



HEMMERA ENVIROCHEM INC.
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Whitehorse YK Y1A 0K7

Date Received: 22-JAN-16
Report Date: 02-FEB-16 13:31 (MT)
Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1726304
Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.15
C of C Numbers: 1
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1726304-1	
Description	Water	
Sampled Date	19-JAN-16	
Sampled Time	11:30	
Client ID	E7	
Grouping	Analyte	
WATER		
Physical Tests	Conductivity (uS/cm)	1150
	Hardness (as CaCO3) (mg/L)	790
	pH (pH)	7.53
	Total Suspended Solids (mg/L)	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0343
	Nitrate (as N) (mg/L)	0.130
	Nitrite (as N) (mg/L)	<0.0020 ^{DLA}
	Phosphorus (P)-Total (mg/L)	0.0038
	Sulfate (SO4) (mg/L)	471
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	8.64
Total Metals	Aluminum (Al)-Total (mg/L)	0.0078
	Antimony (Sb)-Total (mg/L)	0.00026
	Arsenic (As)-Total (mg/L)	0.00050
	Barium (Ba)-Total (mg/L)	0.0750
	Beryllium (Be)-Total (mg/L)	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050
	Boron (B)-Total (mg/L)	0.080
	Cadmium (Cd)-Total (mg/L)	0.0000655
	Calcium (Ca)-Total (mg/L)	135
	Chromium (Cr)-Total (mg/L)	0.00052
	Cobalt (Co)-Total (mg/L)	0.00127
	Copper (Cu)-Total (mg/L)	0.00113
	Iron (Fe)-Total (mg/L)	0.154
	Lead (Pb)-Total (mg/L)	<0.000050
	Lithium (Li)-Total (mg/L)	0.0237
	Magnesium (Mg)-Total (mg/L)	114
	Manganese (Mn)-Total (mg/L)	0.624
	Mercury (Hg)-Total (mg/L)	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00139
	Nickel (Ni)-Total (mg/L)	0.0189
	Phosphorus (P)-Total (mg/L)	<0.050
	Potassium (K)-Total (mg/L)	1.49
	Selenium (Se)-Total (mg/L)	0.000999
	Silicon (Si)-Total (mg/L)	5.42
	Silver (Ag)-Total (mg/L)	<0.000010
	Sodium (Na)-Total (mg/L)	8.91

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1726304-1 Water 19-JAN-16 11:30 E7				
Grouping	Analyte				
WATER					
Total Metals	Strontium (Sr)-Total (mg/L)	0.937			
	Sulfur (S)-Total (mg/L)	166			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Uranium (U)-Total (mg/L)	0.00507			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030			
	Zirconium (Zr)-Total (mg/L)	0.00142			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD			
	Dissolved Metals Filtration Location	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	0.0039			
	Antimony (Sb)-Dissolved (mg/L)	0.00025			
	Arsenic (As)-Dissolved (mg/L)	0.00037			
	Barium (Ba)-Dissolved (mg/L)	0.0730			
	Beryllium (Be)-Dissolved (mg/L)	<0.000020			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	0.075			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000715			
	Calcium (Ca)-Dissolved (mg/L)	133			
	Chromium (Cr)-Dissolved (mg/L)	0.00045			
	Cobalt (Co)-Dissolved (mg/L)	0.00120			
	Copper (Cu)-Dissolved (mg/L)	0.00118			
	Iron (Fe)-Dissolved (mg/L)	0.085			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0231			
	Magnesium (Mg)-Dissolved (mg/L)	111			
	Manganese (Mn)-Dissolved (mg/L)	0.599			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00133			
	Nickel (Ni)-Dissolved (mg/L)	0.0182			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.43			
	Selenium (Se)-Dissolved (mg/L)	0.00102			
	Silicon (Si)-Dissolved (mg/L)	5.26			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			
	Sodium (Na)-Dissolved (mg/L)	8.44			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1726304-1	Water	19-JAN-16	11:30	E7
Grouping	Analyte					
WATER						
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	0.912				
	Sulfur (S)-Dissolved (mg/L)	159				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00489				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0030				
	Zirconium (Zr)-Dissolved (mg/L)	0.00138				

