January 19, 2018 Matrix 21784-546

Ms. Mardy Semmler
INUVIALUIT WATER BOARD
P.O. Box 2531
Inuvik, NT X0E 0T0

Subject: Request to Amend Inuvialuit Water Board Water Licence N3L8-1838

Dear Ms. Semmler:

1 INTRODUCTION

The Northwest Territories Power Corporation (NTPC) recently completed the first season of a biological approach to soil remediation at its former electricity generation plant in Aklavik, Northwest Territories. This program is governed by Inuvialuit Water Board (IWB) under water licence N3L8-1838.

On behalf of NTPC, Matrix Solutions Inc. is writing to request amendments to the water licence for surveillance network program station number 1838-1. This letter provides background information and justification for the requested changes.

2 BACKGROUND

2.1 Biotreatment Cell

The design, construction, and operation of the Aklavik biotreatment cell is detailed in the 2017 remediation summary report (Matrix 2017). The biotreatment cell was constructed in July 2017 and filled with approximately 920 m^3 of hydrocarbon-impacted soils treated with microbe and nutrient amendments upon placement to enhance the petroleum hydrocarbon (PHC) degradation process.

The hydrocarbons originated from accumulated losses during decades of electricity generation operations, which provided power to the hamlet of Aklavik. It is believed that the site's electricity generators were initially fuelled with bunker oil and later with diesel. When the most heavily impacted soils were excavated and placed in storage totes in 2015, analysis showed total PHC concentrations between 4% and 8%, with concentrations of PHC fraction 2 (F2; $C_{>10}$-C_{16}), fraction 3 (F3; $C_{>16}$-C_{34}), and fraction 4 (F4; $C_{>34}$) exceeding remediation guidelines (Northwest Territories 2003). Soils placed in the biotreatment cell in 2017 were lesser-impacted, containing an average of only 1.4% total PHC (Matrix 2017).

2.2 Water Treatment System

Construction of the biotreatment cell in July 2017 included installing a water treatment system to treat any surface water runoff. Water collects in a sump in the lowest corner of the biotreatment cell. When the sump approaches capacity, an operator pumps accumulated water through a 3-stage water treatment system and into a 40 m³ Terra Tank™ for storage until authorization is received to release the water from the site. The 3-stage water treatment process includes a bag filter to remove entrained particulates and sediment; two vessels containing clay-based media to remove hydrocarbons and mineral oil & grease; and two vessels containing activated carbon media to remove any residual hydrocarbons.

In 2017, personnel from Aklavik-based K&D Contacting Ltd. were onsite to operate the water treatment system several times when water accumulated in the biotreatment cell. This included operating the pumps, monitoring pressures, and collecting samples of the treated water for laboratory analysis when it was desired to release the stored water. Water samples were collected from the water treatment system discharge port and from the post treatment holding tank. Samples were shipped to AGAT Laboratories in Edmonton, Alberta, for analysis of parameters specified in the water licence (IWB 2016). A surface water sample was also collected from a background location upgradient of the site and tested for the same parameters.

The water treatment system was winterized on September 13 and 14, 2017. Winterization of the system included draining water from the pumps, lines, treatment vessels, and tanks and placing components in the onsite sea-can for storage during the winter months.

2.3 Release of Treated Water

Treated water was discharged to the drainage ditch to the north of the site following approval from the Water Resources Officer designated by the IWB. A total of 33.1 m³ of treated water was gravity drained from the holding tank through a 50 mm hose to the drainage ditch along the north edge of the site (surveillance network program station number 1838-1) on September 6 and 7, 2017. Flow was monitored to ensure there was no erosion along the drainage ditch.

Due to operational challenges, treated water remaining in the Terra Tank™ could not be released to the drainage ditch when the system was winterized September 13 and 14, 2017. To prevent freezing and damage to system components, this water was drained back onto the biotreatment cell for retention in the sump over the winter months.

3 OPERATIONAL CHALLENGES

Each time water was sampled, the analytical results were compared to the site-specific water release criteria specified in the water licence, as indicated in Table A.

