



October 2, 2018

Sahtu Land and Board File Numbers: S17L8-003 & S17X-004

Ms. Bonnie Bergsma
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CC:

Michael Brownlee –Public Services and Procurement and Canada
Melissa Fraser – Transport Canada
Trevor Bremner – Department of Lands, GNWT;
Erin Goose – Department of Environment and Natural Resources, GNWT

**Memorandum RE: Approval for Movement of Treated Soils
Norman Wells Airside Land Treatment Unit
Norman Wells, Northwest Territories XOE OVO**

Dear Ms. Bergsma:

The following memo documents the sampling results for soil stockpiled within the bermed areas of the Norman Wells Airside Land Treatment Unit (LTU), located on the Norman Wells Airport lands as part of Transport Canada's (TC) Sahtu Land and Water Board Type B Water Licence S17L8-003 and Type A Land Use Permit S17X-004. This memo has been prepared by BluMetric Environmental Inc. (BluMetric) on behalf of TC.

LTU SOIL INVESTIGATIONS

BluMetric has supported the maintenance and sampling work that occurred at the Norman Wells LTU facility in 2017/2018 and has provided supervision for local contractor HRN Contracting.

Soil covering the liner within the LTU has been screened using a PID to assess the potential for hydrocarbon impacted soils and characterization soil sampling was conducted to identify any areas of suspected contamination. Soils that did not indicate the presence of contamination and did not produce elevated soil vapour readings have been stockpiled within the bermed area and

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have undergone comprehensive soil sampling to evaluate the soil quality based on the Treated Soil Criteria defined in the SLWB Type B Water Licence S17L8-003.

BluMetric has conducted soil sampling to meet or exceed the minimum sampling requirements for LTU closure outlined by the SLWB Water Licence (S17L8-003). A summary of stockpile size and the number of soil samples collected and analyzed is presented in Table 1 below to demonstrate that the sampling density meets the SLWB Water Licence requirements.

Table 1: Stockpile Sampling Summary

Stockpile Number	Estimated Volume (m ³)	Total # of Composite Soil Samples Collected
Stockpile 1	331 m ³	3 (SP1-1, SP1-2 and SP1-3)
Stockpile 3	50 m ³	2 (SP3-1 and SP3-2)
Stockpile 4	67 m ³	2 (SP4-1 and SP4-2)

According to Water Licence S17L8-003, soil volumes of 51 m³ – 500 m³ require two (2) composite samples. The sampling densities presented in Table 1 above meet or exceed this requirement.

Soil samples were submitted to ALS Laboratories in Edmonton, AB for rush analyses.

The analytical results for the stockpiles were reviewed and are presented in Tables A-1 through A-5 in Attachment A. No exceedances of the SLWB Water Licence Treated Soil criteria were noted.

BluMetric is requesting permission to move these soil stockpiles out of the LTU bermed area and into the previously approved laydown area in order to facilitate further characterization of the cover soils and to conduct the sub-liner confirmatory test pitting. Your timely response to this request is appreciated in order to ensure continuity on the work site as we would like to complete the sub-liner characterization prior to freeze-up.

CLOSURE

The information presented within this memo has been prepared for the Sahtu Land and Water Board, Public Services and Procurement Canada and Transport Canada. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

If you have any questions please do not hesitate to contact the undersigned.

Respectfully submitted,

BluMetric Environmental Inc.



