



October 26, 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. The remaining cover soil has been grid sampled and clean grids were composited and analyzed for comparison to the Treated Soil Criteria.

BluMetric has conducted soil sampling to meet or exceed the minimum sampling requirements for LTU closure outlined by the SLWB Water Licence (S17L8-003). The volume of soil within the grids was used to determine the number of composite samples required and is presented in Table 1 below. A summary of stockpile size and the number of soil samples collected and analyzed is presented in Table 1 below.

Table 1: Stockpile Sampling Summary

Stockpile Number	Estimated Volume (m ³)	Total # of Composite Soil Samples Collected
Grid Area	380 m ³	2 (Composite Samples 3 and 4)
Grid Area	340 m ³	2 (Composite Samples 5 and 6)

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	Maxxam RDL	Units	Water Licence Criteria ¹	COMPOSITE SAMPLE 3	COMPOSITE SAMPLE 4	COMPOSITE SAMPLE 5	COMPOSITE SAMPLE 6
Date Sampled					2-Oct-2018	6-Oct-2018	13-Oct-2018	14-Oct-2018
Sample ID					L2179825-44	L2179153-29	L2180757-35	L2180752-21
Moisture								
Moisture	0.25	0.3	%	NV	14.5	13.5	15.8	13.3
pH								
pH	0.10	NV	pH	6.5-8.5	7.71	7.65	7.9	8
Metals								
Antimony (Sb)	0.10	0.5	mg/kg	40	0.49	0.62	0.84	0.66
Arsenic (As)	0.10	1	mg/kg	120	13.5	14	12.5	13.2
Barium (Ba)	0.50	1	mg/kg	2000	271	257	279	264
Beryllium (Be)	0.10	0.4	mg/kg	8	0.6	0.6	0.65	0.56
Cadmium (Cd)	0.020	0.05	mg/kg	22	0.392	0.314	0.404	0.363
Chromium (Cr)	0.50	1	mg/kg	87	25.5	24	22.2	25.8
Cobalt (Co)	0.10	0.5	mg/kg	300	11.2	10.5	9.88	10.3
Copper (Cu)	0.50	1	mg/kg	91	20.9	20.1	20.9	19.9
Lead (Pb)	0.50	0.5	mg/kg	260	22.1	24.7	16.2	18.9
Mercury (Hg)	0.0050	0.05	mg/kg	24	0.0634	0.0878	0.0585	0.062
Molybdenum (Mo)	0.10	0.4	mg/kg	40	6.07	5.83	8.93	6.21
Nickel (Ni)	0.50	1	mg/kg	89	38.2	35.6	35.5	36
Selenium (Se)	0.20	0.5	mg/kg	3.9	0.82	0.8	1.08	0.89
Silver (Ag)	0.10	0.2	mg/kg	40	0.13	0.14	0.15	0.13
Thallium (Tl)	0.050	0.1	mg/kg	1	0.516	0.471	0.637	0.464
Tin (Sn)	2.0	1	mg/kg	100	<2.0	<2.0	<2.0	<2.0
Uranium (U)	0.05	0.2	mg/kg	300	1.74	1.54	2.25	1.61
Vanadium (V)	0.20	1	mg/kg	130	45.2	46.4	43.2	42.9
Zinc (Zn)	2.0	10	mg/kg	360	104	95.2	95.4	95.1
Hexavalent Chromium	0.10	0.08	mg/kg	NV	<0.10	<0.10	<0.10	<0.10

14 Exceeds water licence criteria

1 - Type B Water Licence S17L8-003

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	COMPOSITE SAMPLE 3	COMPOSITE SAMPLE 4	COMPOSITE SAMPLE 5	COMPOSITE SAMPLE 6
Date Sampled				2-Oct-2018	6-Oct-2018	13-Oct-2018	14-Oct-2018
ALS Sample ID				L2179825-44	L2179153-29	L2180757-35	L2180752-21
Volatile Organic Compounds							
Benzene	0.0050	mg/kg	5	<i>0.031</i>	<i>0.048</i>	<i>0.063</i>	<i>0.031</i>
Ethylbenzene	0.010	mg/kg	20	<i>0.146</i>	<i>0.119</i>	<i>0.238</i>	<i>0.088</i>
Toluene	0.050	mg/kg	0.8	<0.050	<0.050	<0.050	<0.050
ortho-Xylene	0.050	mg/kg	NV	<i>0.050</i>	<0.050	<0.050	<0.050
meta- & para-Xylene	0.050	mg/kg	NV	<i>0.103</i>	<i>0.055</i>	<0.050	<i>0.063</i>
Xylenes (Total)	0.10	mg/kg	20	<i>0.11</i>	<0.10	<0.10	<0.10
F1 (C6-C10)	10	mg/kg	660	<i>100</i>	<i>116</i>	<i>55</i>	<i>42</i>
F1-BTEX	10	mg/kg	NV	<i>99</i>	<i>116</i>	<i>55</i>	<i>42</i>
Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	10	mg/kg	1500	<i>96</i>	<i>180</i>	<i>120</i>	<i>77</i>
F2-Naphth	20	mg/kg	NV	NV	NV	NV	NV
F3 (C16-C34 Hydrocarbons)	50	mg/kg	2500	<i>197</i>	<i>247</i>	<i>158</i>	<i>202</i>
F3-PAH	20	mg/kg	NV	NV	NV	NV	NV
F4 (C34-C50 Hydrocarbons)	50	mg/kg	6600	<i>126</i>	<i>135</i>	<i>110</i>	<i>116</i>
Heavy Hydrocarbons							
F4G-SG (Heavy Hydrocarbons-Grav.)	500	mg/kg	6600	<i>549</i>	<i>537</i>	<i>618</i>	<500

