

FILE: S03L1-016
(REPORTS)

Subject: Re: Sample Analysis Results

From: "Natalie" <nataliea@envirosearch.ca>

Date: Fri, 26 Aug 2005 16:03:51 -0600

To: <johnsonam@inac-ainc.gc.ca>, <sahtuhyd@allstream.net>

CC: "Margot Ferguson" <margot@envirosearch.ca>, <david.calvert@apachecorp.com>, <john.laidlaw@apachecorp.com>

Hello Patrick and Armin,

Please find attached the analytical results from samples taken at the B-23 lease and the K-14 lease. The location and results of the samples will be discussed in the upcoming Water Licence S03L1-016 Annual Summer Site Inspection Report.

Thanks,

Natalie Albert, B.A.I.E., T.T.

Environmental Technologist

Northern EnviroSearch Ltd.

Phone: 403-543-5353 Fax: 403-233-2513

nataliea@envirosearch.ca

www.envirosearch.ca

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Lab Results B-23 & K-14.pdf

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① FILE: S'03LI-016
(REPORTS)

ALS Environmental



CHEMICAL ANALYSIS REPORT

Date: August 26, 2005
ALS File No. CC510057a
Report On: 2186NT05
Report To: **Northern EnviroSearch Ltd (NESL)**
620, 703 - 6th Avenue SW
Calgary, AB
T2P 0T9
Attention: **Ms. Natalie Albert**
Received: August 15, 2005

ALS ENVIRONMENTAL

per:

Monica Gibson

Monica Gibson, M.Sc. - Project Chemist
Brent Whitehead, B.Sc. - Operations Supervisor

② COMPARE W/ ANNUAL SITE INSPECTION AND
ANNUAL REPORT!
PL 29-08-03

File No. CC510057a

REMARKS



Please note this report for ALS WO# CC510057a supercedes CC510057, added particle size to -1 and -4.

Please note that for particle size analysis for samples -1 and -4 the >75 micron sieve portion consisted primarily of organic material.

Please note that for particle size analysis for samples -1 and -4 had limited volumes of sample available for analysis.

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	B23 Grab 1	B23 Grab 2	B23 Control	K14 Comp Contamin ated 4
ALS ID	1	2	3	4
Physical Tests				
Conductivity (dS/m)	2.27	9.05	0.256	0.789
Moisture %	35.9	61.4	42.3	50.5
pH	7.34	7.59	7.44	5.26
Sodium Adsorption Ratio (SAR)	3.74	9.63	0.29	0.42
Saturation Percentage %	200	200	500	1000
TGR (tonnes/hectare)	<0.10	6.98	<0.10	<0.10
Saturated Paste Extractables				
Calcium Ca	286	474	134	630
Chloride Cl	1150	4910	33.8	493
Magnesium Mg	101	280	68.7	290
Potassium K	<20	1630	30	323
Sodium Na	408	1510	37	160
Sulphate SO4	32.8	396	94.4	1950
Non-Halogenated Volatiles				
Benzene	0.320	0.117	0.059	0.072
Ethylbenzene	0.101	0.052	<0.050	<0.050
Toluene	0.14	<0.10	<0.10	<0.10
meta- & para-Xylene	0.319	0.155	0.102	0.137
ortho-Xylene	0.191	0.168	0.157	0.053
Total Xylenes	0.510	0.323	0.259	0.190
CCME Hydrocarbon Fractions				
F1 (C6-C10)	12	27	11	<10
F1-BTEX	11	27	11	<10
F2 (C10-C16)	2230	553	<30	<60
F3 (C16-C34)	5970	2470	92	1200
F4 (C34-C50)	406	629	86	470
F4G-sg	5510	3680	-	4040
F4G-SG Required (yes/no)	yes	yes	no	yes
Particle Size				
< 0.075 mm %	69.6	-	-	23.1
> 0.075 mm %	30.4	-	-	76.9

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per dry kilogram except where noted.
< = Less than the detection limit indicated.

