September 17, 2017

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

Attn: Mr. Irfan Miraj, P.Eng., MHSc.
Manager, Hazardous Construction Materials Group

Re: Results of PCM and TEM Air Monitoring Program
September 12 and 14, 2017
University of Toronto – Medical Sciences Building
1 King's College Circle, Toronto, Ontario

1.0 INTRODUCTION

Safetech Environmental Limited (SEL) has been retained on September 12 and 14, 2017 to provide air monitoring services for the University of Toronto's Medical Sciences Building located at 1 King's College Circle, Toronto, Ontario M5S 1A8. Air sampling has been performed at the request of Mr. Irfan Miraj, Manager, Hazardous Construction Materials Group, to determine if airborne asbestos fibre concentrations are within acceptable and applicable limits. This report provides detail of air sampling conducted on September 12 and 14, 2017.

On September 12 and 14, 2017 SEL has collected a total of 20 representative samples, 0 location specific samples and 2 outdoor samples:

- Representative samples refer to locations that were uniformly selected and also upon occupant request. These "building-wide" air samples provide an overview of air quality with regard to airborne fibres.
- Location samples refer to samples taken pre- and post-asbestos clean-up in locations where asbestos-containing dust (>0.5%) were present.
- Outdoor reference samples were collected because asbestos fibres are naturally occurring.

2.0 SUMMARY OF CONCLUSIONS

The Medical Sciences Building air quality is not being negatively impacted by the presence of asbestos-containing building materials existing within the building. The building is deemed to be safe for general occupancy. In addition, although construction related work is being conducted at various locations within the Medical Sciences Building it does not appear that airborne fibres are being drawn into the heating, ventilation and air conditioning systems and negatively impacting the quality of air.

SEL has based above conclusions on the facts briefly described below:

- Of the 20 representative samples; all 20 samples indicate that at the time of sampling the airborne fiber concentrations were well below the TWA (time weighted average) of 0.1 fibers per cubic centimeter (f/cc), in accordance with Ontario Regulation 490/09, Designated Substances and also below 50% TWA; an action level followed by SEL.

- All 2 outdoor samples also indicated that at the time of sampling the airborne fiber concentrations were well below 0.1f/cc.

Please refer to Appendix A detailed spread sheets and technical reports of aforementioned samples. As explained in next section (3.1), other non-asbestos fibres and particles may interfere and result in higher fibre counts. Therefore the results shown in Appendix A do not reflect airborne concentrations of asbestos alone but for the purpose of this assessment, it is compared to the TWA for asbestos. Actual airborne asbestos fibre concentration may be lower than the values in Appendix A.

3.0 METHODOLOGY

3.1 Air Monitoring for Airborne Fibres

Phase contrast microscopy (PCM) air samples were retrieved within designated locations. The air samples were collected using a 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.

The air sampling pumps were calibrated to a flow rate of approximately 15 litres per minute. The air samples were collected using 25 mm three piece cassette with 50 mm electrically conductive extension cowl and mixed cellulose ester filter, 0.8 µm (recommended 0.45 to 1.2 in method) effective pore size, and back-up pad. The air 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.

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. The method gives an index of airborne fibres. Fibres less than approximately 0.25 µm in diameter will not be detected by this method. In addition, other airborne fibres and particles that fall within the counting range criteria may act as possible interferences. Demolition and construction related work areas where high levels of dust are present might overload the membrane and/or interfere with the analysis. As required by NIOSH Method 7400, blank

filters were submitted for analysis to ensure that no contamination of the filters occurred during sampling or analytical procedures. Analytical results, as reported in the result table of this report have been field blank corrected.

3.2 Transmission Electron Microscopy

Where PCM results indicate airborne fibres to be greater than 50% of the TWA, a secondary analysis of air samples was conducted using NIOSH Method 7402, Issue 2: Asbestos by TEM (August 15, 1994). This method is used to determine asbestos fibres in the optically visible range and has the ability to distinguish asbestos fibres from other types of fibres (e.g. clothing fibres). It is intended to complement the results obtained by phase contrast microscopy (NIOSH Method 7400).

In accordance with this method, a sample is analyzed at a magnification of 10,000 times. Only fibres with an aspect ratio of >3:1 and only those fibres greater than 5 µm in length are counted. The quantitative working range of this method is 0.04 to 0.5 fibres per cubic centimetre (f/cc) for a 1000 litre (L) air sample. The Limit of Detection (LOD) depends on sample volume and quantity of interfering dust, and is < 0.01 fibres per cubic centimetre (f/cc) for atmospheres free of interferences. Other amphibole particles that have asbestos ratios greater than 3:1 and elemental compositions similar to the asbestos minerals may interfere in the TEM analysis. Some non-amphibole minerals may give electron diffraction patterns similar to amphiboles. High concentrations of background dust may also interfere with fibre identification.

