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NON-VIABLE MOULD AIR SAMPLING – POST REMEDIATION

Sir Sandford Fleming College – Green House
1 Auk Trail
Lindsay, ON
K9V 6G6

FINAL REPORT

Assessment Performed: March 2, 2023
Report issued: March 9, 2023
THEM Project #: T23-18246

Prepared by:

T. HARRIS ENVIRONMENTAL MANAGEMENT INC.

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Prepared for:
Rick Teasdale
Manager of Facilities and Operations
599 Brealey Drive
Peterborough, ON
K9J 7B1

EXECUTIVE SUMMARY

T. Harris Environmental Management Inc. (THEM) performed non-viable mould air sampling within Fleming College – Frost Campus at 1 Auk Trail, Lindsay, Ontario. The assessment was conducted on March 2, 2023, at the request of Rick Teasdale, Manager of Facilities and Operations. The objective of this assessment was to determine the conditions of air quality inside Room 108, the Greenhouse.

Based on the air sampling results and observations made on the survey date, the following conclusions and recommendations are made:

- It is concluded that no mould amplification is occurring within the assessed suites due to an increased spore presence in the outdoor samples, reflecting an increased indoor spore presence. The spaces assessed are safe for occupancy.

- During the air sampling there were no signs of visible mould inside the enclosure. It is to be noted that the exterior total spore counts are likely to be suppressed due to winter weather conditions and ground cover by snow. It is also to be noted that the Cladosporium spore types are dominant in all three (3) samples, and therefore are relatively comparable.

General Considerations

This survey satisfies requirements of the Occupational Health and Safety Act with regards to the presence/absence of hazardous materials identified within this report. This executive summary is not to be used alone and the report should be reviewed in its entirety.

Should you have any questions or comments regarding this survey, please do not hesitate to contact our office.

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March 9, 2023

Sir Sandford Fleming College
599 Brealey Drive
Peterborough, ON
K9J 7B1

Attn: **Rick Teasdale**
Manager of Facilities and Operations

Re: **Non-Viable Mould Air Sampling – Post Remediation in Greenhouse**
1 Auk Trail, Lindsay, ON K9V 6G6

1.0 BACKGROUND

T. Harris Environmental Management Inc. (THEM) performed non-viable mould air sampling within Fleming College – Frost Campus at 1 Auk Trail, Lindsay, Ontario. The assessment was conducted on March 2, 2023, at the request of Rick Teasdale, Manager of Facilities and Operations. The objective of this assessment was to determine the conditions of air quality inside Room 108, the Greenhouse.

2.0 INTRODUCTION

Fungi, also called mould or mildew, are microbiological organisms that can live and reproduce and potentially cause health problems in indoor environments. They are chlorophyll-lacking plant-like organisms that are unicellular (e.g., yeast) or grow in a multinucleate mass (e.g., bread mould), subsist on decomposed organic matter or nutrition from living hosts, and reproduce by production of spores 3 to 200 mm in size.

There are two types of fungal spores: dry spores such as those of Aspergillus spp. or Penicillium spp., which are easily disturbed and can become airborne; and slimy spores, such as those of Stachybotrys spp. and Fusarium spp., which are produced in a slimy mass that is seldom airborne. Mould spores of various types are usually present in indoor and outdoor air. Typically, fungal spore contamination occurs within building construction (e.g., insulation materials, gypsum board, framework, etc.).

Mould growth inside buildings is typically due to excess moisture caused by leakages, condensation or capillary movement of water into the building. Moulds such as Stachybotrys chartarum and some species of Aspergillus spp. are greenish-black, wet and slimy moulds that

grow on soaking wet cellulose-based materials. They are often found near leaks or where drying is very slow and can form after flooding. They will generally not occur if materials are kept dry. The presence of mould spores in indoor environments may not be significant in terms of the causation of fungal infestation since most microorganism contamination does not become a problem until it becomes disturbed and is distributed into the ventilation system or air within the building. In other words, there may be little hazard if microorganisms do not multiply or do not accumulate to harmful levels, if there is no means for microorganisms to become airborne, or if aerosolized microorganisms do not reach susceptible receptors.