Sabrina Penfold, B.Sc. GIT.
Environmental Scientist



Andrea Jenney, P.Eng.
Senior Engineer

List of Attachments

Attachment A - LTU Stockpile Soil Chemistry Tables

Attachment A:
Norman Wells Airside LTU – Stockpile Soil Chemistry Results

Table A-1: Stockpile Soil Sample Analytical Results - Metals

Sample ID	ALS MDL	Units	Water Licence Criteria ¹	SP1-1	SP1-2	SP1-3	SP3-1	SP3-2	SP4-1	SP4-2
Date Sampled				2018-09-26	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018
ALS Sample ID				L2171652-15	L2171652-21	L2171652-27	L2171652-39	L2171652-45	L2171652-51	L2171652-57
Moisture										
Moisture	0.25	%	NV	14.4	15.6	21.5	18.4	17.8	12.8	14.2
pH										
pH	0.10	pH	6.5-8.5	7.93	7.90	7.80	7.81	7.79	8.06	8.16
Metals										
Antimony (Sb)	0.10	mg/kg	40	0.68	0.69	0.88	0.91	0.9	0.62	0.57
Arsenic (As)	0.10	mg/kg	120	12.2	11.8	12.1	11.3	12	15.1	14.9
Barium (Ba)	0.50	mg/kg	2000	291	306	340	314	330	267	318
Beryllium (Be)	0.10	mg/kg	8	0.59	0.58	0.55	0.56	0.55	0.57	0.59
Cadmium (Cd)	0.020	mg/kg	22	0.38	0.377	0.463	0.423	0.488	0.335	0.251
Chromium (Cr)	0.50	mg/kg	87	86.1	49.6	31.8	56.5	65.9	36.8	57.2
Cobalt (Co)	0.10	mg/kg	300	10.5	10.2	9.02	9.24	10.1	10.6	10.6
Copper (Cu)	0.50	mg/kg	91	23.1	20.7	21.4	21.7	23.6	19.5	19.1
Lead (Pb)	0.50	mg/kg	260	15.1	15.9	13	12.9	13.9	36.1	24.4
Mercury (Hg)	0.0050	mg/kg	24	0.0609	0.0633	0.077	0.0905	0.0764	0.0535	0.0519
Molybdenum (Mo)	0.10	mg/kg	40	7.73	7.04	11.4	12.4	11.8	6.44	3.1
Nickel (Ni)	0.50	mg/kg	89	56.4	42.8	38.4	49.1	53.9	40.1	43.4
Selenium (Se)	0.20	mg/kg	3.9	0.9	0.98	1.44	1.4	1.4	0.71	0.51
Silver (Ag)	0.10	mg/kg	40	0.14	0.12	0.14	0.17	0.14	0.15	0.21
Thallium (Tl)	0.050	mg/kg	1	0.552	0.526	0.771	0.757	0.804	0.382	0.28
Tin (Sn)	2.0	mg/kg	100	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	0.05	mg/kg	300	1.8	1.78	2.78	2.71	2.79	1.4	0.918
Vanadium (V)	0.20	mg/kg	130	48	44	48.8	47.3	47.8	45.5	45.1
Zinc (Zn)	2.0	mg/kg	360	90.8	91.1	88.1	87.6	94.2	92.5	87.4
Hexavalent Chromium	0.10	mg/kg	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

14 Exceeds Water Licence criteria

1 - Type B Water Licence S17L8-003

NV - No Value

MDL - Method Detection Limit

Table A-2: Stockpile Soil Sample Analytical Results - Petroleum Hydrocarbons and BTEX

