Meliadine Camp

Sewage Treatment Plant

Status Report

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Meliadine Exploration Site, July 2010

Meliadine Exploration Site, September 2012

OBJECTIVE

This report is a summary of the work performed on the Meliadine sewage treatment plant (STP) since 2010 until April 2013 to bring the effluent into consistent compliance.

BACKGROUND AND REVIEW OF ACTIONS TAKEN

2010

AEM acquired the Meliadine Project from Comaplex in July 2010. When we took possession of the exploration camp, no water treatment was in place.

Sewage was managed through an incineration system and the grey water coming from the dry, showers and kitchen facilities passed through a "basic" sump and wetland system. The sampling done to monitor the water released was unstructured. In the annual report submitted to the Nunavut Water Board, the complete analysis result shows only 1 sample. This unique sample result respects the licence requirement, but it was hard to reach a conclusion over the consistent compliance of treatment with this single sample.

In order to ensure consistent compliance, AEM asked Birchwood to install and commission the "Little John" biodisk that had been purchased by Comaplex but never installed. The biodisk was placed in operation at the beginning of 2011.

2011

During 2011, the biodisk support and operation was done by Birchwood employees.

The effluent monitoring results showed that oil and grease, total suspended solids and fecal coliforms exceeded authorized limits. After reviewing the operation of the treatment system, it was concluded that the system could reach compliance with improved follow-up of operation. Two full time environmental technicians were hired and assigned with the responsibility for the

system performance. A sampling schedule was put in place and follow-up of the STP performance began, as well as implementation of improved water management standards. Samples were taken every week. A grease trap was installed to remove that load from the waste water and control of the cleaning products was established to protect the bacteria and help the biological treatment.

During the drilling campaign, up to 110 people worked at the Meliadine site in 2011 increasing the load to be treated by the Biodisk.

2012

At the beginning of the 2012 drilling season (end of February), the STP performance decreased drastically. According to Birchwood, the system could not take the load, so a second biodisk was installed in April 2012. To regulate the flow sent to the biodisks, an equalisation tank was also installed. In addition, a bubbler was installed to increase the oxygen level and improve treatment.

The number of components in the water treatment system had increased and it was becoming evident that to ensure system stability and provide the required control, we needed dedicated and trained operators. AEM hired two dedicated operators for the STP and contracted an external consultant in water treatment (Nordikeau) to train them and work with them to improve the STP performance.

In 2012, Nordikeau came to Meliadine site on April 3rd to 10th, June 5th to 12th and December 12th to 18th. After each visit, reports were produced with recommendations for improvement. All recommendations were put in place. From the first Nordikeau's visit at the site, the results were considerably improved. The problems with the oil and grease and the total suspended solids were resolved and the number of fecal coliforms was also reduced. Before the involvement of Nordikeau, the fecal coliforms requirement was complied with only 25% of the time and compliance increased to 55% after their involvement.

With an objective to improve performance, in November 2012, a contract was given to Nordikeau for the year 2013 to review the complete water treatment situation with the following elements:

1) **Evaluation of the treatment capacity and determination of the optimal operating process**
    - Review of all documentation
    - Review of the design operating parameters
    - Determination of the plant capacity
    - Determination of future needs
    - Characterization of the flow
    - Determination of the optimal operating process
    - Sludge management
    - Review of reporting

2) **Implementation of a computerized preventive maintenance program**

    - Creation of the data base (equipment, task, calendar)
    - Training
    - Data management
    - Creation of the operation manual:
        - complete description of the operation, maintenance.
        - training of the operators and the staff with manual.

The table of contents of the manual is shown in Appendix A.

As part of the operating procedures, it was decided that Nordikeau would remain available to support the operators when required. This included site visits, phone support, data analysis and recommendations for improvement.

During the drilling campaign, up to 150 people worked at the Meliadine site in 2012.

2013

The exploration activities restarted in February 2013. Effluent quality had improved compared to previous years, with the STP performing as required for all parameters except for fecal coliforms. Different improvements were done on the system or are in process of being implemented, including:

- installation of a new UV treatment after the biodisk (installed in January 2013)
- installation of a recirculation loop to double the UV exposure of the water (in process);
- purchasing and installation of an ozone system to eliminate fecal coliforms (test underway to size the unit, purchase and installation will follow)

CONCLUSION AND 2013 WORK PLAN

AEM has been continuously working on the STP performance problems, with substantial improvement since 2010. We have added the best available control technologies and have involved experts in water treatment to help us resolve our problems. We are confident that our work plan will achieve STP consistent compliance on all parameters.

