June 9, 2017
Our File: C-7711-2

Via Email: jmorgan@chatsworth.ca

Township of Chatsworth
316837 Highway 6
Chatsworth, ON N0H 1G0

Attention: Mr. Jamie Morgan

Re: Pre-Abatement Mold Assessment
Chatsworth Arena – 5 Toronto Street
Township of Chatsworth

Dear Jamie,

As per your request, GM BluePlan Engineering Limited (GMBP) provides this letter report as a summary of the pre-abatement site inspection and air quality sampling program within the Chatsworth Arena, located at 5 Toronto Street in Chatsworth,ON.

As part of a previous preliminary investigation of the dressing room area, a scoped inspection and sampling program were completed by GMBP personnel in September of 2014. At that time, a hot-water pipe within the Mechanical Room was damaged and leaked onto the floor in Dressing Room # 4. As a result of the water release, mold growth and visible surface mold was identified on the floor and walls of the dressing room. Therefore, the scoped mold assessment included a visual inspection of the post-abatement conditions and completion of an air quality sampling program within Dressing Room # 4 to assess the efficacy of the abatement efforts and to determine the post-abatement air quality in that portion of the arena. Analysis of the air samples suggested that the mold abatement efforts completed by the Township were sufficient at that time.

Following the completion of the scheduled building condition assessment, further water damage to the soffit and fascia and roofline of the Zamboni room was identified and an additional site inspection and sampling program was conducted in the arena on May 25, 2017, at which time GMBP personnel attended the subject building. The assessment included a visual inspection of the interior conditions and the extent of surface mold growth throughout the arena. Additionally, an air quality sampling program pertaining to airborne fungal spores was conducted to identify the presence and types of airborne fungal spores and measure their concentrations within the arena prior to determining if restoration efforts are feasible within the building. This report is provided as a general summary of the inspection and analytical findings, and provides a general scope of work related to the potential completion of abatement activities.

BACKGROUND INFORMATION

Based on discussions with the client, it appears that there has been historical water damage and subsequent mold growth within the Zamboni room and main arena area over a period of several years. Reportedly, severe rot of the fascia and soffit of the roofline of the Zamboni room has caused subsequent water damage (partial ceiling collapse was noted during the site investigation). Evidence of water damage was observed (including staining and visual mold growth) on portions of the ceiling within the Zamboni room at the time of the site visit. Additionally, mold growth was noted on the trusses within the main arena area, where water damage and staining was observed.

GMBP was retained to conduct pre-abatement air quality sampling efforts to document the air quality within the arena in order to assist with planning and coordination of potential abatement efforts. This preliminary inspection and mold assessment, as described below, was conducted to provide a general scope of work related to the mold remediation and abatement activities and to provide support to an abatement contractor, should abatement efforts be coordinated.

PRE-ABATEMENT INSPECTION & SAMPLING PROGRAM

GMBP personnel attended the site on May 25, 2017 to conduct a preliminary inspection of the arena and to assess the general extent of mold growth in the affected areas. The general conditions within the arena were documented and an inspection of the accessible surfaces was completed. The relative humidity, surface moisture content, and air temperature were measured and recorded throughout the arena using a thermo-hygrometer/psychrometer to document the interior conditions as they relate to the potential growth and proliferation of mold.

Based on the extent of mold growth and the interior conditions, a pre-abatement air sampling program was developed in consultation with the client and completed simultaneous with the onsite inspection.

A preliminary visual inspection was completed within the Zamboni room, Mechanical room, Dressing Room # 4 and main arena area, to evaluate the extent of mold growth and assess the potential extent of work that is required to remediate the mold issues. A discussion of the inspection findings pertaining to mold growth in the arena is presented below.

General Inspection Findings

The relative humidity, surface moisture, and temperature of a given material are considered to be primary variables associated with potential mold growth and proliferation. These conditions were measured and documented in various locations throughout the arena to obtain a general measure of residual moisture that could potentially contribute to additional mold growth and/or degraded air quality.

The typical or desirable level of humidity in a building is an average relative humidity of about 35% to 45%. Based on a review of documented information, mold growth can occur when surface moisture is present on materials and the proliferation of most mold species can occur when the relative humidity in a localized area exceeds 75% to 80%. However, it should be noted that mold growth is also determined by the substrate and the individual mold species (i.e., a small amount of mold species prefer dry conditions and dry surfaces).

At the time of the site inspection, the measured relative humidity in the arena ranged between 62% to 67% with a measured average temperature of 17 degrees Celsius (63 degrees Fahrenheit). The measured level of humidity within the arena is considered to be slightly above the normal and desired range and is considered to represent residual moisture that could potentially contribute to associated mold issues.

