



October 18, 2018

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

Ms. Bonnie Bergsma
Sahtu Land and Water Board
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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
Stockpile 7	150 m ³	2 (SP7-1, SP7-2)
Stockpile 8	300 m ³	2 (SP8-1, SP8-2)
Grid Composite 1	17 m ³	1 (Composite 1)
Grid Composite 2	60 m ³	2 (Composite 2a, Composite 2b)

According to Water Licence S17L8-003, soil volumes of 0 m³ – 50 m³ require one (1) composite sample and 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	SP7-1	SP7-2	SP8-1	SP8-2	COMPOSITE SAMPLE 1	COMPOSITE SAMPLE 2a	COMPOSITE SAMPLE 2b
Date Sampled					7-Oct-2018	7-Oct-2018	13-Oct-2018	13-Oct-2018	26-Sep-2018	25-Sep-2018	25-Sep-2018
Sample ID					L2179148-6	L2179148-12	L2180757-1	L2180757-7	L2171652-70	UM4989	UM5032
Moisture											
Moisture	0.25	0.3	%	NV	12.8	12.1	15.6	16.8	14.6	15	17
pH											
pH	0.10	NV	pH	6.5-8.5	8.23	8.02	7.75	7.85	8.16	7.53	7.53
Metals											
Antimony (Sb)	0.10	0.5	mg/kg	40	0.56	0.55	0.92	0.68	0.55	0.78	0.82
Arsenic (As)	0.10	1	mg/kg	120	13.5	13.6	12.8	12	15.2	14	14
Barium (Ba)	0.50	1	mg/kg	2000	256	229	284	288	275	230	250
Beryllium (Be)	0.10	0.4	mg/kg	8	0.49	0.46	0.63	0.56	0.64	0.5	0.51
Cadmium (Cd)	0.020	0.05	mg/kg	22	0.236	0.247	0.448	0.434	0.269	0.39	0.41
Chromium (Cr)	0.50	1	mg/kg	87	30.5	20.2	21.9	22.7	31.9	23	26
Cobalt (Co)	0.10	0.5	mg/kg	300	7.83	7.85	9.94	9.39	10.9	12	12
Copper (Cu)	0.50	1	mg/kg	91	15.4	15.3	21.6	20.5	19.5	24	24
Lead (Pb)	0.50	0.5	mg/kg	260	16.6	18	18.5	14.3	19.4	19	20
Mercury (Hg)	0.0050	0.05	mg/kg	24	0.045	0.0496	0.0845	0.0721	0.0561	0.059	0.064
Molybdenum (Mo)	0.10	0.4	mg/kg	40	2.61	4.26	11.9	9.91	2.92	7.8	8.1
Nickel (Ni)	0.50	1	mg/kg	89	31.9	28.6	38.5	36.8	37.6	40	42
Selenium (Se)	0.20	0.5	mg/kg	3.9	0.42	0.56	1.54	1.33	0.57	0.9	0.98
Silver (Ag)	0.10	0.2	mg/kg	40	0.11	0.14	0.18	0.15	0.22	<0.20	<0.20
Thallium (Tl)	0.050	0.1	mg/kg	1	0.235	0.28	0.959	0.781	0.301	0.48	0.51
Tin (Sn)	2.0	1	mg/kg	100	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<1.0
Uranium (U)	0.05	0.2	mg/kg	300	0.902	1.34	3.34	2.72	1.01	1.6	1.7
Vanadium (V)	0.20	1	mg/kg	130	37.2	38.2	55.8	55.6	46.6	36	38
Zinc (Zn)	2.0	10	mg/kg	360	67.7	69.3	108	90.8	88.4	100	110
Hexavalent Chromium	0.10	0.08	mg/kg	NV	<0.1	<0.1	<0.10	<0.10	<0.10	<0.080	<0.080

