Results of PCM Air Testing, Settled Dust Sampling and Bulk Sampling for the Determination of Asbestos Content

Room # 6238 and 6334, 1 Kings College Circle, Medical Sciences Building, University of Toronto Toronto, Ontario

Prepared for:

Mr. Doug Colby
Coordinator, Hazardous Construction Materials Group

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SEL Project Number 116217
Date of Issue: March 9, 2017
March 9, 2017

University of Toronto
255 McCaul Street, Level 4
Toronto, Ontario M5T 1W7

Attention: Mr. Doug Colby
Coordinator, Hazardous Construction Materials Group

RE: Results of PCM Air Testing, Settled Dust Sampling and Bulk Sampling for the Determination of Asbestos Content
Room # 6238 and 6334, 1 Kings College Circle, University of Toronto, Toronto, Ontario

1.0 BACKGROUND

On March 7, 2017, personnel from Safetech Environmental Limited (SEL) performed air sampling for airborne fibres (PCM) and sampling of settled dust on specified surfaces within the above noted areas. Sample locations were selected in consultation with Mr. Doug Colby and Laboratory Representatives from the University of Toronto. In addition, Dr. Maria Rozakis-Adcock, Associate Professor, Laboratory Medicine and Pathobiology, provided SEL with two (2) bulk samples to be analyzed for asbestos content. The asbestos bulk samples and settled dust samples were analyzed for the determination of asbestos content within Rooms # 6238 and 6334 of the Medical Sciences Building, Toronto, Ontario. Following sampling, the remediation contractor, Envirosafe, Inc. conducted surface cleaning within Room # 6334 adjacent to the shaft. It was reported that surface cleaning within Room # 6238 was to be completed on March 8, 2017.

PCM air sampling, dust sampling, and the submission of bulk samples were conducted at the request of Mr. Doug Colby on March 7, 2017, in response to ongoing concerns regarding the presence of suspect asbestos-containing dust within Room # 6238, 6334 and equipment stored therein. As such, the objective of our assessment was to determine if asbestos, a designated substance as defined under the Ontario Occupational Health and Safety Act, RSO 1990 c. 0.1, is present in settled dust and air within the aforementioned areas and to assess requirements for any further remedial action, if necessary.

2.0 METHODOLOGY

2.1 PCM Air Testing

Four air samples were collected using 25-mm three-piece filter cassettes containing a 0.8
µm cellulose ester membrane filter and equipped with a 50-mm electrically conductive extension cowl. The filter cassettes were attached to a high volume air sampling pump calibrated with a filter cassette in line to a known flow rate.

At the completion of air testing the samples were analyzed in accordance with U.S. National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods, Method 7400, Issue 2: Asbestos and other Fibres by PCM (August 15, 1994), using the asbestos fibre counting rules. As required by NIOSH Method 7400, field blanks were also analyzed to ensure that no contamination of the filters occurred during sampling or analytical procedures.

The quantitative working range of this method is 0.04 to 0.5 fibre/cc for a 1000 L air sample. The Limit of Detection (LOD) depends on sample volume and quantity of interfering dust, and is <0.01 fibre/cc for atmospheres free of interferences. Fibres less than approximately 0.25 µm in diameter will not be detected by this method. This analytical method gives an index of airborne fibres as it cannot differentiate between asbestos and other fibres. Other airborne particles that fall within the counting range criteria will act as positive interferences. Result of analysis has been field blank corrected and is reported as the concentration of fibres per cubic centimeter of air (f/cc).

2.2 Surface Sampling of Settled Dust - Microvacuum Sampling

Microvacuum sampling and analysis was conducted in accordance with ASTM D5755-09, “Standard Test Method For Microvacuum Sampling And Indirect Analysis Of Settled Dust By Transmission Electron Microscopy (TEM) for Asbestos Structure Number Surface Loading” and procedures outlined by Millette and Hays, 1994[1].

The sampling procedure used a modified air sampling cassette as a vacuuming collection device. A personal air sampling pump calibrated to 2 L/min was connected to a 0.45µm pore size 25-mm mixed cellulose ester (MCE) membrane filter cassette via Tygon tubing. The inlet of the cassette was then fitted with a one inch nozzle with the end of the nozzle cut at 45 degrees. A known area of the surface in question was vacuumed until no visible dust was observed or for 2 minutes if no visible dust was present. Upon completion of sampling, the samples were sent to an independent laboratory and analyzed for asbestos levels using ASTM Standard D5755-09. This test method positively identifies asbestos fibres from other fibre types in dust and provides an estimate of the surface loading of asbestos in the sampled dust. Results are reported as the number of asbestos structures per unit area of sampled surface (structures/cm²). Concentrations are based on the number of asbestos structures counted and the area analyzed.