TABLE A Water Treatment Analytical Results

Sample Point and Date		Post-Treatment 16-Aug-17	Post-Treatment 29-Aug-17	Post-Treatment 11-Sep-17	Pre-Treatment 14-Sep-17	Background 14-Sep-17	Site-Specific Water Release Criteria*
General and Inorganic Parameters							
pH		*9.91*	7.6	7.73	7.79	7.81	6 to 9
Laboratory EC	µS/cm	1100	769	1130	2320	1650	NS
Ca	mg/L	240	99.9	169	388	235	NS
Mg	mg/L	2.5	28.5	52.9	130	44.9	NS
Na	mg/L	4.8	11.4	7	14.6	38.4	NS
K	mg/L	1.1	7.5	3.9	4.9	7.1	NS
Cl	mg/L	17	10	3	5.9	236	NS
SO_4	mg/L	188	302	500	1160	72.3	NS
F	mg/L	1.28	<0.05	0.27	0.09	0.07	NS
NO_2-N	mg/L	0.09	<0.02	<0.02	<0.01	<0.01	NS
NO_3-N	mg/L	0.72	<0.02	<0.02	<0.02	<0.02	NS
NO_2+NO3-N	mg/L	0.81	<0.02	<0.02	<0.02	<0.02	NS
T-Alkalinity	mg/L	665	103	178	470	462	NS
HCO_3	mg/L	<5	126	218	574	564	NS
Hardness	mg/L	610	367	640	1500	772	NS
TDS	mg/L	747	521	843	1990	911	NS
TSS	mg/L	*30*	14	*20*	*176*	*965*	15
Pb	mg/L	*0.184*	*0.0303*	*0.0673*	0.0037	*0.101*	0.007[H]
Petroleum Hydrocarbons							
Benzene	mg/L	0.0081	---	<0.0005	<0.0005	<0.0005	0.37
Toluene	mg/L	0.0004	---	<0.0003	<0.0003	<0.0003	0.002
Ethylbenzene	mg/L	<0.0005	---	<0.0005	<0.0005	<0.0005	0.09
Xylenes	mg/L	<0.0005	---	<0.0005	<0.0005	<0.0005	0.03
Total Petroleum Hydrocarbons	mg/L	0.4	---	0.5	1.5	4.4	5
Oil & Grease	mg/L	0.5	---	none†	1.1	*18.7*	5
Polycyclic Aromatic Hydrocarbons							
Benzo[a]pyrene	µg/L	<0.007	---	<0.007	<0.007	<0.007	0.015

Notes:

NS - not specified
--- - not analyzed
H - dependent on hardness value
† - laboratory visual determination
* - Water Licence N3L8-1838 (Inuvialuit Water Board 2016)
Italics - indicates values do not meet applicable guidelines

As Table A shows, the background sample exhibited concentrations of total suspended solids (TSS), lead (Pb), and oil & grease exceeding the site-specific water release criteria. Post-treatment samples exhibited TSS and lead concentrations exceeding the release criteria, but less than the background sample.

The first post-treatment sample (August 16, 2017) exceeded the release criteria for pH, TSS, and lead concentrations. The pH may have been temporarily high from low bicarbonate and/or the carbon treatment process, and a subsequent sample on August 29, 2017 was within the criteria for pH. TSS concentrations were also above the release criteria in the August 16, 2017 sample, but were within criteria in the sample collected from the holding tank on August 29, 2017. Lead concentrations remained

above the release criteria in the sample collected August 29, 2017, and appear unrelated to past power plant operations. Results were discussed with the Water Resources Officer designated by the IWB and approval was granted for the release of the water. This water was the 33.1 m^3 released on September 6 and 7, 2017.

The post treatment sample collected on September 11, 2017, exceeded the release criteria for TSS and lead concentrations. After discussions with the Water Resources Officer, release of the water was not authorized. Water was drained back into the biotreatment cell, so that the water treatment system could be winterized.

4 AMENDMENT REQUEST AND RATIONALE

Review of the first season's data indicates that lead, TSS, and oil & grease were problematic analytes. For the reasons outlined below, we respectfully request that the release limits for these three parameters be amended as described below.

4.1 Lead

- Analysis of worst-case soils bagged into totes in 2015, indicated that lead is not a contaminant of concern at this site. Lead concentrations averaged only 24 mg/kg, which is substantially below the most stringent (agricultural) guideline of 70 mg/kg (Northwest Territories 2003).

