T. HARRIS
ENVIRONMENTAL MANAGEMENT
since 1979

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NON-VIABLE MOULD AIR SAMPLING – POST REMEDIATION

Fleming College
1 Auk Trail
Lindsay, Ontario
K9V 6G6

FINAL REPORT

Assessment Performed: October 3, 2022
Report issued: October 3, 2022
THEM Project #: T22-18178

Prepared by:

T. HARRIS ENVIRONMENTAL MANAGEMENT INC.

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Prepared for:
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Project Coordinator

A&O Contracting Inc.
2355 Royal Windsor Dr, Unit 6
Mississauga, Ontario, L5J 4S8

EXECUTIVE SUMMARY

T. Harris Environmental Management Inc. (THEM) performed non-viable mould air sampling within one (1) residential suite at 1 Auk Trail located in Lindsay, Ontario. The assessment was conducted on October 3rd, 2022, at the request of Nemanja Zolak at A&O Contracting Inc. The objective of this assessment was to determine the conditions of air quality post remediation activities inside the suite.

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. The spaces are safe for occupancy.

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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October 3, 2022

A&O Contracting Inc.
2355 Royal Windsor Dr, Unit 6
Mississauga, Ontario, L5J 4S8

Attn: **Nemanja Zolak**
Project Coordinator

Re: **Non-Viable Mould Air Sampling – Post Remediation - THEM #T22-18178**
1 Auk Trail, Lindsay, Ontario

1.0 BACKGROUND

T. Harris Environmental Management Inc. (THEM) performed non-viable mould air sampling within one (1) residential suite at 1 Auk Trail located in Lindsay, Ontario. The assessment was conducted on October 3, 2022, at the request of Nemanja Zolak at A&O Contracting Inc. The objective of this assessment was to determine the conditions of air quality post remediation activities inside the suite.

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 October 3rd, 2022, to conduct air sampling for mould within the residence which had mould remediation activities completed. Results of the airborne mould sampling conducted by THEM personnel are summarized below in **Table II** below. A total of three (3) indoor residence samples, one (1) interior control sample, and one (1) exterior control sample were collected. The Laboratory Certificate of Analysis can be found in **Appendix II**.

Table II
Summary of Non-Viable Mould Air Sampling Results
1 Auk Trail, Lindsay, Ontario
October 3rd, 2022

Sample / Location	Total Spores (spores/m^3)	Fungal Material Type	Concentration (count/m^3)	Percentage of Sample (%)	Percentage of Outdoors (%)
Outdoor reference	3147	*Alternaria* spp.	13	<1	-
		Ascospores	200	6	
		Aspergillus spp. / *Penicillium* spp.	133	4	
		Basidiospores	320	10	
		Cladosporium spp.	733	23	
		Colourless	1667	53	
		Smuts, *Periconia* spp., Myxomycetes	80	3	
1 - Interior Control	627	*Alternaria* spp.	40	6	308
		Ascospores	53	8	27
		Aspergillus spp. / *Penicillium* spp.	160	26	120
		Basidiospores	133	21	42
		Cladosporium spp.	267	43	36
		Colourless	320	51	19
		Smuts, *Periconia* spp., Myxomycetes	27	4	34
Kitchen	560	Ascospores	27	5	14
		Aspergillus spp. / *Penicillium* spp.	40	7	30
		Basidiospores	107	19	33
		Cladosporium spp.	253	45	35
		Colourless	107	19	6
		Polythrincium spp.	13	2	N/A
		Smuts, *Periconia* spp., Myxomycetes	13	2	16
Near door 2135	533	Ascospores	67	13	34
		Aspergillus spp. / *Penicillium* spp.	13	2	10
		Basidiospores	120	23	38
		Cladosporium spp.	253	47	35
		Colourless	67	13	4
		Smuts, *Periconia* spp., Myxomycetes	13	2	16
Near door 2132	1200	Ascospores	187	16	94
		Aspergillus spp. / *Penicillium* spp.	107	9	80
		Basidiospores	147	12	46

Sample / Location	Total Spores (spores/m³)	Fungal Material Type	Concentration (count/m³)	Percentage of Sample (%)	Percentage of Outdoors (%)
		Cladosporium spp.	373	31	51
		Colourless	200	17	12
		Epicoccum spp.	13	1	N/A
		Pithomyces spp.	27	2	N/A
		Rusts	27	2	N/A
		Smuts, *Periconia* spp., Myxomycetes	120	10	150

- 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. Remediation, disinfection, and cleaning activities were successful.

4.2 Summary of Airborne Mould Identified

The following briefly describes the moulds identified:

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

- **Ascospores** are sexual mould spores produced in an ascus. Ascospores can be produced by over 3000 various mould genera.

- ***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.