At the time of the site inspection, evidence of mold and historical mold growth was noted in several locations within the arena. Evidence of former mold growth and water damage was observed on the ceiling within the Zamboni room and Dressing Room #4, and on the wood trusses within the main arena area.

The visible surface mold identified during the site visit was consistent with the leaking conditions that have been reported. Based on these documented conditions, air quality samples were collected at the corresponding locations as discussed in the following sections.

Sampling Program – Methodology

The air sampling program was completed by GMBP personnel following the initial inspection of the arena. A total of four air quality samples were collected including an exterior control sample, and three investigative air samples within the arena as summarized below. The samples were collected using a QuickTake 15 air sampling pump with a diaphragm sample inlet and Zefon Air-O-Cell spore traps. The sample pump was calibrated to a flow rate of 15 litres per minute (L/M) and each air sample was conducted for a sampling duration of 5 minutes.

The air quality samples were submitted to EMC Scientific Incorporated (EMC) for mold analysis including total fungal spore count and identification. Air samples were collected at selected locations to assess the air quality within designated portions of the arena. Additionally, an exterior control sample was collected from a non-affected exterior location in order to establish background mold species and levels in the area of the subject property, which is consistent with standard sampling procedures and methodology.

A summary of the samples and their locations is provided as follows:

- SA-1: Collected from the Zamboni room, where evidence of mold growth was apparent on the ceiling.
- SA-2: Collected from Dressing Room # 4, where evidence of mold growth had previously been identified.
- SA-3: Collected from the trusses above the arena floor, to evaluate the air quality pertaining to fungal spores in this portion of the arena.
- SA-4: Exterior control sample collected on the south side of the building.

It is of note that the sample collected from the main arena area (i.e., SA-3) was collected from the lower trusses of the arena roof due to the accessibility at the time of the sampling program. The majority of the mold and water damage was noted on the top wooden trusses, approximately 15 to 20' above the lower trusses.

Analytical Findings

A copy of the Laboratory Analysis Report from EMC is presented in Appendix "A". Based on the laboratory report, typical types of indoor fungal spores were measured in the interior air samples.

When interpreting mold analysis, indoor levels of fungal spores are typically considered to be "normal" when they are similar to, or generally consistent with outdoor levels of fungal spores. However, during the winter months, indoor levels of fungal spores are commonly identified as being greater than the outdoor levels. Generally, when concentrations of fungal spores are reported and when the *interior* to *exterior* ratio of specific mold species is greater than 10 times, it is a sign that potential mold amplification may be occurring within the interior environment.

The analytical data indicates that elevated levels of Ascospores, *Aspergillus/Penicillium* mold species (sp.), Basidiospores, and *Cladosporium* sp., were identified within the interior samples collected. Of note, the highest measured concentrations are reported from the exterior control sample, and therefore, the elevated interior levels are considered to be generally consistent with or below the background concentrations in most cases.

Based on the analytical results, there is evidence of airborne fungal spores identified within the arena. A more detailed discussion of the analytical findings is provided in the following section. The analytical results are attached for your reference and a copy of the laboratory analytical report is presented in Appendix "A".

DISCUSSION OF ANALYTICAL FINDINGS

Based on our understanding of existing literature, and on a review of available documentation, we provide the following discussion regarding the analytical results.

Ascospores are considered to be a ubiquitous fungal spore and are frequently identified within the interior environment where moisture and damp construction materials are present. Studies indicate that there are known allergenic and toxigenic properties but are highly variable based on the varying nature of the genus and species.

The *Aspergillus/Penicillium sp.* identified within the samples are considered to be a very common type of mold that is widely distributed throughout indoor and outdoor environments and has approximately two hundred different species and varieties. These spore types are common to many different substrates including water damaged indoor environments such as damp wall cavities, wet construction materials, drywall/gypsum board, wet carpets, and soil. Various studies indicate that based on the nature of this type of mold, the amount of airborne spores of *Aspergillus* species in indoor air can be higher than the levels identified in the outdoor air at any given time. The pre-abatement analytical data indicates that concentrations of *Aspergillus/Penicillium sp.* within the Dressing Room # 4 of the arena are elevated (i.e., 280 spores/m^3) compared to the exterior control sample (i.e., 93 spores/m^3). Some of the individual species within this genus have known allergenic properties. However, these species are considered to be ubiquitous and are described as one of the most common fungal genera worldwide. Based on the measured interior concentrations, the levels of *Aspergillus/Penicillium sp.* appear to indicate a residual moisture and/or a potential ongoing mold issue within the dressing room.

