ECOLOGICAL LOGISTICS & RESEARCH LTD.
ATTN: Chris Jastrebski
204 - 105 Titanium Way
Whitehorse YT Y1A 0E7

Date Received: 05-OCT-15
Report Date: 12-NOV-15 17:09 (MT)
Version: FINAL

Client Phone: 867-668-6386

Certificate of Analysis

Lab Work Order #: L1683409

Project P.O. #: NOT SUBMITTED
Job Reference: 15-210
C of C Numbers: 1
Legal Site Desc:

Jamie Lo, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1683409-1	L1683409-2	L1683409-3	L1683409-4	L1683409-5
Description	Water	Water	Water	Water	Water
Sampled Date	02-OCT-15	30-SEP-15	30-SEP-15	30-SEP-15	30-SEP-15
Sampled Time	09:30	11:45	14:30	15:00	16:50
Client ID	HL	CC1	CC2	CC3	WC
Grouping / **Analyte**					
WATER					
Physical Tests Hardness (as CaCO3) (mg/L)	322	337	471	426	379
pH (pH)	8.10	8.24	8.22	8.23	8.19
Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	10.7	25.3
Total Metals Aluminum (Al)-Total (mg/L)	0.0440	0.0525	0.0347	0.315	0.711
Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total (mg/L)	0.00071	0.00086	0.00120	0.00122	0.00138
Barium (Ba)-Total (mg/L)	0.061	0.063	0.058	0.066	0.077
Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total (mg/L)	0.0000493	0.0000347	0.0000541	0.0000548	0.0000462
Calcium (Ca)-Total (mg/L)	70.9	74.2	89.6	79.6	69.9
Chromium (Cr)-Total (mg/L)	<0.0010	0.0013	0.0010	0.0015	0.0023
Cobalt (Co)-Total (mg/L)	0.00047	0.00042	0.00074	0.00069	0.00070
Copper (Cu)-Total (mg/L)	0.0028	0.0028	0.0022	0.0028	0.0035
Iron (Fe)-Total (mg/L)	0.294	0.327	0.397	0.867	1.54
Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00071
Lithium (Li)-Total (mg/L)	0.0030	0.0033	0.0090	0.0062	0.0034
Magnesium (Mg)-Total (mg/L)	35.3	36.7	60.1	55.2	49.7
Manganese (Mn)-Total (mg/L)	0.276	0.181	0.170	0.149	0.127
Mercury (Hg)-Total (mg/L)	0.0000091	0.0000101	0.0000087	0.0000100	0.0000113
Molybdenum (Mo)-Total (mg/L)	0.0013	0.0014	0.0017	0.0014	0.0012
Nickel (Ni)-Total (mg/L)	0.0048	0.0063	0.0148	0.0115	0.0072
Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total (mg/L)	0.00162	0.00174	0.00162	0.00136	0.00110
Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total (mg/L)	3.0	3.1	4.4	4.3	4.3
Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	0.014	0.025
Uranium (U)-Total (mg/L)	0.00214	0.00231	0.00252	0.00285	0.00344
Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00128	0.00248
Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1683409-2, -3, -4, -5
Matrix Spike	Iron (Fe)-Total	MS-B	L1683409-2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L1683409-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

TSS-MAN-WR	Water	Total Suspended Solids by Gravimetric	APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

1

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Submitted To: Janie Lo
ALS Laboratory Group
8081 Lougheed Hwy., Suite 100
Burnaby BC V5A 1W9

REFERENCE DATA **Asbestos in Water by TEM**

Sample Type:	Drinking Water
Method Reference:	EPA Method 100.2
Client Sample No.:	L1683409-1 HL through L1683409-3 CC2
Sample Location:	L1683409
PO No.:	L1683409
ALS Work Order No.:	1510365
ALS Sample No.:	1510365-01 through 1510365-03

The samples indicated in this report were analyzed by Transmission Electron Microscopy (TEM) for asbestos using EPA Method 100.2 "Detection of Asbestos Structures >10μm in Length in Drinking Water". Sample collection is performed outside the laboratory and is the responsibility of the client. Samples must be received by the lab and filtered within 48 hours of collection. Should sample collection or submission deviate from any method requirement, interpretation of the results under strict EPA guidelines cannot be made.