2.3 Bulk Sampling for the Determination of Asbestos Content

Bulk samples of building materials suspected to contain asbestos were submitted by SEL in accordance with Section 3 of O. Reg. 278/05. Two bulk samples of dust were provided to SEL by Dr. Maria Rozakis-Adcock in a labeled sample vile dated March 2, 2017 for transportation to an independent laboratory.
Analysis for asbestos content was performed by the independent laboratory in accordance with the U.S. Environmental Protection Agency (EPA) Test Method EPA/600/R-93-116: Method for the Determination of Asbestos in Bulk Building Materials. June 1993. This method identifies the asbestos fibre content of building materials using polarized light microscopy (PLM) analytical techniques, with confirmation of presence and type of asbestos made by dispersion staining optical microscopy. This analytical method meets the requirements set forth in Section 3 of O. Reg. 278/05.

3.0 RESULTS

3.1 PCM Air Testing

Result of PCM air testing is summarized below in Table 1.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Sample Location</th>
<th>Start Time</th>
<th>Stop Time</th>
<th>Sample Volume (L)</th>
<th>Airborne Fibre Conc. (f/cc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-03-016</td>
<td>Room 6334 Adjacent to Shaft Door</td>
<td>3:21 PM</td>
<td>4:28 PM</td>
<td>1005</td>
<td>&lt;0.0026</td>
</tr>
<tr>
<td>2017-03-017</td>
<td>Centre of Room 6334</td>
<td>3:21 PM</td>
<td>4:28 PM</td>
<td>1005</td>
<td>&lt;0.0026</td>
</tr>
<tr>
<td>2017-03-018</td>
<td>Room 6238 Adjacent to Orbit Shaker</td>
<td>4:35 PM</td>
<td>5:42 PM</td>
<td>1005</td>
<td>&lt;0.0026</td>
</tr>
<tr>
<td>2017-03-019</td>
<td>Room 6238 Adjacent to Thermo Controller</td>
<td>4:35 PM</td>
<td>5:42 PM</td>
<td>1005</td>
<td>&lt;0.0026</td>
</tr>
</tbody>
</table>

3.2 Surface Sampling of Settled Dust

Results of settled dust sampling are summarized below in Table 2. Results are summarized according to the concentration of all asbestos structures detected. The Laboratory Certificates of Analysis are included in Appendix A.
### TABLE 2
Summary of Analysis for Determination of Asbestos Content in Settled Dust Microvacuum Sampling
Room # 6238 and 6334, 1 Kings College Circle, Toronto, Ontario
Sample Collection Date: March 7, 2017

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Surface</th>
<th>Asbestos Type</th>
<th>All Asbestos Structures (structures/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Room 6238, Thermal Controller Vent</td>
<td>Vent</td>
<td>Chrysotile L Amphibole</td>
<td>51,800</td>
</tr>
<tr>
<td>2</td>
<td>Room 6238, 2nd Shelf Adjacent to Thermal Controller Vent</td>
<td>Wood Shelf</td>
<td>Chrysotile</td>
<td>&lt;2,730</td>
</tr>
<tr>
<td>3</td>
<td>Room 6334 Adjacent to Shaft</td>
<td>Floor</td>
<td>Chrysotile</td>
<td>360,100</td>
</tr>
</tbody>
</table>

### 3.3 Bulk Sampling for the Determination of Asbestos Content

Results of analysis for the determination of asbestos content are summarized in Table 3. Materials have been classified as “ACM”, “Non-ACM”, “Suspected ACM” or “Presumed Non-ACM” based on analytical results. Materials classified as Suspected ACM or Presumed Non-ACM may require further analysis (depending on site-specific conditions) to verify whether the material should be classified as ACM or Non-ACM. Please refer to the Limitations section of this report for additional details. The Laboratory Certificate of Analysis is attached in Appendix B.