* 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)
Duplicate	Nitrite (as N)	DLA	L1726304-1
Duplicate	Bismuth (Bi)-Total	DLA	L1726304-1
Duplicate	Copper (Cu)-Total	DLA	L1726304-1
Duplicate	Lead (Pb)-Total	DLA	L1726304-1
Duplicate	Nickel (Ni)-Total	DLA	L1726304-1
Duplicate	Silver (Ag)-Total	DLA	L1726304-1
Duplicate	Thallium (Tl)-Total	DLA	L1726304-1
Duplicate	Tin (Sn)-Total	DLA	L1726304-1
Duplicate	Uranium (U)-Total	DLA	L1726304-1
Duplicate	Vanadium (V)-Total	DLA	L1726304-1
Duplicate	Zinc (Zn)-Total	DLA	L1726304-1
Duplicate	Zirconium (Zr)-Total	DLA	L1726304-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1726304-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1726304-1
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1726304-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1726304-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1726304-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1726304-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1726304-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1726304-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1726304-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
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**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
BE-T-L-CCMS-VA	Water	Total Be (Low) 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.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using an electrode.			
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-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

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-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

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

MET-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 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 procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-WR Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-WR Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA Water Dissolved Sulfur 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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur 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

Reference Information

microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SO4-IC-N-WR Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

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
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Chain of Custody Numbers:

1

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.



L1726304-COFC

Report To		Report Format / Distribution			w (Rush Turnaround Time (TAT) is not available for all tests)														
Company: Hemmera Environchem Inc.		Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)														
Contact: Natasha Sandys		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT														
Address: 230 - 2237 2nd Avenue Whitehorse, YT		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT														
Phone: 867-456-4865		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge														
		Email 1 or Fax nsandys@hemmera.com			Specify Date Required for E2,E or P:														
		Email 2 chris@elr.ca			Analysis Request														
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below														
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
Copy of Invoice with Report <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Email 1 or Fax nsandys@hemmera.com																	
Company: Hemmera Environchem Inc.		Email 2 chris@elr.ca																	
Contact: Natasha Sandys																			
Project Information		Oil and Gas Required Fields (client use)																	
ALS Quote #: Q51108		Approver ID:		Cost Center:															
Job #: 1343-005.15		GL Account:		Routing Code:															
PO / AFE:		Activity Code:																	
LSD:		Location:																	
ALS Lab Work Order # (lab use only)		ALS Contact:		Sampler: AN/CH															
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	Low Level Diss. Met (incl. Hg) and Hardness	Low Level Tot. Met (incl. Hg) and Hardness	Chromium Speciation (III/VI) - Total	Chromium Speciation (III/VI) - Dissolved	Ammonia - N	Dissolved Organic Carbon (DOC)	Nitrate-N	Nitrite - N	Total Phosphorus	Sulphate	pH, Conductivity, Total Susp Solids	Number of Containers	
E7				19-01-16	11:30	Water	R	R			R	R	R	R	R	R	R		9
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)														
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please hold samples for total and dissolved Chromium III/VI pending regular metals analysis results.			Frozen <input type="checkbox"/> SIF Observations: Yes <input type="checkbox"/> No <input type="checkbox"/>														
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact: Yes <input type="checkbox"/> No <input type="checkbox"/>														
					Cooling Initiated <input checked="" type="checkbox"/>														
					INITIAL COOLER TEMPERATURES °C						FINAL COOLER TEMPERATURES °C								
					2.5														
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)											
Released by: <i>[Signature]</i>		Date: JAN 22 '16	Time: 10:15	Received by: <i>[Signature]</i>		Date: 22-Jan-16	Time: 10:15	Received by:				Date:		Time:					