The details of the planned activities and schedule for 2013 are as follows.

January 14th:

- a new UV system TROJAN 3000 was installed to provide a "back-up" for the system in place which had encountered some operational problems

February 6th to 19th:

- a water technician (from Nordikeau, water consultant) was on site to operate the STP and to improve the management and operation of the system.
- The old UV system was repaired.

March:

- Reception and installation of the material required to install the 2 UV in series. March 14th, the 2 UV systems were to be installed in series to double the water contact time with the UV light.

- A sludge detector was received on site to have a good sludge survey in the Biodisk, that survey and the appropriate sludge management was put in place to improve the effectiveness of the biological treatment.

April:

- A design was submitted by Nordikeau in collaboration with BraultMaxtech (UV representative) to recirculate the water in the UV more than one time. It seems that we do not have enough turbulence in the UV system due to the low volume of water treated (approx. 20m³/day and the UV could treat 80m³/day).
- Water filters (5 microns) were installed between the Biodisk and the UV systems to catch part of the TSS and help the disinfection.

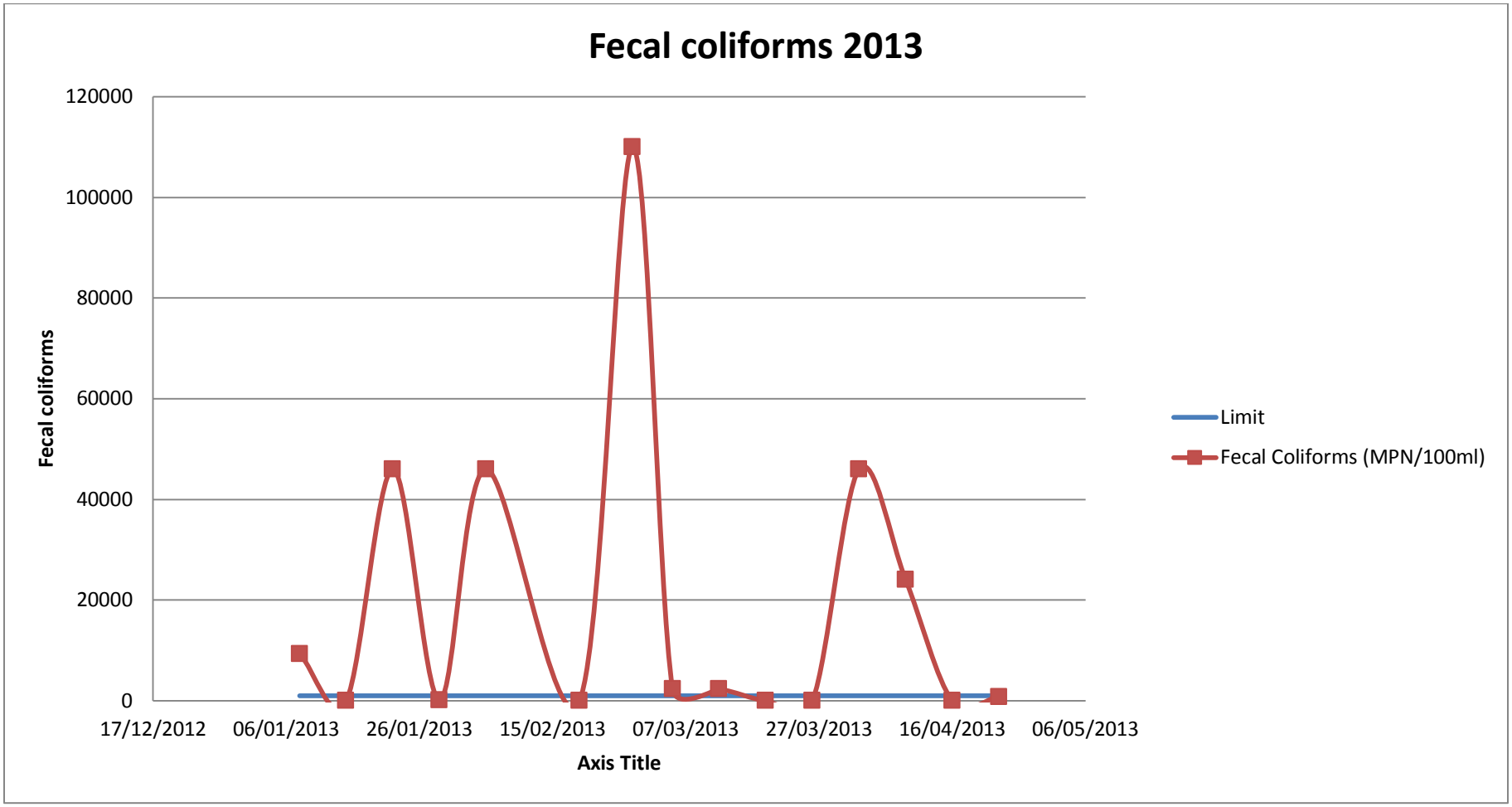
May:

- Tests to install a physicochemical system will be done on site by a water treatment engineer. If results are positive, this could improve the water transmittance before the UV treatment and disinfection.
- Test will be conducted with beneficial bacteria capable to solubilise soluble pollution and improve disinfection of the water. Tests will be conducted with the STP water to test the disinfection with an ozone system (OZOMAX system). If the Ozone disinfects the water correctly, the system could be implemented rapidly.
- A used water management plan is under preparation for submission to the KIA and Nunavut Water Board. This plan includes the details for all the used water system from the water use to the sludge management. This plan also describes the action plan for 2013.
- Nordikeau continues to work on many fronts to help the operation of the STP. They are producing a complete operation manual, a data processing management system, a preventive maintenance plan, a dehydration system for the sludge, etc. This work has led to great improvement of performance as can be seen from the results in Table 1 and Figure 1

Table 1: Sample analysis result up to date in 2013

Station: STP-OUT (MEL-7)		January				February			March				April			
DATE	**Limits**	**08/01/2013**	**15/01/2013**	**22/01/2013**	**29/01/2013**	**05/02/2013**	**19/02/2013**	**27/02/2013**	**05/03/2013**	**12/03/2013**	**19/03/2013**	**26/03/2013**	**02/04/2013**	**09/04/2013**	**16/04/2013**	**23/04/2013**
Ammonia as N (mg/L)		1.71	9.60	7.6	6.0	5.4	10.8	9.3	22.7	18.9	34.0	23.0	35.9	18.8	7.8	18.4
Biochemical Oxygen Demand (mg/L)	80	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	9.7	12.2	6.0	6.1	<6.0	15.4	8.5	<6.0	6.0
Heterotrophic Plate Count (AAHB) (CFU/ml)		>3000	<10	>3000	1,370.0	>3000	200.0	>3000	>3000	>3000	150.0	>3000	>3000	>3000	140.0	310.0
Nitrate-N (mg/L)		19.0	21.7	16.2	10.3	10.9	13.6	10.3	7.8	12.2	22.9	<0.050	12.7	13.4	20.7	19.0
Nitrate and Nitrite as N (mg/L)		19.00	21.70	16.30	10.4	11.0	13.8	10.3	8.82	14.40	23.90	0.14	14.00	14.90	20.90	19.30
Nitrite-N (mg/L)		<0.050	<0.050	0.1	0.1	0.1	0.2	<0.050	0.995	2.2	1.1	0.14	1.3	1.4	0.208	0.31
Oil & Grease-(IR) (mg/L)	5	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Phosphorus (P)-Total (mg/L)		6.4	6.3	7.5	6.8	7.6	7.5	8.75	8.6	9.9	14.7	4.9	12.7	11.7	12.2	11.7
TKN (mg/L)		8.32	13.10	10.70	9.70	9.50	12.20	13.10	28.00	26.60	37.60	28.20	41.5	24.8	12.6	25.9
Total Suspended Solids (mg/L)	100	9.0	10.0	7.0	5.0	<5.0	7.0	14.0	18.0	13.0	11.0	5.0	<5.0	17.0	12.0	10.0
Transmitance (%T)		51.0	59.8	38.3	37.1	28.1	23.7	19.4	24.4	31.6	32.0	46.5	25.2	22.5	35.7	38.3
pH (pH units)	6.5-9	6.81	5.30	7.6	7.4	7.3	7.2	7.28	7.5	7.4	7.3	7.7	7.6	7.66	7.0	7.4
Fecal Coliforms (MPN/100ml)	1000	9,300.0	9.0	46,000.0	150.0	46,000.0	9.0	110,000.0	2,300.0	2,300.0	<3	430.0	46,000.0	24,000.0	<3	750.0
Total Coliforms (MPN/100ml)		9,300.0	9.0	46,000.0	430.0	46,000.0	9.0	110,000.0	2,300.0	2,300.0		930.0	46,000.0	24,000.0	93.0	750.0

Figure 1: Fecal coliforms results, up to date



APPENDIX A

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STP Operating Manual