Sample ID	ALS MDL	Units	Water Licence Criteria ¹	SP1-1	SP1-2	SP1-3	SP3-1	SP3-2	SP4-1	SP4-2	
Date Sampled				26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018
ALS Sample ID				L2171652-15	L2171652-21	L2171652-27	L2171652-39	L2171652-45	L2171652-51	L2171652-57	
Volatile Organic Compounds											
Benzene	0.0050	mg/kg	5	<i>0.0123</i>	<i>0.0177</i>	<i>0.03824</i>	<i>0.0215</i>	<i>0.04894</i>	<i>0.02168</i>	<i>0.01815</i>	
Ethylbenzene	0.010	mg/kg	20	<i>0.0516</i>	<i>0.1394</i>	<i>0.2538</i>	<i>0.116</i>	<i>0.185</i>	<i>0.04825</i>	<i>0.0665</i>	
Toluene	0.050	mg/kg	0.8	< <i>0.050</i>	<i>0.0328</i>	< <i>0.050</i>	< <i>0.050</i>	< <i>0.050</i>	< <i>0.050</i>	<i>0.0404</i>	
ortho-Xylene	0.050	mg/kg	NV	< <i>0.050</i>	<i>0.0708</i>	<i>0.0556</i>	<i>0.031</i>	<i>0.0474</i>	< <i>0.050</i>	<i>0.0334</i>	
meta- & para-Xylene	0.050	mg/kg	NV	<i>0.061</i>	<i>0.0764</i>	<i>0.0894</i>	<i>0.037</i>	<i>0.0614</i>	< <i>0.050</i>	<i>0.0548</i>	
Xylenes (Total)	0.10	mg/kg	20	< <i>0.10</i>	<i>0.148</i>	<i>0.146</i>	<i>0.068</i>	<i>0.108</i>	< <i>0.10</i>	<i>0.088</i>	
F1 (C6-C10)	100	mg/kg	660	<i>24</i>	<i>34.6</i>	<i>97</i>	<i>32.2</i>	<i>75.6</i>	<i>170.6</i>	<i>102.8</i>	
F1-BTEX	10	mg/kg	NV	<i>24</i>	<i>34.2</i>	<i>96.6</i>	<i>32</i>	<i>75</i>	<i>170.6</i>	<i>102.4</i>	
Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	10	mg/kg	1500	61	69	161	68	108	166	42	
F2-Naphth	20	mg/kg	NV	61	69	161	68	108	166	42	
F3 (C16-C34 Hydrocarbons)	50	mg/kg	2500	159	199	500	113	157	219	102	
F3-PAH	20	mg/kg	NV	159	199	500	113	157	218	102	
F4 (C34-C50 Hydrocarbons)	50	mg/kg	6600	115	195	1230	117	163	134	63	
Heavy Hydrocarbons											
F4G-5G (Heavy Hydrocarbons-Grav.)	500	mg/kg	NV	580	1040	5300	550	1330	<500	-	

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Note - *Italicized values indicate an average concentration of five representative discrete samples analyzed for F1 and BTEX from the indicated stockpile. Non-detects were represented as half of the MDL when used to calculate the average concentration.*

Table A-3 - Stockpile Soil Sample Analytical Results - PAHs

Sample ID	ALS MDL	Units	Water Licence Criteria ¹	SP1-1	SP1-2	SP1-3	SP3-1	SP3-2	SP4-1	SP4-2	
Date Sampled				2018-09-26	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018
ALS Sample ID				L2171652-15	L2171652-21	L2171652-28	L2171652-42	L2171652-49	L2171652-56	L2171652-63	
Acenaphthene	0.0050	mg/kg	NV	<0.0050	<0.0050	<0.0080	<0.0070	<0.0070	<0.011	<0.0090	
Acenaphthylene	0.0050	mg/kg	NV	<0.0050	<0.0050	0.0068	<0.0050	<0.0070	<0.0050	<0.0050	
Anthracene	0.0040	mg/kg	NV	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0184	<0.010	
Benz(a)anthracene	0.0100	mg/kg	10	0.013	0.016	0.011	<0.010	<0.010	0.11	0.047	
Benzo(a)pyrene	0.0100	mg/kg	0.7	0.018	0.021	0.014	<0.010	0.011	0.131	0.061	
Benzo(b&j)fluoranthene	0.0100	mg/kg	10	0.033	0.036	0.026	0.017	0.02	0.185	0.088	
Benzo(g,h,i)perylene	0.0100	mg/kg	NV	0.021	0.022	0.019	0.014	0.017	0.085	0.05	
Benzo(k)fluoranthene	0.0100	mg/kg	10	0.01	0.015	<0.010	<0.010	<0.010	0.071	0.037	
Chrysene	0.0100	mg/kg	NV	0.034	0.032	0.037	0.027	0.035	0.144	0.069	
Dibenz(a,h)anthracene	0.0050	mg/kg	10	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0205	0.011	
Fluoranthene	0.0100	mg/kg	NV	0.024	0.028	0.02	0.014	0.017	0.169	0.07	
Fluorene	0.0100	mg/kg	NV	<0.010	<0.010	0.028	0.017	0.021	0.024	0.033	
Indeno(1,2,3-c,d)pyrene	0.0100	mg/kg	10	0.012	0.014	<0.010	<0.010	<0.010	0.059	0.032	
Naphthalene	0.0100	mg/kg	22	0.019	<0.010	0.071	0.036	0.045	0.048	0.049	
Phenanthrene	0.0400	mg/kg	50	0.05	0.033	0.072	0.049	0.071	0.11	0.107	
Pyrene	0.0100	mg/kg	100	0.027	0.03	0.025	0.02	0.024	0.146	0.071	
IACR:Coarse	0.1500	mg/kg	NV	0.069	0.089	<0.050	<0.050	<0.050	0.456	0.226	
IACR:Fine	0.1500	mg/kg	NV	0.132	0.171	0.089	0.066	0.075	0.879	0.437	
B(a)P Total Potency Equivalent	0.0200	mg/kg	NV	0.027	0.032	0.022	<0.020	<0.020	0.196	0.093	