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	Maxxam RDL	Units	Water Licence Criteria ¹	SP7-1	SP7-2	SP8-1	SP8-2	COMPOSITE SAMPLE 1	COMPOSITE SAMPLE 2a	COMPOSITE SAMPLE 2b
					7-Oct-2018	7-Oct-2018	13-Oct-2018	13-Oct-2018	26-Sep-2018	25-Sep-2018	25-Sep-2018
ALS Sample ID					L2179148-6	L2179148-12	L2180757-1	L2180757-7	L2171652-70	UM4989	UM5032
Volatile Organic Compounds											
Benzene	0.0050	0.005	mg/kg	5	0.012	0.0059	0.04408	0.03299	0.10782	0.130	0.130
Ethylbenzene	0.010	0.01	mg/kg	20	0.0362	0.0514	0.223	0.1922	0.3195	0.408	0.408
Toluene	0.050	0.02	mg/kg	0.8	<0.050	<0.050	<0.050	<0.050	<0.050	0.022	0.022
ortho-Xylene	0.050	0.02	mg/kg	NV	0.045	0.0368	0.0382	0.045	<0.050	0.047	0.047
meta- & para-Xylene	0.050	0.04	mg/kg	NV	0.066	0.0472	0.0582	0.0986	<0.050	0.067	0.067
Xylenes (Total)	0.10	0.045	mg/kg	20	0.086	0.078	<0.10	0.136	<0.10	0.11	0.11
F1 (C6-C10)	100	10	mg/kg	660	74.6	200.2	99	72.81	149	262	262
F1-BTEX	10	10	mg/kg	NV	74.6	200.2	98.8	72.61	149	262	262
Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	10	10	mg/kg	1500	760	139	73	56	267	479	479
F2-Naphth	20	NV	mg/kg	NV	760	139	73	56	NV	NV	NV
F3 (C16-C34 Hydrocarbons)	50	50	mg/kg	2500	815	300	114	110	278	376	376
F3-PAH	20	NV	mg/kg	NV	815	297	114	110	NV	NV	NV
F4 (C34-C50 Hydrocarbons)	50	50	mg/kg	6600	153	148	109	135	166	147	147
Heavy Hydrocarbons											
F4G-SG (Heavy Hydrocarbons-Grav.)	500	500	mg/kg	6600	<500	1150	770	850	690	<500	<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 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	Maxxam RDL	Units	Water Licence Criteria ¹	SP7-1	SP7-2	SP8-1	SP8-2	COMPOSITE SAMPLE 1	COMPOSITE SAMPLE 2a	COMPOSITE SAMPLE 2b
					7-Oct-2018	7-Oct-2018	13-Oct-2018	13-Oct-2018	26-Sep-2018	25-Sep-2018	25-Sep-2018
Sample ID					L2179148-6	L2179148-12	L2180757-1	L2180757-7	L2171652-70	UM4989	UM5032
Acenaphthene	0.0050	0.005	mg/kg	NV	<0.0050	0.043	<0.010	<0.0050	<0.013	0.0061	0.02
Acenaphthylene	0.0050	0.005	mg/kg	NV	<0.0050	<0.0050	<0.0060	<0.0050	<0.0090	0.012	0.017
Anthracene	0.0040	0.004	mg/kg	NV	<0.0040	0.113	<0.0040	<0.0040	<0.0060	<0.0040	0.0059
Benz(a)anthracene	0.0100	0.005	mg/kg	10	<0.010	0.309	<0.010	0.013	<0.010	0.014	0.02
Benzo(a)pyrene	0.0100	0.005	mg/kg	0.7	<0.010	0.259	<0.010	0.03	0.013	0.018	0.027
Benzo(b&j)fluoranthene	0.0100	0.005	mg/kg	10	<0.010	0.4	0.013	0.04	0.024	0.036	0.046
Benzo(g,h,i)perylene	0.0100	0.005	mg/kg	NV	<0.010	0.202	0.01	0.026	0.018	0.022	0.032
Benzo(k)fluoranthene	0.0100	0.005	mg/kg	10	<0.010	0.155	<0.010	<0.010	<0.010	0.0077	0.0097
Chrysene	0.0100	0.005	mg/kg	NV	<0.010	0.325	0.02	0.041	0.023	0.018	0.022
Dibenz(a,h)anthracene	0.0050	0.005	mg/kg	10	<0.0050	0.0461	<0.0050	<0.0050	<0.0050	<0.0050	0.0055
Fluoranthene	0.0100	0.005	mg/kg	NV	<0.010	0.709	<0.010	0.013	0.02	0.034	0.044
Fluorene	0.0100	0.005	mg/kg	NV	<0.010	0.051	0.02	<0.010	0.034	0.044	0.056
Indeno(1,2,3-c,d)pyrene	0.0100	0.005	mg/kg	10	<0.010	0.123	<0.010	0.016	0.012	0.027	0.037
Naphthalene	0.0100	0.005	mg/kg	22	<0.010	0.025	0.068	0.024	0.082	0.17	0.18
Phenanthrene	0.0400	0.005	mg/kg	50	0.012	0.476	0.051	0.036	0.088	0.082	0.11
Pyrene	0.0100	0.005	mg/kg	100	<0.010	0.528	0.014	0.024	0.024	0.033	0.042
IACR:Coarse	0.1500	N/A	mg/kg	NV	<0.050	1.01	<0.050	0.062	<0.050	NV	NV
IACR:Fine	0.1500	N/A	mg/kg	NV	<0.050	1.95	0.059	0.119	NV	NV	NV
IACR (CCME)	0.1500	N/A	mg/kg	NV	NV	NV	NV	NV	0.08	NV	NV
B(a)P Total Potency Equivalent	0.0200	0.0071	mg/kg	NV	<0.020	0.409	<0.020	0.04	<0.020	0.029	0.044

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	Maxxam RDL	Units	Water Licence Criteria ¹	SP7-1	SP7-2	SP8-1	SP8-2	COMPOSITE SAMPLE 1	COMPOSITE SAMPLE 2a	COMPOSITE SAMPLE 2b
Date Sampled					7-Oct-2018	7-Oct-2018	13-Oct-2018	13-Oct-2018	26-Sep-2018	25-Sep-2018	25-Sep-2018
ALS Sample ID					L2179148-6	L2179148-12	L2180757-1	L2180757-7	L2171652-70	UM4989	UM5032
Aroclor 1016	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1221	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1232	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1242	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1248	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1254	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1260	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1262	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Aroclor 1268	0.010	0.10	mg/kg	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.10	<0.10
Total PCBs	0.050	0.10	mg/kg	33	<0.050	<0.050	<0.050	<0.050	<0.050	<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-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