Upon receipt by ALS, the samples are ultrasonically treated in their original containers for 15 minutes to suspend the solids and aliquots of the suspension are filtered onto 0.22μm pore size MCE filters. These filters are later carbon coated and mounted on TEM grids for analysis. Whenever possible, a sufficient volume is analyzed to yield the method recommended analytical sensitivity (AS) of <0.20MFL. This is equivalent to the detection of one confirmed asbestos fiber in the total area analyzed and is also referred to as limit of detection (LOD). However, since the volume analyzed is based on the filter loading which is a result of the clarity of the ultrasonicated sample, analysis of water samples containing large amounts of suspended solids may not reach the recommended LOD/AS.

Analysis is performed on an FEI Tecnai Spirit G2 Twin TEM with EDAX Genesis System. Results apply only to portions of samples analyzed. Original samples are disposed after sufficient filtration. Filters are disposed after 1 year, and grids analyzed are archived for a minimum of 3 years.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

Ohio Analyst #2268; Ohio Lab #4077
PA DEP Lab ID #68-01320; Cert. #003
NELAC accredited through New York ELAP (LAB #11371)

CLIENT: ALS Laboratory Group
SAMPLE LOCATION: L1683409

SAMPLE PREP DATA		***ANALYSIS DATA***	
Date Received:	10/8/2015	Date and Time Analyzed:	10/19/2015 & 13:30
Date Filtered:	10/8/2015	Magnification:	13,500x
Time Filtered:	11:15	Calibration Constant:	1 cm = 0.74μm
Filter Type:	MCE, 0.22μm	EDXA Resolution:	<175eV
Filter Size:	47mm	Accelerating Voltage:	100keV
Collection Area:	1075mm^2	Camera Constant:	129.25mm-Å

SAMPLE IDENTIFICATION			
Client Sample No.:	L1683409-1 HL	L1683409-2 CC1	L1683409-3 CC2
ALS Sample No.:	1510365-01	1510365-02	1510365-03
Date Sampled:	10/2/2015	9/30/2015	9/30/2015
Time Sampled:	Not Provided	Not Provided	Not Provided
Volume Filtered (L):	0.010	0.025	0.025
No. Grid Openings Analyzed:	4	4	4
Average Grid Opening Area:	0.0105	0.0105	0.0105
AS (MFL):	2.56	1.02	1.02
Asbestos Fibers ≥ 10 microns			
Chrysotile:	16	26	24
Amosite:	0	0	0
Crocidolite:	0	0	0
Act-Tremolite†:	0	1	0
Anthophyllite:	0	0	0
Total Asbestos ≥ 10 microns			
Count:	**16**	**27**	**24**
Concentration (MFL):	**40.95**	**27.64**	**24.57**

†Act-Tremolite concentrations include: Actinolite, as well as the Libby Amphiboles; Tremolite, Winchite, and Richterite.
AS= Analytical Sensitivity MFL= Millions of Fibers per Liter

NOTE: All samples were received past the method hold time of 48 hours but were analyzed per client request. Because samples contained a large amount of suspended solids, we could only filter a small volume without overloading the filters. Analysis was terminated upon completion of the fourth grid opening due to the high asbestos concentration.