4.0 LIMITATIONS

The investigation, assessments and recommendations detailed in this report were carried out in a manner consistent with the level of care and skill normally exercised by reasonable members of the environmental and industrial hygiene consulting profession currently practicing under similar conditions in the area. Furthermore, the investigation, assessments and recommendations in this report have been made based on conditions observed at the time of the assessment and are limited to the areas investigated.

In preparing this report, Safetech Environmental Limited (SEL) relied on information supplied by others. Except as expressly set-out in this report, SEL has not made any independent verification of such information.

The analytical method used meets the requirements of O.Reg. 278/05. However, it is important to note that this method is not specific to the identification of asbestos fibres. All particles with a length greater than 5 micrometres, less than 3 micrometres in diameter and a length to diameter ratio of 3 to 1 or greater are included in the count. Fibres with diameters less than about 0.3 micrometres cannot be detected using this method regardless of length.

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.

Should you have any questions regarding this project, please contact our office.
Sincerely,

SAFETECH ENVIRONMENTAL LIMITED

Josh Hamilton
OH&S Technician

D. Glenn Smith, BA, CRSP, AMRT
Senior Project Manager

Appendices:

Appendix A – PCM Air Sample Spreadsheets – SEL
Appendix B – Pump Calibration Sheets
Appendix C – PCM Analysis Example Calculation Sheet

Appendix A
PCM AIR SAMPLE SPREADSHEET-SEL

Phase Contrast Microscopy Air Sampling Program, Medical Sciences Building, Floor 3, University of Toronto, September 14, 2017

Floor	Room	Description	Sample Location	Sample Number	Pump Number	Litres Per Minute	Time On	Time Off	Duration	Total Litres	Total Fibres	Results f/cc	Analyst	Within Acceptable Limits	Comments
3	3279	Janitor Closet	Central	2017-09-1930	10	15.06	8:48	10:02	74	1114.44	6	0.003	SC/GS	Yes	Vacant.
3	3292	Janitor Closet	Central	2017-09-1931	9	15.07	8:51	10:04	73	1100.11	4	0.002	SC/GS	Yes	Vacant.
3	3284	Lab	Central	2017-09-1932	7	15.05	8:54	10:07	73	1098.65	4	0.002	SC/GS	Yes	Vacant.
3	3287K	Corridor	Central	2017-09-1933	8	15.01	8:58	10:09	71	1065.71	8	0.004	SC/GS	Yes	Occupied.
3	3270	Lab	Central	2017-09-1934	6	15.03	9:00	10:12	72	1082.16	4	0.002	SC/GS	Yes	Vacant.
3	3376	Lab	Central	2017-09-1935	5	15.01	9:03	10:15	72	1080.72	2	0.001	SC/GS	Yes	Vacant.
3	3238	Lab	Central	2017-09-1936	5	15.01	10:21	11:37	76	1140.76	4	0.002	SC/GS	Yes	Vacant.
3	3335	Lab	Central	2017-09-1937	6	15.03	10:25	11:39	74	1112.22	2	0.001	SC/GS	Yes	Vacant.
3	3201K	Corridor	Central	2017-09-1938	8	15.01	10:29	11:43	74	1110.74	5	0.002	SC/GS	Yes	Occupied.
3	3321	Lab	Central	2017-09-1939	7	15.05	10:33	11:46	73	1098.65	1	<0.001	SC/GS	Yes	Vacant.
	Exterior Control	NA	South of Medical Sciences Building	2017-09-1940	9	15.07	10:37	11:51	74	1115.18	2	0.001	SC/GS	Yes	Exterior sample for comparison.
3	Field blank	NA	NA	2017-09-1941	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1942	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1943	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1944	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.

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Interpretation of Results
1) Within Ontario, the Occupational Health and Safety Act - Ontario Regulation 490/09 Designated Substances adopts the ACGIH TWA of 0.1 fibres/cc.

2) For each area tested compare the "Results f/cc" column to your area and how it compares to the above noted regulation.