Fungi or moulds which are typically found on building materials that have become damaged due to moisture problems, can cause or exacerbate allergic type symptoms in occupants who have a history of hypersensitivity diseases (e.g., asthma). Thus, people suffering from respiratory disorders or severe allergies may be at greater risk for developing health problems associated with exposures to fungi found in water damaged areas. Such people may need to be removed from the affected areas until remediation and clearance testing, if required, is completed. However, any decisions regarding medical removal must be based on recommendations made by an occupational medicine specialist trained in symptomatology related to this type of exposure.

2.1 Hazard Categories

In order to define risk for areas that are suspected or confirmed to be contaminated with mould, the extent of water damage and/or visible mould growth on building materials must be considered. THEM recommends the following criteria as per **Table I** for determining risk levels (hazard categories) and associated remediation protocols. This criterion is based on the *Institute of Inspection Cleaning and Restoration Certification (IICRC) S520 Standard and Reference for Professional Mould Remediation.*

TABLE I
Recommended Mould Risk Management Levels

Hazard Category	Mould Growth Present in Accessible Areas, Based on Visual Inspection[1]	Summary of Minimum Recommended Remediation Requirements
Level 0	No visible signs of mould growth, no evidence of water damage and no health complaints.	No remediation required.
Level 1	Small Areas of Mould (Source Containment)	• Work should be conducted by qualified environmental contractor or in-house maintenance personnel trained in mould remediation procedures. • Personnel conducting the work should be wearing the appropriate PPE. • No critical barriers required. • Mould contaminated building materials can be contained with polyethylene sheeting and duct tape and removed.
Level 2	Moderate Levels of Mould (Local Containment)	• Work should be conducted by a qualified environmental contractor. • Personnel conducting the work should be wearing the appropriate PPE. • A polyethylene enclosure should be erected to isolate mould-contaminated materials. • A decontamination chamber may be required • The following procedures should be followed during cleaning activities: HEPA vacuum, clean with a solution that contains a surfactant, HEPA vacuum, clean with a solution that contains a surfactant and a final HEPA vacuum. A disinfectant (that at minimum has a Health Canada DIN Number) should be applied to the remediation area following cleaning.
Level 3	Extensive Mould (Full Scale Containment)	• Work should be conducted by a qualified environmental contractor. • Personnel conducting the work should be wearing the appropriate PPE. • The mould contaminated room and/or building section should be isolated with critical barriers. • Building materials within the remediation area that cannot be cleaned effectively must be sealed off with polyethylene barriers. • A decontamination unit is required • The following procedures should be followed during cleaning activities: HEPA vacuum, clean with a solution that contains a surfactant, HEPA vacuum, clean with a solution that contains a surfactant and a final HEPA vacuum. A disinfectant (that at minimum has a Health Canada DIN Number) should be applied to the remediation area following cleaning.

Note 1: May or may not include destructive testing.

3.0 ASSESSMENT METHODOLOGY

3.1 Non-Viable Total Mould Air Sampling

In order to measure total airborne (non-viable) fungi/mould, air samples were collected on Air-O-Cell cassettes using the SKC QuickTake 15 constant flow diaphragm pump. The pump maintains a set flow rate throughout the sampling period in order to compensate for the inherent backpressure created by sampling media. Samples were collected at a flow rate of 15 litres per minute (lpm) over 5-minute duration for a total sample volume of 75 litres.

Analysis of spore trap samples was performed using direct microscopy techniques by EMC Scientific Inc. EMC participates and maintains proficient status in the American Industrial Hygiene Association (AIHA) Environmental Microbiology Proficiency Analytical Testing (EMPAT) program, for both direct examination and culture analysis. All samples at EMC are analyzed by PhD or Master's mycologists and microbiologist.

Sample analysis of individual mould spores is reported in spores per cubic meter of air (spores/m3).

No data is currently available that establish a clear dose-response relationship for saprophytic fungal spore exposure (i.e., those mould deriving nutrition from non-living materials in the environment). The interpretation of the air sampling results is carried out by comparing indoor and outdoor fungal spore biodiversity or composition. The same type of fungal spores should be present in indoor environments at concentrations reflective or lower as compared to the outside. Overall, the composition of the indoor air spora should reflect that of the outdoor, suggesting that the fungal spores found indoors originated from the outdoor air. For the purposes of comparison, one outside (exterior) sample was collected on the date of our assessment.