Pamela Johnson
Analyst

Shawn Smythe
Project Manager

Ohio Analyst #2268; Ohio Lab #4077
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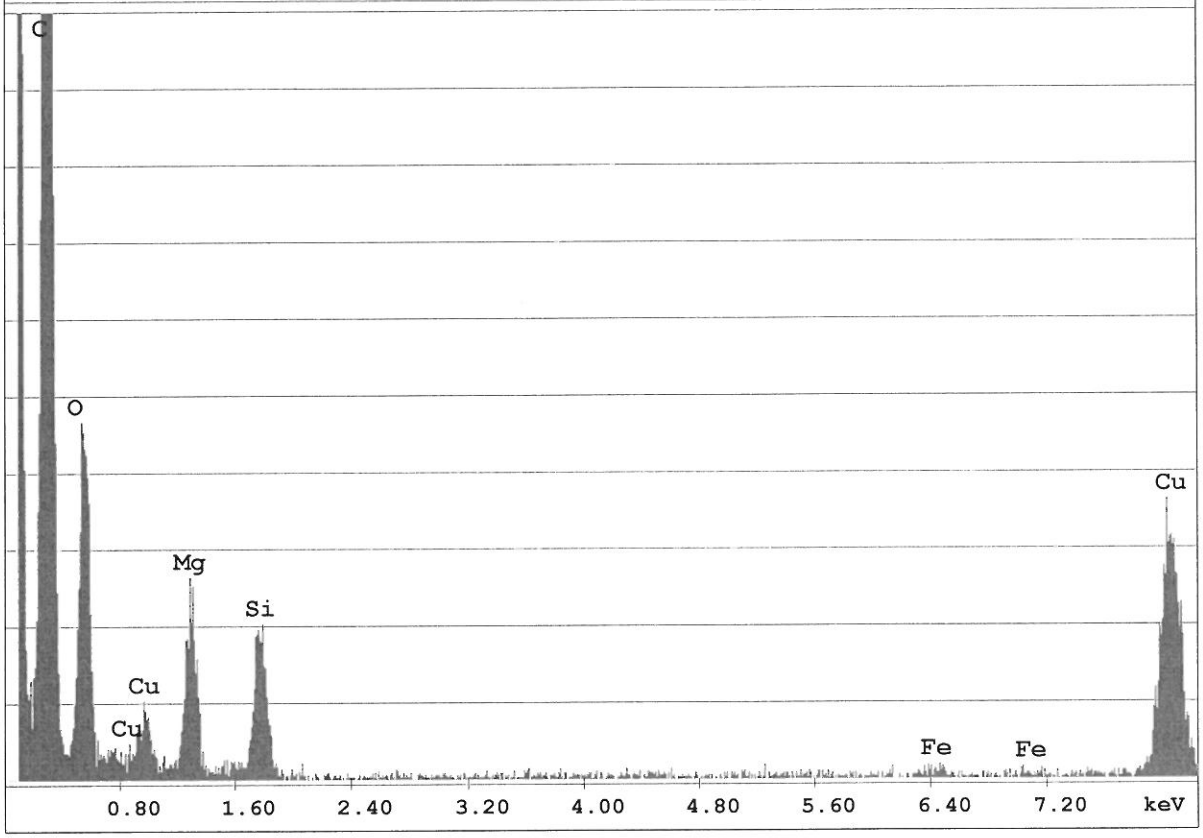
ALS Environmental
4388 Glendale-Milford Road, Cincinnati, Ohio 45242
Phone (513) 733 5336 Fax (513) 733 5347 www.alsenviro.com
A Campbell Brothers Limited Company