Appendix 1 - METHODOLOGY



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Conductivity in Soil by Saturation Paste Extraction

This analysis is adapted from the methods outlined in "Soil Sampling and Methods of Analysis" (Canadian Society of Soil Science). In summary, 200 - 500 dry grams of sample is extracted for a minimum of 4 hours with an amount of deionized water required to create a saturated paste. The resulting extract is then filtered or decanted and analysed for conductivity with an conductivity electrode using procedures adapted from APHA Method 2510 "Conductivity".

Recommended Holding Time:

Sample Extraction: 6 months

Sample Analysis: 28 days

Reference: Canadian Society of Soil Science and APHA

For more detail see ALS Environmental "Collection & Sampling Guide"

Moisture in Sediment/Soil

This analysis is carried out gravimetrically by drying the sample at 103 C for a minimum of six hours.

Recommended Holding Time:

Sample: 14 days

Reference: Puget

For more detail see ALS Environmental "Collection & Sampling Guide"

pH in Sediment/Soil

This analysis is adapted from the methods outlined in "Soil Sampling and Methods of Analysis" (Canadian Society of Soil Science).

"Saturated Paste Extract" In summary, 200 - 500 dry grams of sample is extracted for a minimum of 4 hours with an amount of deionized water required to create a saturated paste. The resulting extract is then filtered and analysed for pH.

"Fixed Ratio Extract (e.g., 1:1, 1:5)" In summary, weigh out the appropriate amount of air-dried soil and add sufficient deionized water to achieve the desired extraction ratio and shake for 1 hour. The resulting extract is then filtered and analysed for pH.

pH 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.

Recommended Holding Time:

Extract: asap



Appendix 1 - METHODOLOGY - Continued

Reference: APHA
For more detail see ALS Environmental "Collection & Sampling Guide"

Sodium Adsorption Ratio (SAR) in Sediment/Soil

Sodium Adsorption Ratio (SAR) is calculated from the Sodium, Calcium, and Magnesium concentrations in the saturated paste extract of a sediment sample. The SAR calculation is described in "Soil Sampling and Methods of Analysis" by M. Carter.

Recommended Holding Time:
Sample/Extract: not applicable

Saturated Paste Extracts

This analysis is adapted from the methods outlined in "Soil Sampling and Methods of Analysis" (Canadian Society of Soil Science). In summary, 200 - 500 dry grams of sample is extracted for a minimum of 4 hours with an amount of deionized water required to create a saturated paste. The saturation % can be calculated from the amount of soil and water. The resulting extract is then filtered or decanted and analysed for various parameters.

Recommended Holding Time:
Sample: 6 month
Reference: Canadian Society of Soil Science
For more detail see ALS Environmental "Collection & Sampling Guide"

Theoretical Gypsum Requirement (TGR) in Sediment/Soil

Theoretical Gypsum Requirement (TGR) is calculated from the Sodium Adsorption Ratio (SAR), and from the Sodium and Saturation % results, using Method A as described in "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth, D. Keyes and J. Crepin (Cdn J. of Soil Science, 1999). Theoretical Gypsum Requirement results are reported as metric tonnes per hectare to a depth of 15 cm.

Please note that 50 tonnes/hectare is considered the maximum practical gypsum amendment.

Recommended Holding Time:
Sample/Extract: not applicable

Metals in Saturated Paste Sediment Extracts

Saturated paste sediment extracts are analyzed for metals by inductively coupled plasma optical emission spectrophotometry (EPA Method 6010B) or flame atomic absorption/emission spectrophotometry (EPA Method 7000)



Appendix 1 - METHODOLOGY - Continued

series). Reported metals results have been converted into milligrams per dry kilogram.

Recommended Holding Time:
Sample/Extract: 6 months
Reference: EPA

Anions in Soil by Saturation Paste Extraction

This analysis is adapted from the methods outlined in "Soil Sampling and Methods of Analysis" (Canadian Society of Soil Science). In summary, 200 - 500 dry grams of sample is extracted for a minimum of 4 hours with an amount of deionized water required to create a saturated paste. The resulting extract is then filtered or decanted and analysed by IC for the requested parameters using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Anions are determined by filtering the sample through a 0.45 micron membrane filter and injecting the filtrate onto a Dionex IonPac AG17 anion exchange column with a sodium carbonate and sodium bicarbonate eluent stream. Anions routinely determined by this method include: bromide, chloride, fluoride, nitrate, nitrite and sulphate. Further details are available on request.