14 Exceeds Water Licence criteria

1 - Type B Water Licence S17L8-003

NV - No Value

MDL - Method Detection Limit

Table A-4: Stockpile Soil Sample Analytical Results - PCBs

Sample ID	ALS MDL	Units	Water Licence Criteria ¹	SP1-1	SP1-2	SP1-3	SP3-1	SP3-2	SP4-1	SP4-2	
Date Sampled				2018-09-26	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018	26-Sep-2018
ALS Sample ID				L2171652-15	L2171652-21	L2171652-28	L2171652-42	L2171652-49	L2171652-56	L2171652-63	
Aroclor 1016	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1221	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1232	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1242	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1248	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1254	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1260	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	
Aroclor 1262	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aroclor 1268	0.010	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Total PCBs	0.050	mg/kg	33	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	

14 Exceeds Water Licence criteria

1 - Type B Water Licence S17L8-003

NV - No Value

MDL - Method Detection Limit

Table A-5: LTU Soil - PFAS Analytical Results

Sample ID	MDL	Units	Water Licence Criteria ¹	11S	11D	12S	12D	13S	13D	14S	14D	DUP 3	
Date Sampled				8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17	8-Jul-17
ALS Sample ID				ESQ209	ESQ210	ESQ211	ESQ212	ESQ213	ESQ214	ESQ215	ESQ216	ESQ217	
Perfluorobutane Sulfonate (PFBS)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorobutanoic acid	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorodecane Sulfonate	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorodecanoic Acid (PFDA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorododecanoic Acid (PFDoA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluoroheptane sulfonate	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluoroheptanoic Acid (PFHpA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	1.2	1.6	<1.0	<1.0	<1.0	
Perfluorohexane Sulfonate (PFHxS)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorohexanoic Acid (PFHxA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	1.2	1.8	<1.0	<1.0	<1.0	
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	1.9	2.6	<1.0	<1.0	<1.0	
Perfluorononanoic Acid (PFNA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorooctane Sulfonamide (PFOSA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorooctane Sulfonate (PFOS)	ug/kg	1.0	210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluoropentanoic Acid (PFPeA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	1.5	2.2	1.5	<1.0	<1.0	
Perfluorotetradecanoic Acid	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorotridecanoic Acid	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Perfluorou<1.0ecanoic Acid (PFUnA)	ug/kg	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
PFOS/PFOA Screening Approach (≤ 1) ²	N/A	N/A	NV	N/A	N/A	N/A	N/A	0.0015	0.0020	N/A	N/A	N/A	

Notes:

- 1 - Type B Water Licence S17L8-003 & Type A Land Use Permit S17X-004
- 2 - Health Canada's recommended screening approach when both PFOS and PFOA concentrations are detected

NV - No Value
MDL - Method Detection Limit