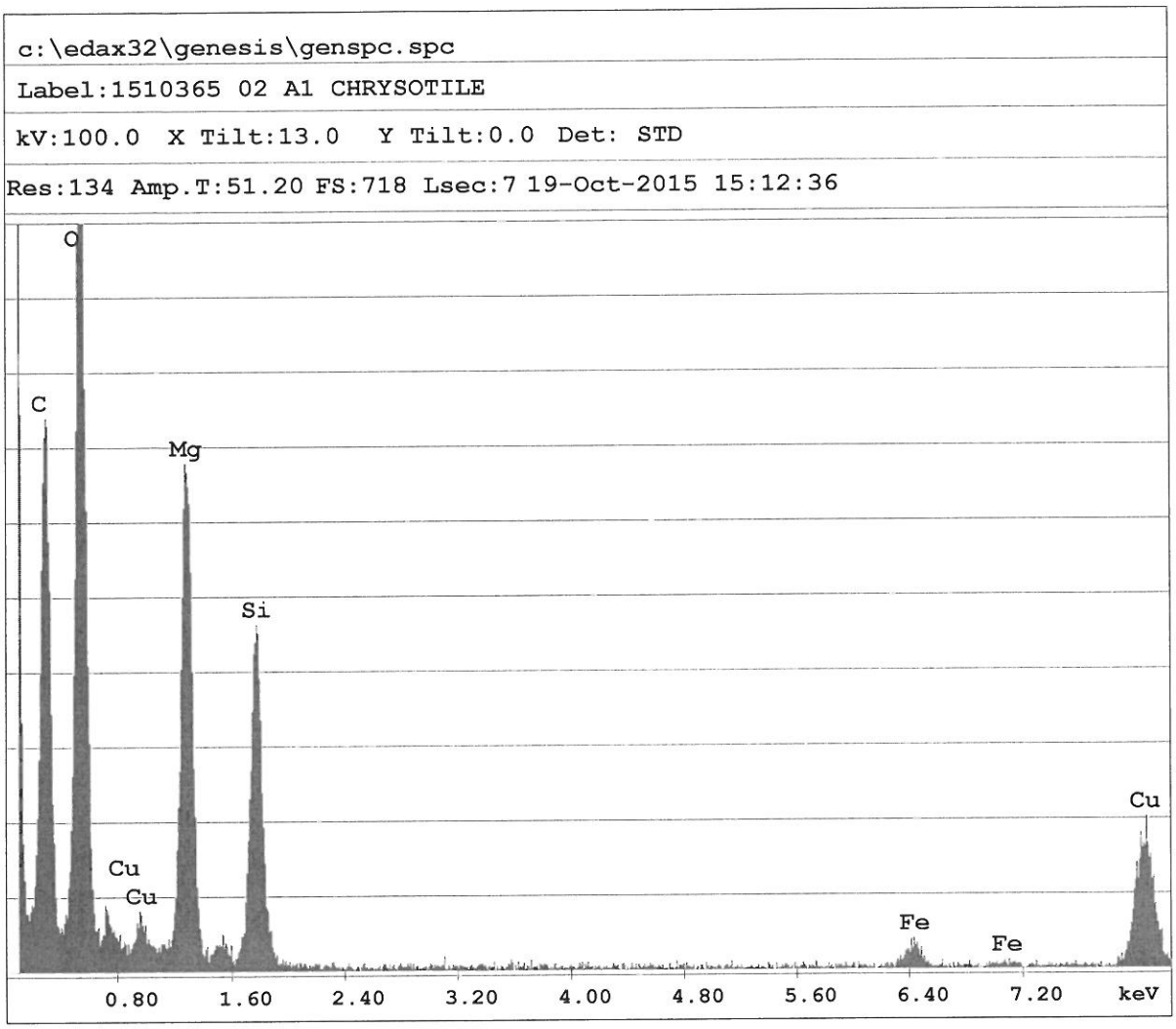
c:\edax32\genesis\genspc.spc

Label:1510365 01 A1 CHRYSOTILE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:379 Lsec:15 19-Oct-2015 14:51:02