The following criteria were used to interpret total airborne mould sampling data:

1. Total airborne mould spore concentrations should be lower inside the building as compared to the outside of the building.

2. A similar composition of fungal spores should be present inside the building areas sampled as compared to the outside sample locations.

3. Airborne concentrations of any one type of mould genus/species, other than common environmental mould detected on the outside of the building, should not be dominant in any one location sampled. Dominant being defined as representing > 50 % of total spores

or species detected in any one sample, as determined by spore trap sampling or culturable air sampling results.

4. No known toxic (or pathogenic) mould spores or species should be present in the air samples at significant percentages. Significant percentage being defined as representing > 25 % of total mould spores or species detected in any one sample.

Please note that the above criteria are based on currently acceptable guidelines recommended for interpretation for mould air sampling results, as suggested by Health Canada, the American Industrial Hygiene Association (AIHA) and the American Conference of Governmental Industrial Hygienists (ACGIH).

4.0 RESULTS

4.1 Non-Viable Total Mould Air Sampling

THEM personnel were onsite March 2, 2023, to conduct air sampling for mould within the Greenhouse which had level 2 mould remediation activities completed. Results of the airborne mould sampling conducted by THEM personnel are summarized below in **Table II** below. The Laboratory Certificate of Analysis can be found in **Appendix II**.

Table II
Summary of Non-Viable Mould Air Sampling Results
Fleming College
1 Auk Trail, Lindsay, ON
March 2, 2023

Sample / Location	Total Spores (spores/ m^3)	Fungal Material Type	Concentration (count/m^3)	Percentage of Sample (%)	Percentage of Outdoors (%)
Outdoor Reference	107	*Aspergillus* spp. / *Penicillium* spp.	13	12	-
		Cladosporium spp.	80	75	
		Colourless	13	12	
Remediated Area	427	*Aspergillus* spp. / *Penicillium* spp.	53	12	408
		Chaetomium spp.	27	6	N/A
		Cladosporium spp.	307	72	384
		Colourless	40	9	308
Indoor Reference	200	*Alternaria* spp.	13	7	N/A
		Aspergillus spp. / *Penicillium* spp.	13	7	100
		Basidiospores	13	7	N/A
		Cladosporium spp.	133	67	166
		Colourless	27	14	208

- As per **Table II**, the criteria outlined in section 3.1 has not been met; therefore, no mould amplification is occurring in the assessed spaces due to an increased spore presence in the outdoor sample, causing an increase in the indoor samples. Remediation, disinfection, and cleaning activities are not required.

4.2 Summary of Possible Airborne Mould Identified

The following briefly describes possible moulds identified:

- ***Alternaria spp.*** is a common mould ubiquitous in outdoor air; also, widespread indoors.

- ***Aspergillus spp****.* are common in outdoor environments and commonly can grow on a various substrate and with a wide range of water requirements. Some genera of Aspergillus are known to known to produce mycotoxins.

- **Basidiospores** are sexual mould spores produced in a basidium. Basidiospores may be produced by approximately 1200 mould genera.

- ***Chaetomium spp.*** is a common mould ubiquitous in outdoor air. It is also widespread indoors, commonly found on damp sheetrock paper. *Chaetomium spp.* is typically associated with water damaged building materials.

- ***Cladosporium spp***. is a common mould ubiquitous in outdoor air; also, widespread indoors on many substrates, including textiles, wood, moist windowsills.

- **Colorless** spores are spores lacking distinguishable characteristics.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the air sampling results and observations made on the survey date, the following conclusions and recommendations are made:

- It is concluded that no mould amplification is occurring within the assessed suites due to an increased spore presence in the outdoor samples, reflecting an increased indoor spore presence. The spaces assessed are safe for occupancy.

- During the air sampling there were no signs of visible mould inside the enclosure. It is to be noted that the exterior total spore counts are likely to be suppressed due to winter weather conditions and ground cover by snow. It is also to be noted that the Cladosporium spore types are dominant in all three (3) samples, and therefore are relatively comparable.

