combination of three separate visits to the building. On 11/4/2022 testing was done at the completion of remediation activities in Rooms 123 and 124. At your request, further testing was done on 11/8/2022 to reaffirm the results obtained on 11/4 and to test the air quality in Hallway 100. On 11/11 an investigation was conducted of the cavity space above the drop ceiling in the 100 Hallway.

11/4/2022:
Air sampling was conducted in Rooms 124 and 123 to confirm that previous remediation activity was complete. The results shown in Table B (and certificates of laboratory analysis A attached) confirmed that those two rooms had been restored to a 'normal fungal ecology'.

11/8/2022:
Additional air sampling was conducted in Rooms 124 and 123 along with four samples taken in the 100 Hallway. Sample results shown in Table C (and certificates of laboratory analysis B attached) showed slightly altered indoor air in all the samples except the one taken in Room 123 (Sample 06).

11/11/2022:
Based on the inconsistent sample results from the previous testing an investigation was conducted of the cavity in Hallway 100 above the drop ceiling and Room 124. Between 11/8 and 11/11 the HVAC system had been converted from the cooling mode to heating. As can be seen in Table A above the temperature was at a consistent 77^0F on this date and the Humidity levels had been reduced to 42 to 43%. In Room 124 it was found that over 20 Orchid plants had been introduced

into the room. A surface sample (Sample 18) taken from the surface of an Orchid leaf and the table they were on contained Numerous *Penicillium/Aspergillus* spores along with occasional levels of other common spores. An additional surface sample taken from the nearby window ledge (sample 17) contained only occasional settled fungal spores.

Ceiling tiles were removed in several locations along the Hallway and the area above examined. It was found that the chiller pipes consistently showed staining, in many cases relatively light but in some places very heavy. Two surface samples were taken from stained chiller pipes, Sample 16 taken near Room 121 contained Numerous *Cladosporium* spores Occasional *Penicillium/Aspergillus* spores and Moderate Hyphal Elements (the growth structure of fungal spores), Sample 19 taken near Room 127 contained Numerous *Stachybotrys* spores and Numerous Hyphal Elements. The air samples taken on this date (Samples 11 thru 14) showed a normal fungal ecology except for Sample 14 taken in Room 124 which had a very slightly elevated level of *Penicillium/Aspergillus* spores. It was also noted that the HVAC unit located in the cavity was not well sealed with gaps in the sheet metal on the return side. That would allow make up air to be pulled into the unit from the cavity which from time to time would contain fungal spores pulled from the pipe insulation.

Summary of findings:
The slightly altered air in Room 124 can possibly be explained by the presence of plant matter that had *Penicillium/Aspergillus* spores on the surface.

The change in Humidity level is the result of going from the cooling to heating mode.

The variance in the air quality from testing to testing is most likely the result of when the tests were taken. It is my opinion that when the system located in the cavity operates it pulls some level of fungal spores from the pipe insulation and introduces them into the hallway. Visual observations would indicate that the deterioration of the insulation on the chiller pipes has recently begun and that the quality of air in the building will deteriorate with time. At this point in time the impact is inconsistent and minimal.

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.

Surface Samples:

Surface sampling results should follow guidelines as stated in the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation,* Third Edition (S520). Under normal circumstances, building materials that appear clean and free of dirt, water damage, and/or fungal amplification should show "Condition 1" or "normal fungal ecology". Condition 1 is described in the Standard as "an indoor environment that may have settled spores, fungal fragments or traces of actual growth whose identity, location and quantity are reflective of a normal fungal ecology for a similar indoor environment". Results from sampling "clean" surfaces, if performed, should show that there is no evidence of fungal amplification. Condition 2 is described as "an indoor environment which is primarily contaminated with settled spores that were dispersed directly or indirectly from a Condition 3 area, and which may have traces of actual growth". Condition 3 is described as "an indoor environment contaminated with the presence of actual mold growth and associated spores". Representative surface tape lift samples were collected as discussed below. Surface samples may be taken either with a tape lift or a swab and are analyzed microscopically. Sampling results are shown in the Certificates of Laboratory Analysis attached to this report. Results are discussed below.

SAMPLING RESULTS

Total Non-Viable Spore Air Sample Results: 11/4/2022

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 03) was measured at 3787 Spores/m^3 and was comprised of *Cladosporium* (31%), Ascospores (10%), Basidiospores (32%), Smuts (15%), *Penicillium/Aspergillus* group (6%), Hyphal Elements (6%), and 1% or less of various other fungal spores. The air sample results are summarized below in Table B.