14 Exceeds water licence criteria

1 - Type B Water Licence S17L8-003

NV - No Value

MDL - Method Detection Limit

Note - Italicized values indicate an average concentration of compiled representative discrete samples analyzed for F1 and BTEX from the grid sampling. 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	Maxxam RDL	Units	Water Licence Criteria ¹	COMPOSITE SAMPLE 3	COMPOSITE SAMPLE 4	COMPOSITE SAMPLE 5	COMPOSITE SAMPLE 6
Date Sampled					2-Oct-2018	6-Oct-2018	13-Oct-2018	14-Oct-2018
Sample ID					L2179825-44	L2179153-29	L2180757-35	L2180752-21
Acenaphthene	0.0050	0.005	mg/kg	NV	<0.0050	<0.0070	<0.010	<0.0080
Acenaphthylene	0.0050	0.005	mg/kg	NV	<0.0050	<0.0060	<0.0070	<0.0050
Anthracene	0.0040	0.004	mg/kg	NV	<0.0050	<0.0070	<0.0040	<0.0040
Benz(a)anthracene	0.0100	0.005	mg/kg	10	0.027	0.032	<0.010	0.016
Benzo(a)pyrene	0.0100	0.005	mg/kg	0.7	0.036	0.045	<0.010	0.026
Benzo(b&j)fluoranthene	0.0100	0.005	mg/kg	10	0.055	0.077	0.016	0.047
Benzo(g,h,i)perylene	0.0100	0.005	mg/kg	NV	0.035	0.045	0.013	0.041
Benzo(k)fluoranthene	0.0100	0.005	mg/kg	10	0.017	0.022	<0.010	0.014
Chrysene	0.0100	0.005	mg/kg	NV	0.044	0.059	0.029	0.042
Dibenz(a,h)anthracene	0.0050	0.005	mg/kg	10	0.0076	0.0102	<0.0050	0.0067
Fluoranthene	0.0100	0.005	mg/kg	NV	0.049	0.066	0.011	0.028
Fluorene	0.0100	0.005	mg/kg	NV	<0.010	<0.030	0.019	0.012
Indeno(1,2,3-c,d)pyrene	0.0100	0.005	mg/kg	10	0.028	0.033	<0.010	0.03
Naphthalene	0.0100	0.005	mg/kg	22	0.017	0.059	0.067	0.054
Phenanthrene	0.0400	0.005	mg/kg	50	0.047	0.082	0.062	0.067
Pyrene	0.0100	0.005	mg/kg	100	0.048	0.07	0.018	0.036
IACR:Coarse	0.1500	N/A	mg/kg	NV	0.119	0.161	<0.050	0.098
IACR:Fine	0.1500	N/A	mg/kg	NV	0.23	0.309	0.064	0.189
IACR (CCME)	0.1500	N/A	mg/kg	NV	NV	NV	NV	NV
B(a)P Total Potency Equivalent	0.0200	0.0071	mg/kg	NV	0.057	0.072	<0.020	0.045

14 Exceeds water licence criteria

14 Exceeds GNWT Guidelines

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	Maxxam RDL	Units	Water Licence Criteria ¹	COMPOSITE SAMPLE 3	COMPOSITE SAMPLE 4	COMPOSITE SAMPLE 5	COMPOSITE SAMPLE 6
Date Sampled					2-Oct-2018	6-Oct-2018	13-Oct-2018	14-Oct-2018
ALS Sample ID					L2179825-44	L2179153-29	L2180757-35	L2180752-21
Aroclor 1016	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1221	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1232	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1242	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1248	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1254	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1260	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1262	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Aroclor 1268	0.010	0.10	mg/kg	NV	<0.10	<0.10	<0.010	<0.010
Total PCBs	0.050	0.10	mg/kg	33	<0.10	<0.10	<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	
Perfluoroundecanoic 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