Basidiospores are described as ubiquitous in the exterior environment and are known to have a widespread distribution. Of particular significance, some of the species are documented to be the agent of "dry rot" causing white and brown wood rot and has been studied and documented to be particularly destructive to the structural wood of buildings. The highest interior concentrations were measured in the area of the arena trusses and in the Zamboni room where evidence of severe wood rot in the roof, soffit board, and fascia has been noted during completion of the building condition assessments.

The *Cladosporium* species identified within the sample collected from the main arena area is described as being a ubiquitous species that is considered one of the most common indoor and outdoor fungal species. Cladosprium genera has a worldwide distribution. *Cladosporium sp.* is prone to airborne transport and can be widely distributed throughout various *indoor* environments such as textiles, wood, and window sills, and is frequently found indoors at elevated levels in water-damaged environments.

Of significance is the fact that the fungal spore is recognized as a common and important allergen. Based on ongoing scientific research, *Cladosporium sp.* is considered to be a potential cause of respiratory problems in certain individuals and is a common cause of Type I allergies (i.e., produces an immediate response such as hay fever, asthma, hives, etc). *Cladosporium* concentrations in the pre-abatement sampling were reported as high as 640 spores/m^3, which is elevated when compared to the reported exterior control sample (i.e., 267 spores/$m^{3)}$.

It is our understanding that the presence of mold species at the subject building, and exposure to mold does not guarantee that health problems will arise for all residents of the building. However, it is well documented that some people are more sensitive to molds and are more susceptible to suffering various symptoms such as asthma, headaches, irritation of the mouth, nose, and throat, and difficulty concentrating that may occur from exposure to certain fungal spores.

RECOMMENDATIONS

The measured mold concentrations and the analytical findings indicate slightly elevated mold concentrations at the identified locations within the building. The interior concentrations are generally consistent with the exterior except where noted herein. However, the presence of the identified fungal spores in the building and the reported water damage suggest that ongoing/residual moisture and mold growth are likely to be an ongoing issue in the arena. The appropriate removal and/or cleaning, sealing, and encapsulation of all impacted surfaces and building materials in the affected areas is recommended to reduce the potential for structural damage and/or human health effects that can arise from the presence of fungal spores. Building conditions that currently exist that may contribute to reduced ventilation, moisture accumulation or ongoing leakage, should be further evaluated and corrected to mitigate the potential for ongoing water damage and residual moisture.

Based on the measured concentrations and spore types within the building, the removal of the visible water damaged surfaces, and the correction of building conditions that may contribute to ongoing moisture issues is expected to sufficiently mitigate the mold issues.

Based on the pre-abatement inspection and analytical findings, the following standard practices and site specific activities are recommended as part of any planned abatement efforts:

- To prevent cross-contamination and reduce the potential for residual mold growth, any impacted contents of the building which consist of fabric materials, soft/porous surfaces, and clothing should be removed or concealed with poly sheeting.

- Abatement activities should be completed within designated, contained areas that are maintained under negative pressure and are vented to the exterior air. Additionally, fans and ventilation should include the use of HEPA filtration systems such as HEPA air scrubbers.

- It is recommended that the discharge/exhaust from the HEPA air scrubbers be directed to the exterior via an existing building opening (i.e., existing window or door) with the use of flex exhaust tubing.

- At the location of water damaged surfaces, the use of LGR dehumidifiers combined with heat should be employed to maintain a reduced relative humidity and to reduce the surface moisture of damaged materials.

- Removal and offsite disposal of any impacted materials from within the building.

- Cleaning and encapsulation of surface materials that are identified as being affected by surface mold using industry accepted compounds such as Concrobium, Microban, Benefact, or equivalent products.

- The abatement activities (i.e., removal of wallboard, handling and removal of contents, invasive procedures, abrasive techniques such as sanding, the use of fans, handling and movement of moldy materials, etc.) have the potential to disturb mold and mold spores and cause them to become airborne. As a result, the potential for respiratory exposure increases for the personnel responsible for completing these activities. Therefore, the use of personal protective equipment (PPE) where applicable is recommended, including the use of gloves, a half-face respirator with P-100/N-100 HEPA filter cartridges (or equivalent), disposable clothing/suits (i.e., one-piece tyvek suits) as required. The use of PPE shall be at the discretion, and be the responsibility of the Restoration Contractor.

- Should the use of disposable clothing/suits be implemented by contractor personnel, the suits should be removed within the containment area(s) and placed in sealed disposal bags for offsite disposal.

- A post-abatement air sampling program be completed to evaluate and confirm the post-remediation air quality relative to the pre-abatement conditions in terms of re-occupancy.

STATEMENT OF LIMITATIONS

The information in this report is intended for the use of the Township of Chatsworth and the associated Restoration & Abatement Contractor. Any decisions made by third parties on the basis of information provided in this report are made at the sole risk of the third parties. GM BluePlan Engineering Limited accepts no responsibility for damages incurred by any third parties as a result of any decisions or actions made as a result of this report.

This report outlines the pre-abatement mold assessment of building materials within the onsite building and identifies the nature and location of mold impacted materials and the measured air quality in the building at the sampled locations. The mold assessment included the inspection of accessible building materials within the portions of the building as described herein.

The assessment did not include inspection or sampling of inaccessible or concealed areas that are not specifically described herein such as wall and ceiling cavities, roofing materials, subsurface features, etc.

The condition of subsurface and/or concealed building materials may vary from those described within this report. This report is not to be considered to provide information regarding the structural condition of the specified materials.

Although comments are provided regarding the use of PPE, the health and safety requirements and the associated procedures for contractor personnel are the responsibility of the general contractor. GM BluePlan Engineering Limited accepts no liability for the implementation of site-specific H&S procedures.

GM BluePlan Engineering Limited cannot guarantee the accuracy or reliability of information provided by others. GM BluePlan Engineering Limited does not accept liability for unknown, unidentified, undisclosed or unforeseen building conditions that may be identified at a later date.

The conclusions pertaining to the pre-abatement condition of building materials and the interior air quality identified at the building are based on the visual observations and on analytical data from the sampling programs conducted at the specified locations.

The information represents the site conditions at the sampling points at the time of sampling only and is not a guarantee of future conditions and/or air quality. This report is believed to provide documentation of site conditions as of May 25, 2017.

I trust that this is sufficient for your use at this time. Please do not hesitate to contact me if you have any questions, or should you wish to discuss this further.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED
Per:

J.K. Weller Env. Tech., Dipl.

Per:

A. W. Bringleson, B.E.S., C.E.T.
JW/mz
Encl.

cc: File No. C-7711-2

APPENDIX A:
LABORATORY CERTIFICATE OF ANALYSIS

emcscientific INCORPORATED

Laboratory Analysis Report

To:

Jessica Weller
GM BluePlan Engineering Ltd.
1260 - 2nd Avenue East, Unit 1
Owen Sound, Ontario
N4K 2J3

EMC LAB REPORT NUMBER: 62208
Job/Project Name: Chatsworth Arena
Job/Project No: C-7711-1 **No. of Samples:** 4
Sample Type: Air-O-Cell **Date Received:** May 26/17
Analysis Method(s): Fungal Spore Counting
Date Analyzed: May 31/17 **Date Reported:** May 31/17
Analyst: Weizhong Liu, Ph.D., *Mycologist*
Approved By: Fajun Chen, Ph.D., *Principal Mycologist*

Client's Sample ID	**SA-1**			**SA-2**			**SA-3**			**SA-4**					
EMC Lab Sample No.	273883			273884			273885			273886					
Sampling Date	May 25/17			May 25/17			May 25/17			May 25/17					
Description/Location	Zamboni room			Dressing room #4			Main arena			Exterior control					
Air Volume (m^3)	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															
Arthrinium															
Ascospores	183	37	2440	42	28	560	62	12	827	600	44	8000			
Aspergillus/Penicillium type	3	1	40	21	14	280	3	1	40	7	1	93			
Basidiospores	124	25	1653	12	8	160	146	29	1947	400	29	5333			
Cercospora															
Chaetomium															
Cladosporium	14	3	187	13	9	173	48	9	640	20	1	267			
Colorless	172	35	2293	62	41	827	250	49	3333	350	25	4667			
Curvularia															
Drechslera/Bipolaris group															
Epicoccum															
Oidium															
Pithomyces															
Polythrincium															
Rusts															
Smuts, *Periconia*, Myxomycetes															
Stachybotrys															
Torula															
Ulocladium															
Unidentified spores															
Number of spores/sample	496			150			509			1377					
Fungal fragments (0-3 +)	0+			0+			0+			0+					
Non-fungal material (0-3 +)	2+			2+			2+			1+					
TOTAL SPORES/M^3	**6,613**			**2,000**			**6,787**			**18,360**					

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.

APPENDIX B:
SITE PHOTOGRAPHS

Pre-Abatement Mold Assessment - Chatsworth Arena (5 Toronto Street, Chatsworth)

Photo 1 - Water damage and mold growth observed within Zamboni Room.

Photo 2 - Wood trusses within main arena area, where evidence of water damage and mold growth was observed.

File No. C-7711-2
Photos - May 25, 2017

BluePlan ENGINEERING

Photo 3 - Mold growth observed on ceiling of Dressing Room # 4.

Photo 4 - Additional view of Dressing Room #4 where mold growth was observed.