- The origin of lead in the water samples is unclear. The pre-treatment water sample contained less lead than post-treatment samples, but the water treatment system components are off-the-shelf items intended for treating drinking water and there is no reason to believe that they are imparting any lead.

- The concentration of lead in a background surface water sample (collected from a ditch northwest and upslope of the NTPC site) was 0.101 mg/L. Lead concentrations from the biotreatment cell have been variable, with three of the four water samples containing less lead than background. The average concentration of all four water samples was 0.07 mg/L, indicating that repeated release of this water will not be contributing lead mass above background in the local environment.

- We request that the release limit for lead be increased to 0.1 mg/L, reflective of background conditions.

4.2 Total Suspended Solids

- The TSS concentration of the background surface water sample (collected from a ditch northwest and upslope of the NTPC site) was 965 mg/L.

- The pre-treatment TSS concentration was 176 mg/L and the post-treatment concentrations averaged 21 mg/L, suggesting that the treatment system removed almost 90% of the suspended solids.

- The first season of operations has demonstrated that consistently meeting a guideline of 15 mg/L is beyond the capability of the 3-stage water treatment system. There is no room onsite to add

flocculation and settlement facilities to further polish the water, and further treatment is viewed as pointless since the water will pick up substantial ditch sediment (similar to the background sample) immediately upon release to the municipal drainage.

- The Canadian Council of Ministers of the Environment suggests not exceeding background by more than 25 mg/L for discharges up to 24 hours in duration (CCME 1999). We request that the release limit for TSS be raised to 40 mg/L, which is more stringent than this guidance but within the demonstrated capabilities of the 3-stage water treatment system.

4.3 Oil and Grease

- The water treatment system is effective for removing hydrocarbons, as evidenced by Table A.

- Assurance of hydrocarbon removal is given by a gas chromatography (GC) analysis, which is designed for total PHCs and can differentiate from natural carbon based compounds such as natural acids. This is the appropriate analysis for the bunker/diesel hydrocarbon source at this site.

- Oil & grease analysis was developed for the dairy industry and was implemented as criteria before the wide acceptance of the GC method and is considered out-dated; it does not appear in the Northwest Territories remediation guidelines (Northwest Territories 2003). The analysis has fallen out of use in most regulatory jurisdictions because of its traditional reliance on ozone-depleting chorofluorocarbons and other chlorinated solvents; efforts to use more environmentally friendly extraction solvents have not produced entirely successful analytical results (U.S. EPA 2017).

- Because the oil & grease method cannot differentiate material type, using this aggressive solvent often includes natural organic matter. The method includes a visual indicator step after the solvent is evaporated (unless an infrared method is used) to determine whether the residual material appears to be PHC based.

- For the reasons above we request that the limit for oil & grease be removed.

- The water licence mentions “and no sheen” along with the oil & grease limit, but removing the oil & grease analysis will not affect judgment of sheen, as sheen is also addressed in the licence below the effluent quality table.

5 CLOSURE

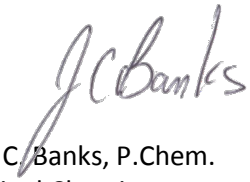
On behalf of NTPC, Matrix thanks you for considering this request to amend release limits for lead, TSS, and oil & grease in water licence N3L8-1838. The requested amendments will simplify water collection, transport, and analysis with no perceived adverse effect to the environment. We would appreciate receiving your response by March 31, 2018, so that we can plan for the summer 2018 operation of the biotreatment facility in Aklavik. If you have any questions or comments, please call Margaret Allan at 780.989.8343.

Yours truly,

MATRIX SOLUTIONS INC.

Margaret Allan, M.Eng., P.Eng., P.Geo., EP(CEA)
Principal Engineer

Reviewed by



John C. Banks, P.Chem.
Principal Chemist

MA/eh
Attachment: 2017 Remediation Summary, Former Aklavik Power Plant

copy: Joshua Clark, Northwest Territories Power Corporation, Hay River, Northwest Territories

REFERENCES

Canadian Council Ministers of the Environment (CCME). 1999. *Suspended Sediments: Canadian Environmental Quality Guidelines Fact Sheet 218.* http://st-ts.ccme.ca/en/index.html?lang=en&factsheet=218

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