

12 March 2009

Mr. Don Beatty
Director of Public Works
Town of Windsor
PO Box 158
Windsor, NS B0N 2T0

Dear Mr. Beatty:

RE: DRAFT – AIS Brine Treatment Review

I have reviewed the waste characteristics of a brine solution produced as part of an inland drilling operation submitted by Atlantic Industrial Services. The purpose of this review was to gather information necessary to evaluate the potential effects of discharge at the Windsor Municipal Wastewater Treatment Plant. The following table summarizes the characteristics of concern for the brine solution contained in the AIS submission.

Parameter	Value
Volume	Approximately 10 000 m ³ per year
Dissolved Chloride Concentration	25 000 mg/L
Iron Concentration	25 mg/L

The contaminants identified have the potential to impact lagoon operations by increasing chloride concentrations to levels that are inhibitory to the biological treatment process. Chloride concentrations in raw wastewater are typically limited to 1500 mg/l in municipal prohibited wastewater bylaws to prevent effluent discharge concentration from approaching the potentially toxic concentration of 750 mg/L in freshwater receiving streams. Iron concentrations are typically limited to 50 mg/L in municipal prohibited wastewater bylaws.

The primary method available to decrease the chloride and iron concentrations is through dilution of the chloride plus oxidation and settling of the iron. As the iron is currently below the municipal bylaw limits and the flows are low it is not expected to be an issue and is only mentioned here as a parameter that should continue to be monitored if the brine is accepted at the plant. The chloride dilution will occur both through mixing with the influent wastewater and the pond contents. In order to evaluate the potential effects of brine addition we have considered both the short terms effects during tanker discharge and the longer term effects that occur over time.

The short term effects have been evaluated by assuming that no more than one tanker load (34 m³) of brine will be discharged in any given day. The average wastewater flowrate at the lagoon is approximately 1600 m³/d containing a chloride concentration of approximately 50 mg/L. The combined wastewater (influent plus brine) would have a chloride concentration of approximately 570 mg/L which is below the municipal discharge limit. When dispersed within the 50,000 m³ primary lagoon (also assumed to have a chloride concentration in the order of 50 mg/L) the overall effect will be an increase in chlorides of less than 20 mg/L. However, over the longer

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term these slight increases in concentration could result in further elevation of lagoon concentrations to potentially problematic levels.

The long term effects were evaluated based on the yearly addition (10,000 m³) of brine into the yearly (584,000 m³) wastewater flow. The resultant concentration of 470 mg/L is below the municipal wastewater discharge limit and the limit for release to fresh water. However, it is approaching the 750 mg/L limit and will have to be closely monitored.

The proposed method of introducing leachate into the lagoons is by discharging the contents of 34-m³ tanker trucks either to the pump station or directly into the pond. Regardless of which method is utilized, it will be important to disperse the leachate throughout the pond as quickly as possible. This will best be accomplished through introduction of the brine into the pump station, however this may cause additional concerns with corrosion and hydraulic overload of the pump station and increased operation and maintenance costs related to the handling of brine.

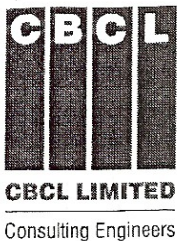
Therefore, the primary risks identified with treating the brine include:

- Potential for toxicity resulting in odours and effluent limit excursions.
- Increased metals content in the lagoon sludge.
- Introduction of brine into pump station when pump station is already running at capacity resulting in increased overflows.
- Introduction of brine directly into the pond resulting in localized areas of biological inhibition and odour production.
- Increased corrosion of pumping equipment.

The evaluations undertaken above do not eliminate the acceptance of the brine due to any foreseeable technical issues with treating the brine solution. However, should the Town commit to treating the brine, it will be important to address the risks associated with treatment when creating the agreement between the Town and the brine discharger. Therefore we advise that the following items be considered:

- The ability to restrict brine addition if the lagoons exhibit signs of stress (low DO, poor color, low quality effluent, etc.).
- The ability to restrict brine addition to the pump station should it be operating at capacity.
- The ability to terminate the agreement should the introduction of brine result in continuous plant upset conditions.
- A sampling/reporting protocol to monitor the addition of the brine to the lagoons.
- An ability to enforce the agreement.

The evaluations performed above do not include the effects of other non-municipal wastewaters that may be discharged at the treatment plant. It is understood that the Town has an agreement in place to treat pre-treated leachate at the plant in question. Therefore, some flexibility will have to be built into the agreement such that revisions can be made to suit both parties should difficulties arise. It is highly advisable that a



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second treatment facility be identified as a back-up should problems arise at your facility. If brine storage at the drilling site is the only contingency plan then it will be very difficult to restrict brine addition when all available storage has been exhausted.

Please call if you require further information or have any questions related to the above. Following the formulation of the draft agreement, please forward for review and comment.

Yours very truly,
CBCL Limited

A handwritten signature in black ink, appearing to be 'Mike Abbott', written in a cursive style.

Mike Abbott, M.Eng., P.Eng.
Wastewater Process Engineer
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