sentry™

Yoho National Park - Field, BC

Remote monitoring and alarm notifications of high organic loading to MBR WWTP treatment facility

24 September 2019

1. Executive Summary

Problem Statement:

Two sensors were installed to alert operators to high organic loading and potential wastewater toxicity events. Sensor performance was monitored over a 4-month period.

Deployment:

A SENTRY microbial activity monitoring system consists of a control and data management panel and two sensors. Sensors were installed in a feed-forward location (in the primary settler's effluent, and aeration zones) of an MBR system, prior where the membranes are located.

- Sensor 1 was installed in the effluent stream of the first tank after EQ tank.
- Sensor 2 was installed at an influent aeration location, closest to the membrane.

Value Proposition:

- Aggregation of data from the 4-month period could be used to show typical daily and weekly organic loading profiles to the facility.
- The SENTRY sensor is validated as a low maintenance, always on sensor platform that alerts operators to changing organic load conditions for MBR wastewater treatment.
- Operators can now better predict and mitigate the impact of high organic loading events on treatment performance.
- Routine manual sampling for BOD, COD could be eliminated or dramatically reduced.

The Experience:

- The sensors did not require any cleaning or maintenance in the 4-month window.
- The sensors flagged and alerted operators to higher-than-normal organic loading from August 10th through August 22nd.
- The sensors also flagged the impact of heavy rain events on incoming wastewater quality and flagged potential toxicity events in the wastewater.
- These events aligned with higher-than-normal people attending the campsite and expected higher organic loading to the facility

"**SENTRY** has been providing real-time feedback on wastewater strength at several of our treatment plants across the Agency. **The data is presented in a simple, graphical format, which helps us to better understand our operations** and treatment plant performance. We are learning how BOD varies throughout the day and how plant performance responds at various locations within the treatment process."

Quote from Dwayne Doucette, Water and Wastewater Engineer, Parks Canada / Government of Canada

1. Installation Information

Yoho National Park (BC, Canada) is operating a membrane filtration plant wastewater treatment facility. The system is in a relatively remote location and is receiving 450-500 m3/day.

Figure 1 Remote MBR wastewater treatment plant location in Yoho Park, British Columbia, BC.

SENTRY was installed to monitor the incoming wastewater quality and notify the operators to problem high organic loading or potential wastewater toxicity.

Sensors were installed in a feed-forward location (in the primary settler's effluent, and aeration zones) prior where the membranes are located.

Sensor 1 was installed in the effluent stream of the first tank after EQ tank. The sensors were attached to each other with a worm drive clamp. The sensors were hung from railing inside the tank with a stainless-steel wire, zip-tied to the cable for security. The cable was run underneath the stainless-steel lids up to the panel.

Sensor 2 sensor was installed at an influent aeration location, closest to the membrane. The location experiences heavy turbulent periods from aeration and aeration has a power cycle. The sensors were hung from railing inside the tank with a stainless-steel wire, zip-tied to the cable for security. The cable was run underneath the stainless-steel lids up to the panel.

2. Problem statement at the Yoho National Park

Using membrane biofilm reactor (MBR) as key treatment at the treatment station during seasonal surge flows, operators make frequent visits from Lake Louise to check the system and perform maintenance when required. The SENTRY sensors monitor the performance throughout the system, providing real-time data every minute. Sensors monitor pre- and post-MBR biology performance, measuring how membranes function under increased flows and when membranes may be failing. By observing the daily trends on the SENTRY dashboard, operators can decrease the frequency and

dependency of check-ins at the station, and schedule non-annual maintenance accordingly.

3. General Response

The data highlights that typically the wastewater entering the treatment facility in general had a very low activity, correlating with general low organic loading to the plant. The facility is impacted by seasonal population change with higher loading expected in late Summer. Based on our understanding of the system, the treatment design capacity is much greater than the current loading rate. This extended time upfront likely results in a relatively large amount of the bio-available carbon being removed prior to aeration.

During the monitoring period there were events that resulted in a rise in activity in the aeration basin from August 10th to 22nd. This period aligns well with higher organic loading to the facility and a large increase in people visiting this remote camp facility.
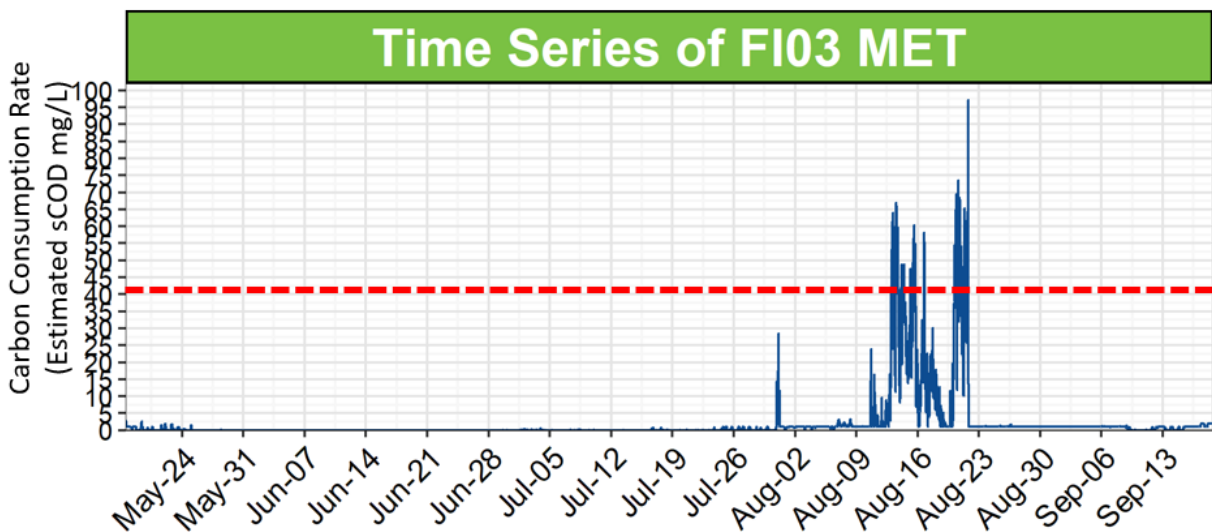

Figure 2 MET in Aeration Basin FI03. Very low organic loading and microbial activity were shown for the majority of the 4-month test period. Operators were notified of high organic loading From August 10th to August 22nd.

4. Data Analysis

Aggregation of the data can show us the typical weekly organic loading profiles entering the facility. At a weekly view it is clear that organic loading to the plant is on average higher on Sunday, Monday, Tuesday. The signal analysis also clearly shows the diurnal nature of the wastewater quality change with the highest loading typically arriving to the facility just after 12:00pm.
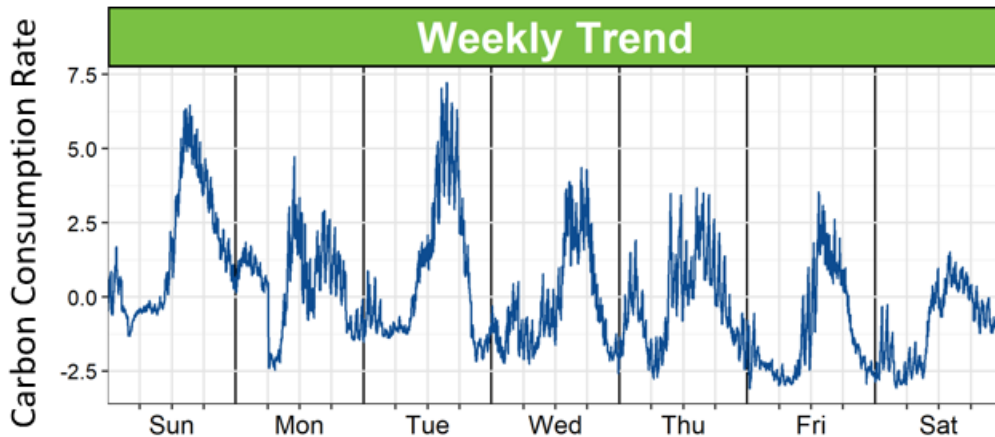
Figure 3 Variation in the weekly MET in the Primary Settler Effluent. Relatively low activity, but daily patterns emerge.

Daily

A daily trend exists in the Primary Settler where there are peaks in activity in the very early morning (3 am) as well as extended activity from 12-7 pm. The period from 12-7 pm may represent the greatest influence period by the flux of tourist populations; but the peak in the early morning is poorly understood. Sampling efforts should look to contextualize the variation, and most likely should focus on the peaks as they likely represent the periods of greatest loading.
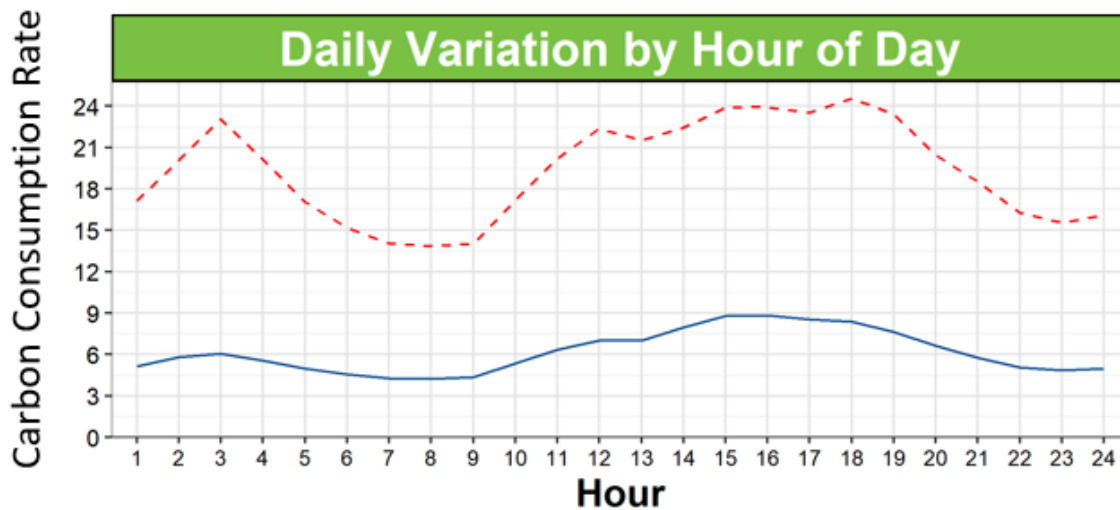

Figure 4 Daily MET pattern of Primary Settler Effluent. the 95% confidence interval highlight the potential for early morning (3 am) and afternoon peeks.