5.1 General Considerations

- This survey satisfies requirements of the Occupational Health and Safety Act with regards to the presence/absence of hazardous materials identified within this report. This executive summary is not to be used alone and the report should be reviewed in its entirety.

- Should you have any questions or comments regarding this survey, please do not hesitate to contact our office.

6.0 LIMITATIONS

In this statement of limitations, the “Client” refers to the persons or entities to whom this report (the “Report”) is addressed. “THEM” refers to T. Harris Environmental Management Inc. The “Contract” refers to any general or project-specific written agreement, including THEM’s Terms and Conditions and project-specific scope of work documents, executed between THEM and the Client pertaining to the subject matter of this Report.

This Report is subject to the limitations set out below and any other limitations set out in the body of this Report and/or in the Contract between THEM and the Client.

The investigation and assessment described in this Report were conducted in accordance with the Contract agreed upon by the Client in a manner consistent with a reasonable level of care and skill normally exercised by members of the occupational hygiene consulting profession currently practising under similar conditions in the Province of Ontario and/or Quebec, as applicable, and observing the code of ethics of the Canadian Registration Board of Occupational Hygienists (CRBOH) and the American Board of Industrial Hygiene (ABIH).

In preparing this Report, THEM has relied on information provided by others, including without limitation, information concerning the history and operation of the site, and test results and analyses of other consultants, independent laboratories, or testing services. Except as expressly stated in this Report, THEM has not made any independent verification of such information. Findings cannot be extended to portions of the site, which were unavailable for direct observation.

The assessment in this Report has been made in the context of regulations which were in force and effect at the time of the assessment, and which are specified in this Report. The assessment did not consider any regulations, which were not in effect at the date of the assessments, or any guideline or standard not specified in this Report. Regulatory standards do not exist for all materials of a potentially hazardous nature.

The collection of any samples at the site (including the location of samples and the analytical parameters applied to the samples) was undertaken in accordance with the Contract agreed upon by the Client, based upon the information provided to THEM by the Client concerning existing site conditions. Conditions between sample locations (if any) may differ from those indicated in this Report.

This Report is intended solely for the use or uses specified in this Report and/or the Contract. Use of this Report for purposes other than those expressly set out in this Report and/or the Contract will be at the sole risk of the Client.

Copying of this Report except as may be reasonably required for internal use by the Client and any distribution of this Report to persons other than the Client in whole or in part, is not permitted without the prior express written permission of THEM.

This Report is for the sole use of the Client. THEM makes no representation or warranty, either expressed or implied, to any third party with regard to this Report and the work referred to in this Report and expressly disclaims any, and accepts no duty of care to any third party or any responsibility or liability whatsoever to any third party for any loss, expenses, damages (direct,

consequential or contingent), fines, penalties, or other harm that may be suffered or incurred by any third party as a result of any use of, any reliance placed upon, or any decision made or actions taken based upon this Report or the work referred to herein.

In no event shall THEM be liable for any indirect, incidental, special or consequential damages, or damages from loss of profits, revenue, or use, whether in an action in tort, contract or otherwise, even if THEM has been advised of the possibility of such damages. If new information concerning the subject matter of this report arises, the Client should contact THEM to re-evaluate the conclusions of this Report and to provide amendments as required.