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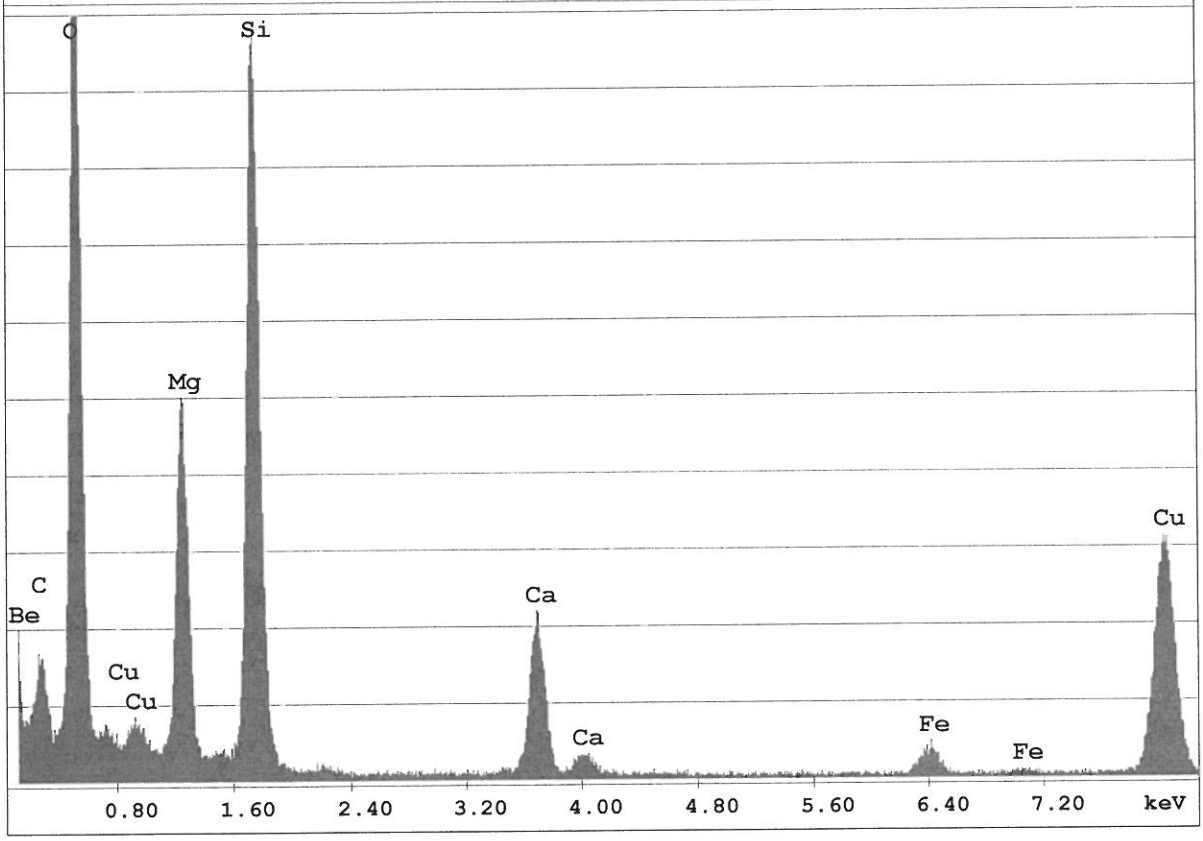
Label:1510365 02 A1 CHRYSOTILE
kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD
Res:134 Amp.T:51.20 FS:718 Lsec:7 19-Oct-2015 15:12:36
O
C
Mg
Si
Cu
Cu
Fe
Fe
Cu
0.80
1.60
2.40
3.20
4.00
4.80
5.60
6.40
7.20
keV

c:\edax32\genesis\genspc.spc

Label:1510365 02 A2 ACTINOLITE-TREMOLITE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:2074 Lsec:15 19-Oct-2015 15:18:10