### TABLE 3
Bulk Sample Analytical Results of Determination of Asbestos Content
Room # 6238 and 6334, 1 Kings College Circle, Toronto, Ontario
Sample Collection Date: March 7, 2017

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Material Description</th>
<th>Sample Location</th>
<th>Asbestos Content</th>
<th>Material Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dust</td>
<td>Reported to be Collected within Room 6238, Centrifuge</td>
<td>None Detected</td>
<td>Non-ACM</td>
</tr>
<tr>
<td>2</td>
<td>Dust</td>
<td>Reported to be Collected within Room 6238, Centrifuge Filter</td>
<td>None Detected</td>
<td>Non-ACM</td>
</tr>
</tbody>
</table>
4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 PCM Air Testing

Results of PCM air testing indicated that at the time of sampling, the airborne fibre concentrations within Rooms # 6238 and 6334 were well below the occupational exposure limit for asbestos (0.1 fibres/cc) and the generally accepted post-abatement standard (0.01 fibres/cc). Based on these results, Rooms # 6238 and 6334 are deemed to be safe for general occupancy.

4.2 Surface Sampling of Settled Dust

In Canada, no provincial or federal regulations or guidelines exist with respect to settled dust sampling and interpretation of analytical results. In addition, at present, there is no direct correlation between asbestos structures in settled dust and exposure to human beings. However, a considerable number of studies with respect to settled dust sampling for asbestos using the microvacuum procedure and TEM analysis have been performed[1]. Based on results from these studies typical levels of asbestos in settled dust have been determined for various building conditions. Settled asbestos concentrations are considered to be low if less than 1,000 structures/cm$^2$ are detected, background if between 1,000 and 10,000 structures/cm$^2$ are detected, above background if levels are greater than 10,000 structures/cm$^2$, and high if levels are above 100,000 structures/cm$^2$. Levels above 100,000 structures/cm$^2$ are usually associated with an accidental release of asbestos. All of these guidelines are based on total asbestos structures and do not distinguish between fibres/structures greater or less than 5 µm.

Based on analytical results summarized in Table 2, chrysotile and L. Amphibole structures were detected in Sample 1 at “above background” levels (51,800 structures/cm$^2$) but below levels indicative of an accidental release of asbestos. Chrysotile structures were detected in Sample 2 at “background” levels (<2,730 structures/cm$^2$) while chrysotile asbestos structures were detected at levels above 100,000 structures/cm$^2$, which is typically associated with an accidental release of asbestos within Sample 3.

4.3 Bulk Sampling for the Determination of Asbestos Content

As results summarized in Table 3 indicate, asbestos was not detected in samples provided to SEL by Dr. Maria Rozakis-Adcock, Associate Professor, Laboratory Medicine and Pathobiology of dust and debris reported to have been collected from within the Centrifuge stored in Room # 6238.

4.4 Summary

Based on the results noted in Section 4.1, Rooms # 6238 and 6334 are deemed to be safe for general occupancy based on the results of PCM air testing. It should be noted that there is no direct correlation between the presence of asbestos structures in settled dust and the presence of airborne asbestos fibres meaning the presence of asbestos structures in settled dust will not necessarily result in these fibres becoming airborne.
5.0 LIMITATIONS

The information and recommendations detailed in this report were carried out by trained professional and technical staff in accordance with generally accepted environmental and industrial hygiene work practices and procedures. Recommendations provided in this report have been generated in accordance with accepted industry guidelines and practices. These guidelines and practices are considered acceptable as of the date of this report. In preparation of this report, Safetech Environmental Limited (SEL) relied on information including testing services provided by independent laboratories. Except as expressly set out in this report, SEL has not made any independent verification of this information provided by independent entities. The collection of samples at the location noted was consistent with the scope of work agreed-upon with the person or entity to whom this report is addressed and the information obtained concerning prior site investigations. As conditions between samples may vary, the potential remains for the presence of unknown additional contaminants for which there were no known indicators. The analytical method used meets the requirements of O. Reg. 278/05. However, small asbestos fibres may be missed by PLM due to resolution limitations of the optical microscope. Interfering binder/matrix and/or low asbestos content may also hinder positive identification by PLM. These conditions are common for vermiculite attic insulation (VAI) and non-friable organically bound (NOB) materials such as vinyl floor tiles, roofing materials, mastics and caulking and can lead to “false negative” results. If PLM analytical results for these types of materials indicate no asbestos detected they have been reported as “Presumed Non-ACM”. Due to limitations of the analytical method we cannot confirm that low quantities of asbestos are not present in these samples using solely PLM analysis. Additional analytical procedures should be considered for such materials to rule out false negative results. Table 1 of Ontario Regulation 278/05 indicates the required minimum number of bulk material samples to be collected from a homogeneous material. Depending on the type of material and size of area, typically 3, 5 or 7 samples should be analyzed and all deemed as negative (i.e. less than 0.5% asbestos) prior to confirming that the material sampled is non-asbestos. A single negative sample result is not considered to be sufficient evidence to confirm a material to be non-asbestos-containing.