Appendix B
PUMP CALIBRATION SHEET

Phase Contrast Microscopy Air Sampling Program, Medical Sciences Building, Floor 3, University of Toronto, September 14, 2017

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3	Field blank	NA	NA	2017-09-1941	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1942	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1943	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.
3	Field Blank	NA	NA	2017-09-1944	NA	NA	NA	NA	NA	NA	0	Not applicable	Not applicable	Not applicable	Required as per NIOSH Method 7400.

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Interpretation of Results
1) Within Ontario, the Occupational Health and Safety Act - Ontario Regulation 490/09 Designated Substances adopts the ACGIH TWA of 0.1 fibres/cc.

2) For each area tested compare the "Results f/cc" column to your area and how it compares to the above noted regulation.

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Pump Calibration Form

Calibration Device: BIOS DryCal DC Lite HV

Date: September 14, 2017

Name: Anthony Fiume

Temperature: 17°C

Barometric Pressure: 101kPa

Pump Number	Flow Rate (L/min)			Average Flow Rate (L/min)	Average Flow Rate (L/min) +10%	Average Flow Rate (L/min) - 10%
	Trial #1	Trial #2	Trial #3			
MSB -1						
MSB-2						
MSB -3						
MSB -4						
MSB-5	15.02	15.01	15.01	15.01	16.51	14.51
MSB -6	15.03	15.03	15.04	15.03	16.53	14.53
MSB -7	15.05	15.07	15.03	15.05	16.55	14.55
MSB-8	15.01	15.03	15	15.01	16.51	14.51
MSB -9	15.05	15.11	15.06	15.07	16.57	14.57
MSB -10	15.05	15.08	15.04	15.06	16.56	14.56

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Pump Calibration Form

Calibration Device: BIOS DryCal DC Lite HV

Date: September 12, 2017

Name: Josh Hamilton

Temperature: 22°C

Barometric Pressure: 101.6 kPa

Pump Number	Flow Rate (L/min)			Average Flow Rate (L/min)	Average Flow Rate (L/min) +10%	Average Flow Rate (L/min) - 10%
	Trial #1	Trial #2	Trial #3			
MSB -1						
MSB-2						
MSB -3						
MSB -4						
MSB-5	15.06	15.04	15.01	15.04	16.54	13.54
MSB -6	14.99	15.03	15.00	15.01	16.51	13.51
MSB -7	14.93	15.01	14.97	14.97	16.47	13.47
MSB-8	14.92	15.06	14.96	14.98	16.48	13.48
MSB -9	15.01	15.04	15.01	15.02	16.52	13.52
MSB -10	14.90	14.96	14.99	14.95	16.45	13.45

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Appendix C
PCM ANALYSIS EXAMPLE CALCULATION SHEET

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PCM Air Sample Analysis

Project Name:	U of T Medical Sciences Building		
Project Number:	119917		
Sample ID:	2017-09- 1916	Sample Type:	Ambient
Sample Collected By:	JH	Date:	September 12, 2017
Sample Analyzed By:	JC/GS	Date:	September 13, 2017
Sample Location:	4279 Lecture Hall		
Start Time:	7:32	Sample Duration (min)	70
Finish Time:	8:42	Flow Rate (L/min)	14.98

Volume (V)	1049	L	
Total Fibres Counted in Sample (FCS)	3	fibres	
Total Fields Counted in Sample (FLS)	100	fields	
Reticle Field Area (RFA)	0.00801	mm^2	
Area of Filter (AF)	385	mm^2	
NIOSH 7400 Counting Rules Used	A		
Fibre Density (E)		$fibres/mm^2$	E = (FCS/FLS)/RFA
Fibre Concentration (C)		fibres/cc	C = (E*385)/(V*1000)

1	-	11	.	21	-	31	.	41	-	51	.	61	.	71	.	81	-	91	-
2	.	12	-	22	-	32	.	42	.	52	.	62	.	72	-	82	-	92	-
3	-	13	-	23	.	33	-	43	.	53	-	63	.	73	-	83	.	93	.
4	.	14	.	24	.	34	-	44	.	54	.	64	.	74	-	84	-	94	-
5	-	15	.	25	-	35	-	45	.	55	-	65	1	75	-	85	-	95	-
6	-	16	-	26	.	36	.	46	.	56	.	66	.	76	-	86	-	96	-
7	.	17	.	27	.	37	.	47	.	57	.	67	.	77	.	87	-	97	1
8	.	18	.	28	.	38	.	48	.	58	.	68	-	78	.	88	-	98	-
9	-	19	.	29	.	39	1	49	-	59	-	69	.	79	.	89	-	99	-
10	-	20	-	30	.	40	.	50	.	60	.	70	-	80	.	90	-	100	-

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