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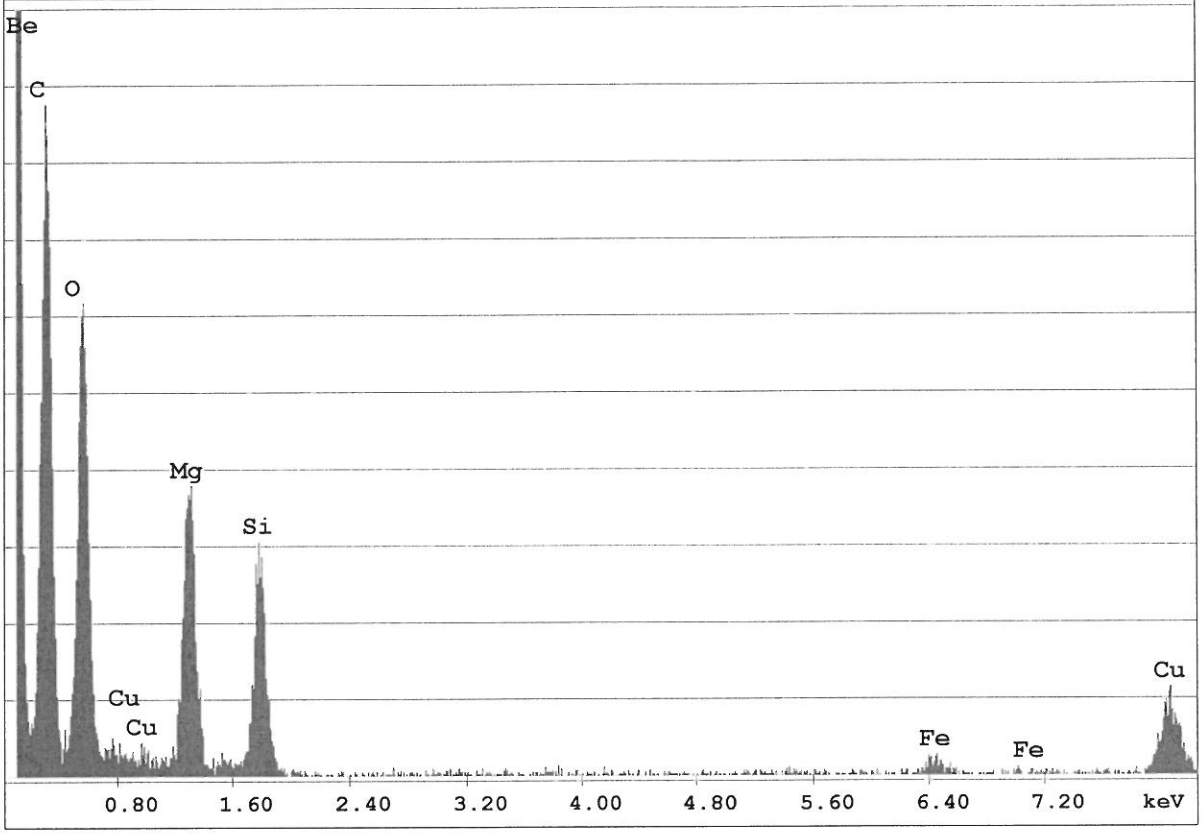
Label:1510365 03 A1 CHRYSOTILE

kV:100.0 X Tilt:13.0 Y Tilt:0.0 Det: STD

Res:134 Amp.T:51.20 FS:454 Lsec:5 19-Oct-2015 15:29:34



Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L1683409-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Ecological Logistics & Research Ltd.	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3 pm - business days)
Contact:	Chris Jastrebski	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address:	204-105 Titanium Way Whitehorse, YT Y1A 0E7	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Phone:	867.668.6386	Email 1 or Fax: chris@elr.ca, patricia.randell@gov.yk.ca	Specify Date Required for E2,E or P:
		Email 2: kmartens@minnow.ca	

Invoice To	Same as Report To ☑ Yes ☐ No	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Company:	Ecological Logistics & Research Ltd.	Email 1 or Fax: chris@elr.ca	
Contact:	Chris Jastrebski	Email 2: Patricia.Randell@gov.yk.ca	

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q52337	Approver ID:	Cost Center:
Job #:	15-210	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	Total Metals and Mercury	Asbestos	pH									Number of Containers
						P											
	HL	02-Oct-15	9:30	Water	R	R	R	R									4
	CC1	30-Sep-15	11:45	Water	R	R	R	R									4
	CC2	30-Sep-15	14:30	Water	R	R	R	R									4
	CC3	30-Sep-15	15:00	Water	R	R		R									3
	WC	30-Sep-15	16:50	Water	R	R		R									3

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
5.0			12 coolers 8	C Avg	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Chris Jastrebski	Date: Oct 15/15	Time: 17:70	Received by: Bruno	Date: 5 Oct 15	Time: 16:30 5:08	Received by: Shafee	Date: Oct.6	Time: 1800

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY