

Ultrasound Technology Helps Reduce Algae Blooms, Lowers TSS and Avoids Production of Microcystin Toxins

TOWN OF ESSEX, ONTARIO

Background And Problem

The Ontario Ministry of Environment, Conservation and Parks (MECP) sets effluent limits under an Environmental Compliance Approval (ECA) for the spring discharge from the Town of Essex sewage lagoons. Discharge normally occurs during spring freshet and not later than April 30th into the Puce Drain. Extremely poor water quality in Cell 4 of the lagoons (see photograph 1) led to a decision to test the effectiveness of Dual Band (DB) Algae Control Ultrasound unit to control algal blooms in the cell to enhance the quality of the cell water for the request to extend the discharge window to May 15, 2021. The MECP agreed to the extension to allow time for the ultrasound, which was installed on March 31, 2021, to control algae in the lagoon.

Results

The direct effect of the ultrasound resulted in the **reduction of the Total Cyanobacterial cell count by more than 5 times in 33 days of operation** (from 14,100,000 on March 16 to 3,160,000 by May 3, 2021) (see Figure 1). Extending the treatment window would have further benefitted the quality of the cell water but effluent discharge had to begin in order to comply with the discharge window.



Photograph 1: Samples from cell 4 on March 16, 2021

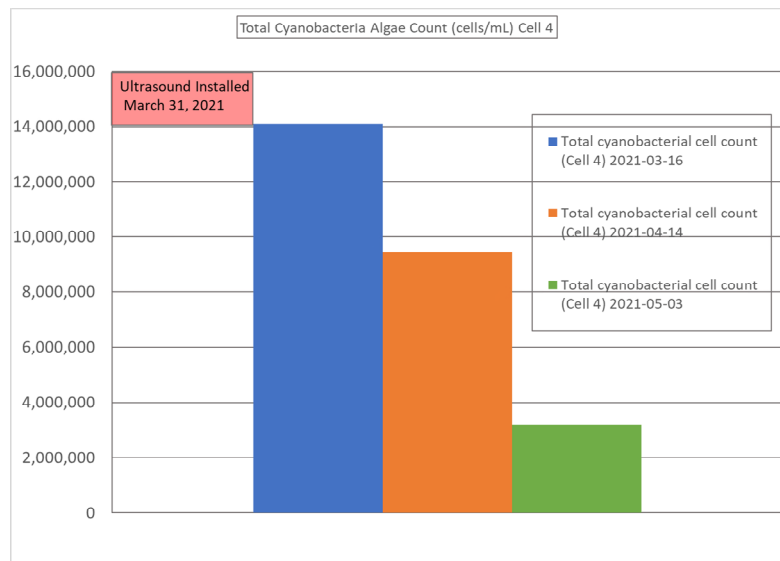


Figure 1: Trend of total cyanobacterial algae after installation of ultrasound on March 31, 2021



Microcystin Toxins

In addition to general water chemistry including un-ionized ammonia, microcystin toxins were analysed in both the lagoon and the receiving waters due to a concern that ultrasound would result in cell lysing (breaking of the cell wall) which could release the microcystin toxins stored within the blue-green algae cell. As with demonstrations elsewhere, the DB algae control ultrasound unit does not result in cavitation; and consequently, does not result in lysing of the blue-green algae cells. This was demonstrated by the analysis of total microcystin using the Enzyme-Linked Immunosorbent Assay (ELISA) with a detection limit of 0.10 or 0.20 µg/L (depending on the laboratory that undertook the analysis) never exceeded the detection limit on a total of 11 samples in the lagoon (5 samples between March 16 and May 4, 2021) or downstream of the discharge in the Puce Drain (6 samples between May 3 and May 12, 2021). MECP further noted, based on their analysis of a sample from Cell 4 final effluent collected on May 4, 2021 that ***“No algal mat, cyano bloom or algae bloom found”*** and ***“The sample contained extremely deteriorated material. There were numerous bacterial cells and debris observed in the sample. The sample also contained numerous extremely small algal cells which were not identifiable due to poor condition. These cells might have formed colonies when they were in good condition. Some very small fragments of filamentous blue-green algae (96 cells/mL) were observed in the sample as well.”***

On August 18, 2021 the MECP Provincial Officer for the Essex facilities provided the following direction by e-mail to the Senior Operations Manager for OCWA:

Review of the data collected by OCWA and ERCA in the Puce Drain/River during the last discharge shows that the ultrasound treatment was effective in preventing a bloom to form downstream in the river.

Based on these positive results from the spring discharge, we support the use of ultrasound treatment in the lagoons on a permanent basis. I've confirmed with the Director of Approvals that the permanent addition of these ultrasound units would not require an ECA amendment and can proceed through Limited Operational Flexibility (LOF).

Other Strengths of Ultrasound

- reduce TSS and pH
- low maintenance
- AC or solar power options
- cost effective
- scalable from ponds to 50 ha or more
- simple to use

For more information, please contact:

CanDetec Inc.

Dennis Gregor dgregor@candetec.ca 905-516-9009

www.candetec.ca

Mailing: Suite 325, 12 – 111 Fourth Ave.,
St. Catharines, ON L2S 3P5