- ***Cercospora* spp.** growth is not typically found indoors, grows outdoors as a parasite on higher plants.

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

- ***Drechslera/Biopolaris spp.*** are common moulds ubiquitous in outdoor environments, also common indoors on a variety of substrates.

- ***Epicoccum spp.*** is a common mould ubiquitous in outdoor air; grows indoors on many substrates, including paper, textiles and insects.

- ***Fusarium* spp.** a common mould ubiquitous in outdoor air; occasionally found indoors on a variety of substrates, however, requires very wet conditions.

- **Myxomycetes** are common moulds (~ 45 genera) ubiquitous in outdoor air and occasionally found growing indoors. While a few are distinctive, many of the myxomycete spores are difficult to distinguish from the smuts. These spores are placed in the group "smuts, myxomycetes, Periconia," due to their similar "round, brown" morphology.

- ***Penicillium spp.*** is a common mould ubiquitous in outdoor environments, often found in soils and decaying plant debris. They are a common allergen and one species of *Penicillium* (P. marneffei) is known to produce mycotoxins.

- ***Periconia spp.*** are common mould ubiquitous in outdoor air, however rarely found growing indoors. Generally, it is difficult to distinguish *Periconia* spores from the smuts, myxomycetes and other round, brown spore types.

- ***Pithomyces spp.*** is a common mould ubiquitous in outdoor air, rarely found indoors, however, can grow on paper.

- **Rusts** are common moulds ubiquitous in outdoor environments. Rusts do not grow indoors unless their host plants are present. They are parasitic plant pathogens and need a living host for growth.

- **Smuts** are common moulds ubiquitous in outdoor air. Smuts do not normally grow indoors; they are parasitic plant pathogens that require a living host for the completion of their life cycle.

- ***Stachybotrys spp.*** is a genus of moulds that can grow on material with high cellulose content such as wallboard, jute, wicker, straw baskets, and other paper materials. Materials that are chronically moist or water damaged promote the growth of these organisms. This organism is known to produce mycotoxins.

- ***Ulocladium spp.*** is a common mould ubiquitous in outdoor air. It is widespread indoors, found on gypsum board, paper, paint, tapestries, jute, and other straw materials. *Ulocladium spp.* has a high-water requirement.

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. The spaces are safe for occupancy.

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.

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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. Health Canada, Fungal Contamination in Public Buildings – Health Effects and Investigation Methods, 2004

APPENDIX II
LABORATORY CERTIFICATES

emcscientific
INCORPORATED

Laboratory Analysis Report

To:

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

EMC LAB REPORT NUMBER: 86938
Job/Project Name: 1 Auk Trail, Lindsay, ON
Job/Project No: 18178 **No. of Samples:** 5
Sample Type: Air-O-Cell **Date Received:** Oct 3/22
Analysis Method(s): Fungal Spore Counting
Date Analyzed: Oct 3/22 **Date Reported:** Oct 3/22
Analyst: Weizhong Liu, Ph.D., *Mycologist*
Approved By: Fajun Chen, Ph.D., *Principal Mycologist*

Client's Sample ID	**1**			**2**			**Kitchen**			**2135**			**2132**		
EMC Lab Sample No.	369893			369894			369895			369896			369897		
Sampling Date	Oct 3/22			Oct 3/22			Oct 3/22			Oct 3/22			Oct 3/22		
Description/Location	Indoor reference			Outdoor reference			Kitchen area			Near door 2135			Near door 2132		
Air Volume (m^3)	0.075			0.075			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	3	4	40	1	0	13									
Arthrinium															
Ascospores	4	5	53	15	6	200	2	5	27	5	13	67	14	16	187
Aspergillus/Penicillium type	12	15	160	10	4	133	3	7	40	1	3	13	8	9	107
Basidiospores	10	13	133	24	10	320	8	19	107	9	23	120	11	12	147
Cercospora															
Chaetomium															
Cladosporium	20	26	267	55	23	733	19	45	253	19	48	253	28	31	373
Colorless	24	31	320	125	53	1667	8	19	107	5	13	67	15	17	200
Curvularia															
Drechslera/Bipolaris group															
Epicoccum													1	1	13
Fusarium															
Nigrospora															
Oidium															
Pithomyces													2	2	27
Polythrincium							1	2	13						
Rusts													2	2	27
Smuts, *Periconia* , Myxomycetes	5	6	67	6	3	80	1	2	13	1	3	13	9	10	120
Stachybotrys															
Ulocladium															
Unidentified spores															
Number of spores/sample	78			236			42			40			90		
Fungal fragments (0-3 +)	0+			0+			0+			0+			0+		
Non-fungal material (0-3 +)	2+			2+			2+			1+			3+		
TOTAL SPORES/M^3	**1,040**			**3,147**			**560**			**533**			**1,200**		

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.