APPENDIX I
REFERENCES

1. American Industrial Hygiene Association. Recognition, Evaluation, and Control of Indoor Mould. Edited by Bradely Prezant, Donald M. Weekens, J. David Miller, 2008
2. Institute of Inspection, Cleaning and Restoration Certification, IICRC Standard for Professional Mould Remediation S520, 2015
3. NYC DOH, Guidelines on Assessment and Remediation of Fungi in Indoor Environment, April 2008
4. Institute of Inspection, Cleaning and Restoration Certification, IICRC Standard and Reference Guide for Professional Water Damage Restoration S500, 2015
5. American Industrial Hygiene Association, Field Guide for the Determination of Biological Contaminants in Environmental Samples, AIHA Biosafety Committee, 2005
6. Public Works and Government Services Canada, Fungal Contamination Guidelines: Interpreting the Analysis, June 2000, Revised April 2005.
7. Environmental Abatement Council of Canada (EACC) – Mould Abatement Guidelines Third Edition, 2015
8. Canadian Construction Association – Mould Guidelines for the Canadian Construction Industry, 2018
9. Environmental Microbiology Laboratory Inc. – Characteristics of Some Commonly Encountered Fungal Genera. Compiled By Janet Gallup and Miriam Valesco Dr. P.H., 2002-2003
10. Microorganisms In Home and Indoor Work Environments. Diversity, Health Impacts, Investigation and Control. Edited by Brian Flanningan, Robert A. Samson, J.David Miller., 2001
11. US EPA, Mold Remediation in Schools and Commercial Buildings, March 2001
12. American Conference of Governmental Industrial Hygienists, Bioaerosols Assessment and Control, 1999
13. Eurofins US, Mitosporic Fungi – Hyphomycetes - Torula sp., Fungal Library, 2021.
14. Health Canada, Fungal Contamination in Public Buildings – Health Effects and Investigation Methods, 2004

APPENDIX II
SITE PHOTOGRAPHS

Photograph 1: View of the affected area where remediation procedures were taken for a level 2 mold contamination.

APPENDIX III
LABORATORY CERTIFICATES

emcscientific
INCORPORATED

Laboratory Analysis Report

To:

Erin Rowland
T. Harris Environmental
93 Skyway Avenue, Suite 101
Toronto, Ontario
M9W 6N6

EMC LAB REPORT NUMBER: 89036
Job/Project Name: Green House - Fleming College
Job/Project No: 18246 **No. of Samples:** 3
Sample Type: Air-O-Cell **Date Received:** Mar 2/23
Analysis Method(s): Fungal Spore Counting
Date Analyzed: Mar 3/23 **Date Reported:** Mar 3/23
Analyst: Weizhong Liu, Ph.D., *Mycologist*
Approved By: Fajun Chen, Ph.D., *Principal Mycologist*

Client's Sample ID	**1**			**2**			**3**								
EMC Lab Sample No.	378283			378284			378285								
Sampling Date	Mar 2/23			Mar 2/23			Mar 2/23								
Description/Location	Remediated area			Indoor reference			Outdoor reference								
Air Volume (m^3)	0.075			0.075			0.075								
Fungal Spores	raw ct.	%	spores/m^3	raw ct.	%	spores/m^3	raw ct.	%	spores/m^3	raw ct.	%	spores/m^3	raw ct.	%	spores/m^3
Alternaria				1	7	13									
Arthrinium															
Ascospores															
Aspergillus/Penicillium type	4	13	53	1	7	13	1	13	13						
Basidiospores				1	7	13									
Cercospora															
Chaetomium	2	6	27												
Cladosporium	23	72	307	10	67	133	6	75	80						
Colorless	3	9	40	2	13	27	1	13	13						
Curvularia															
Drechslera/Bipolaris group															
Epicoccum															
Fusarium															
Nigrospora															
Oidium															
Pithomyces															
Rusts															
Smuts, *Periconia* , Myxomycetes															
Stachybotrys															
Ulocladium															
Unidentified spores															
Number of spores/sample	32			15			8								
Fungal fragments (0-3 +)	0+			0+			0+								
Non-fungal material (0-3 +)	3+			2+			2+								
TOTAL SPORES/M^3	**427**			**200**			**107**								

Note:
1. *Aspergillus/Penicillium* type spores may include those of *Acremonium, Paecilomyces, Trichoderma* and others.
2. A scale of 0 + to 3 + (indicating increasing amount) is used to rate abundance of fungal fragments and non-fungal material, with 3+ indicating the most abundance.
3. The presence of a large amount of dust debris may obscure some spores to be counted. Spore counts from samples with 3 + non-fungal material and/or 3 + fungal material may be treated as under-counts.
4. Unidentified spores are those lacking distinguishable characteristics for correct identification. Colorless are colorless spores lacking distinguishable characteristics.
5. These results are only related to the sample(s) analyzed.