Table B – Air Sampling Results

Sample #	Location	Total Airborne Spore Count (Spores/m^3)	*Non-Fungal Background Particulate Level
01	Room 124	1240	Moderate-heavy
02	Room 123	1173	Moderate-heavy
03	Outdoor Air	3787	Low

*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 but somewhat higher than we normally see indoors. The types of fungal spores found in the indoor air samples were all common outdoor-type fungi present in low concentrations. Therefore, the results suggested a normal indoor fungal ecology in the areas sampled.

Total Non-Viable Spore Air Sample Results: 11/8/2022

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 08) was measured at 11467 Spores/m^3 and was comprised of *Cladosporium* (72%), Basidiospores (9%), Smuts (6%), *Penicillium/Aspergillus* group (6%), Ascospores (4%), and 2% or less of various other fungal spores. The air sample results are summarized below in Table C.

Table C – Air Sampling Results

Sample #	**Location**	**Total Airborne Spore Count (Spores/m^3)**	***Non-Fungal Background Particulate Level**
04	Room 124	1453	Low
05	Room 123	240	Low
06	Hall @ Room 121	1400	Low-moderate
07	Hall @ Room 124	973	Low-moderate
08	Hall @ Room 127	1867	Low-moderate
09	Hall @ Room 129	1920	Low-moderate
10	Outdoor Air	11,467	Moderate

*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 Sample 5 taken in Room 123 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 that sample. Samples 4, 6, 7, 8 and 9 contained higher levels of *Penicillium*/*Aspergillus* group spores. Spores in this grouping are commonly considered to be among the water loss fungi. Therefore, the results suggested a slightly altered indoor airborne fungal ecology in those samples. Some species of these fungi are considered allergenic and/or toxicogenic and should be handled with caution.

Total Non-Viable Spore Air Sample Results: 11/11/2022

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 14,773 Spores/m^3 and was comprised of *Cladosporium* (12%), Ascospores (79%), Basidiospores (3%), *Penicillium/Aspergillus* group (3%), and 1% or less of various other fungal spores. The air sample results are summarized below in Table D.

Table D – Air Sampling Results

Sample #	Location	Total Airborne Spore Count (Spores/m^3)	*Non-Fungal Background Particulate Level
11	Hall @ Room 127	1013	Low-moderate
12	Hall @ Room 124	1960	Low
13	Hall @ Room 121	2133	Low
14	Room 12	1960	Low-moderate
15	Outdoor Air	14,773	Low

*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 11, 12, and 13 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 those areas samples. The total fungal spore count in Sample 14 was lower than that found in the outdoor air. However, the sample contained a slightly elevated level of *Penicillium*/*Aspergillus* group spores. Spores in this grouping are commonly considered to be among the water loss fungi. Therefore, the results suggested a very slightly altered indoor airborne fungal ecology in that sample. Some species of these fungi are considered allergenic and/or toxicogenic and should be handled with caution.

The background particulate that we see in the microscope at the magnification used is usually called 'coarse particulate' and consists of many things and can include the following: dirt, dust, 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.

Surface Non-viable Tape Lift Sample Results:
Representative surface tape lift samples were collected from suspect mold-contaminated surfaces. Tape lift samples are collected to confirm visual observations. The samples are discussed in the narrative above and detailed in the attached certificates of laboratory analysis. The surface sampling results are summarized below in Table E.

Table E – Surface Sampling Results

Sample #	Location	Spores and Enumeration	Condition
16	Chiller Pipe Insulation	Numerous: *Cladosporium* Occasional: *Penicillium/Aspergillus* Moderate: Hyphal Elements	3
17	Window Ledge Room 124	Occasional: *Cladosporium* Occasional: Smuts, Periconia, Myxomycetes	1
18	Room 124 Orchid Leaves	Numerous: *Penicillium/Aspergillus* Occasional: Alternaria Occasional: Smuts Periconia, Myxomycetes	2
19	Chiller Pipe Insulation	Numerous: *Stachybotrys* Numerous: Hyphal Elements	3

CONCLUSIONS AND RECOMMENDATIONS

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.

LRC's visual inspection of the structure was as thorough as possible considering the nature of this investigation. It should be noted that conditions reported in this report were based on the time of the inspection only and circumstances may change following the inspection. Should further issues occur and conditions change it may be necessary to re-evaluate the structure and consider more in-depth testing. Standard quality controls such as air filtration devices, negative pressure and containments should be used.