Conclusions are based on site conditions at the time of inspection and can only be extrapolated to an undefined limited area around inspected locations. The extent of the limited area depends on building construction and conditions. SEL cannot warrant against undiscovered environmental liabilities. If any information becomes available that differs from the findings in this report, we request that we be notified immediately to reassess the conclusions provided herein. This report has been prepared for the sole use of the person or entity to who it is addressed. No other person or entity is entitled to use or rely upon this report without the express written consent of Safetech Environmental Limited and the person or entity to who it is addressed. Any use that a third party makes of this report, or any reliance based on conclusions and recommendations made, are the responsibility of such third parties. SEL accepts no responsibility for damages suffered by third parties as a result of actions based on this report.

Appendix A
Laboratory Certificate of Analysis – Microvacuum Sampling
# Test Report: Asbestos Analysis via Transmission Electron Microscopy ASTM Method D5755

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Area Sampled (cm²)</th>
<th>Asbestos Type</th>
<th>Asbestos Structures</th>
<th>Sensitivity (str/cm²)</th>
<th>Concentration (str/cm²)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1: Room 6238 Thermo controller Vent 551702311-0001</td>
<td>100</td>
<td>Chrysotile L. Amphibole</td>
<td>57</td>
<td>909</td>
<td>51800</td>
<td></td>
</tr>
<tr>
<td>S2: Room 6238 2nd Shelf adjacent to Thermo 551702311-0002</td>
<td>100</td>
<td>Chrysotile</td>
<td>&lt;3</td>
<td>909</td>
<td>&lt;2730</td>
<td></td>
</tr>
<tr>
<td>S3: Room 6334 Adjacent to Vault 551702311-0003</td>
<td>100</td>
<td>Chrysotile</td>
<td>108</td>
<td>3330</td>
<td>360000</td>
<td>Due to excessive particulate the analytical sensitivity of 1000 str/cm² as required by the method was not reached</td>
</tr>
</tbody>
</table>

**Analyst(s):**

Natalie D'Amico (3)

Matthew Davis or other approved signatory

The above report relates only to the items tested. This report may not be reproduced, except in full, without written approval by EMSL Analytical, Inc. Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Canada Inc. Mississauga, ON
Appendix B
Laboratory Certificate of Analysis – Asbestos Bulk Sampling
Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

### Client Sample ID: S1
**Sample Description:** ROOM 6238 - CENTRIFUGE

<table>
<thead>
<tr>
<th>TEST</th>
<th>Analyzed Date</th>
<th>Color</th>
<th>Non-Asbestos</th>
<th>Asbestos</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLM</td>
<td>3/07/2017</td>
<td>Gray</td>
<td>90% Fibrous</td>
<td>10% Non-Fibrous</td>
<td>None Detected</td>
</tr>
</tbody>
</table>

### Client Sample ID: S2
**Sample Description:** ROOM 6238 - CENTRIFUGE FILTER

<table>
<thead>
<tr>
<th>TEST</th>
<th>Analyzed Date</th>
<th>Color</th>
<th>Non-Asbestos</th>
<th>Asbestos</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLM</td>
<td>3/07/2017</td>
<td>Gray</td>
<td>90% Fibrous</td>
<td>10% Non-Fibrous</td>
<td>None Detected</td>
</tr>
</tbody>
</table>

**Analyst(s):**
- Romeo Samson
- PLM (2)

**Reviewed and approved by:**

Matthew Davis
or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Report amended: 03/08/2017 10:24:26 Replaces initial report from: 03/08/2017 09:36:36 Reason Code: Client-Change to Project

Printed: 3/08/2017 10:24AM
Appendix C
Site Photographs
P1 - Room 6238

View of Thermal Controller; settled dust was sampled at side-vent and confirmed to contain asbestos structures above “background” levels but not indicative of an accidental release.

P2 – Room 6331

View of floor/baseboard where settled dust was sampled and confirmed to contain asbestos levels above 100,000 structures/cm².
P3 – Room 6238
View of 2nd shelf where settled dust was confirmed to contain asbestos structures at “background” levels.

P4 – Room 6238
View of Centrifuge; bulk samples were reportedly retrieved by Dr. Maria Rozakis-Adcock.