Recommended Holding Time:
Sample Extraction: 6 months
Sample Analysis: 28 days (bromide, chloride, fluoride, sulphate)
Sample Analysis: 2 days (nitrate, nitrite)
Reference: Canadian Society of Soil Science, APHA and EPA
For more detail see ALS Environmental "Collection & Sampling Guide"

Volatile Organic Compounds in Sediment/Soil

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analyzed for specific Volatile Organic Compounds (VOC) by capillary column gas chromatography with mass spectrometric detection (GC/MS). The VOC analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 8260, published by the United States Environmental Protection Agency (EPA).

Recommended Holding Time:
Sample: 7 days Extract: 40 days
Reference: EPA
For more detail see ALS Environmental "Collection & Sampling Guide"



Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

Petroleum Hydrocarbons in Sediment/Soil (Canada-Wide Standard)

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." The various extraction fractions are analysed as follows:

CWS Fractions 1 and 1-BTEX:

This procedure involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analysed by capillary column gas chromatography with flame-ionization detection (GC/FID) for CWS Fraction 1, and by capillary column gas chromatography with mass spectrometric detection (GC/MS) for the BTEX compounds.

Reported results may include any or all of the following:

CWS Fraction 1 (C6-10):

sum of all petroleum hydrocarbon compounds that elute between nC6 and nC10 obtained by GC/FID analysis

CWS Fraction 1-BTEX:

CWS Fraction 1 (C6-10), minus BTEX compounds

Recommended Holding Time:

Sample: 7 days for CWS Fraction 1

Extract: 7 days for all CWS Fractions

Reference: CCME

For more detail see ALS Environmental "Collection & Sampling Guide"

Petroleum Hydrocarbons in Sediment/Soil (Canada-Wide Standard)

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." The various extraction fractions are analysed as follows:

CWS Fractions 2, 2-PAH, 3, 3-PAH, 4 and 4G-SG:



Appendix 1 - METHODOLOGY - Continued

The procedure uses a Soxhlet system to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is concentrated and undergoes a silica-gel clean-up to remove polar material. The final extract is analysed by high temperature capillary column gas chromatography with flame ionization detection (GC/FID). CWS Fractions 4G and 4G-SG (Gravimetric Heavy Hydrocarbons) are analysed gravimetrically.

Reported results may include any or all of the following:

CWS Fraction 2 (C10-16):

sum of all petroleum hydrocarbon compounds that elute between nC10 and nC16 obtained by GC/FID analysis

CWS Fraction 2-PAH:

CWS Fraction 2 (C10-16), minus selected PAH compounds (Naphthalene)

CWS Fraction 3 (C16-34):

sum of all petroleum hydrocarbon compounds that elute between nC16 and nC34 obtained by GC/FID analysis

CWS Fraction 3-PAH:

CWS Fraction 3 (C16-34), minus selected PAH compounds

CWS Fraction 4 (C34-50):

sum of all petroleum hydrocarbon compounds that elute between nC34 and nC50 obtained by GC/FID analysis

CWS Fraction 4G (GHH):

Results obtained by gravimetric analysis.

CWS Fraction 4G-SG (GHH + SG):

Results obtained by gravimetric analysis after silica gel clean-up

Recommended Holding Time:

Sample: 14 days for CWS Fractions 2, 3, 4, 4G & 4G-SG

Extract: 7 days for all CWS Fractions

Reference: CCME

For more detail see ALS Environmental "Collection & Sampling Guide"

Sediment/Soil Particle Size Distribution

This analysis is carried out in accordance with Canadian Society of Soil Science and Iowa Department of Transportation I.M. 306. The procedure involves oven-drying a representative subsample which is then passed through all requested sieves. Particle size is determined as the percentage of a sample that is greater than and less than the requested sieve sizes.

Recommended Holding Time:

Sample: not applicable

Reference: Canadian Society of Soil Science and IDT IM

For more detail see ALS Environmental "Collection & Sampling Guide"

File No. CC510057a

Appendix 1 - METHODOLOGY - Continued



Results contained within this report relate only to the samples as submitted.

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End of Report