All water damage and fungal remediation should follow guidelines as stated in the ANSI/IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration,* Fourth Edition (S500) and in the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation,* Third Edition (S520). All work should follow recommendations therein to protect workers, occupants, building spaces from dusts and debris during remediation and removal of fungal contaminated materials.

Due to finding the inconsistent quality results in the indoor air we make the following recommendations. Please see Appendix A at the end of this document for general mold remediation recommendations and general responsibilities of the remediation contractor.

Specific recommendations for this project are as follows:

- The best practice and most appropriate solution would be to replace the paper chiller pipe insulation with poly sealed insulation. The other hallways in the building should be examined prior to any action to determine if they are also deteriorating. If you decide to

pursue this option, I will supply a protocol to ensure that no additional harm is done to the environment in the building.

- Interim steps that could help minimize the impact on air quality in the building would be:
    - Seal up the gaps in the sheet metal of the Hallway HVAC unit or cease to operate the unit entirely.
    - Clean and encapsulate the existing chiller pipe insulation in the Hallway. Again, I can provide a protocol if this option is chosen.
    - Operate HEPA filtered air scrubbers in the Hallway in an ongoing basis during the school day.

Before clearance testing:

- Run air scrubbers at the completion of remediation to cleanse the air to get a minimum of 100 air exchanges.
- Prior to re-sampling, seal and turn off air scrubbers.
- HEPA vacuum and wipe clean all surfaces within the containment.
- Control the indoor relative humidity to be between 30 and 60% at all times.

Disclaimer:
The recommendations are given in order to assist a certified mold remediation contractor in returning the impacted structures to "Condition 1" or "normal fungal ecology" in accordance with the ANSI/IICRC S520 *Standard and Reference Guide for Professional Mold Remediation*, Third Edition (S520).

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

Sincerely,

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

APPENDIX A

General recommendations are as follows:

- Services should be performed by a certified mold remediation contractor. IICRC or equivalent certifications and experience are suggested.
- Mold remediation contractors should carry Mold Specific Liability Insurance.
- Remediation workers should use all appropriate personal protective equipment (PPE), including but not limited to half-face respirators with HEPA cartridges, protective eyeglasses, disposable protective clothing, gloves, and safety shoes.
- All negative air machines and air scrubbers must have triple filtration, including at least one HEPA filter.
- All vacuums must have a certified HEPA filter.

The remediation contractor will use their professional judgment to:

- Determine the ultimate extent and method of material removal based on current environmental conditions and previous sampling and inspection results.
- Preserve the structure's architectural and structural integrity.
- Identify and implement specific work practices meeting health, safety, and environmental regulations.
- Select appropriate and, where regulated, approved materials to successfully conduct this project.
- Construct containment(s) and place all work areas to be remediated under negative pressure relative to surrounding areas. If possible, negative pressure should be maintained using HEPA-filtered air scrubbers exhausted to the outside. Containment should include polyethylene barriers, negative air pressure machines with HEPA-filtration, and decontamination chambers. Care should be taken to ensure make up air is drawn from acceptable sources.
- Any debris or materials removed from containment should be secured in closed 6-mil polyethylene bags or containers prior to removal. Any sheetrock removed should be removed to a distance of 24 inches beyond the end of damage or visible microbial growth if practical. Removal of additional material to facilitate ease of work, i.e. replacing sheetrock in full or half sheets should be after discussion with the homeowner and insurance representative.
- Source or sources of water intrusion should be identified and corrected before final cleaning is conducted or new materials are installed.
- Surfaces inside the containment that will not be removed should be HEPA-vacuumed, cleaned with an appropriate detergent and/or treated with an EPA registered biocide, and vacuumed a second time to remove any residue.
- The use of HEPA filtered air scrubbers is recommended in areas outside containment to minimize dust and inadvertent cross contamination.
- Inspect the HVAC system and associated duct work and where appropriate clean and treat with an EPA registered and approved biocide including components such as fan, coil, ducts, and diffusers.

- A thorough HEPA filtered vacuuming should be performed of the surfaces, floors and carpets, and a final HEPA vacuuming be performed after all remediation is complete.
- After cleaning and removal is complete, a final inspection and testing should be performed prior to the replacement of building materials. Application of an anti-microbial sealant such as Fosters or Fiberlock is permissible based on discussion with the building owner and the insurance company.
- Prior to rebuild or put back, LRC should be engaged to perform a post-remediation verification (PRV). The standard in our industry. The IICRC S520, states: "It is preferable that the IEP [Indoor Environmental Professional] be an unbiased resource … independent of the remediator. If the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose in writing to the client that they are deviating from the Standard."