Striking a Balance

AN ONTARIO TREATMENT PLANT ADOPTS A BIOMASS BALANCE STRATEGY, USING PROCESS CENTRIFUGES TO DELIVER ACCURATE DATA FOR QUICK, INFORMED DECISIONS

By Mike Grennier

Guelph Wastewater Treatment Plant (GWWTP) prides itself on using advanced technology and best practices, and every aspect of the plant's operation plays a key role. That explains why the plant recently began using process centrifuges to quickly and accurately gauge the level of biomass throughout the operation. In turn, that helps the plant consistently achieve effluent quality and stability.

With a population of about 100,000, Guelph lies just west of Toronto in southern Ontario. The Wastewater Services Division operates the 64,000 m^3/day activated sludge plant, which provides tertiary treatment, discharging to the Speed River.

Biosolids are anaerobically digested and mechanically dewatered. The biosolids, which meet or exceed Ontario Ministry of the Environment Class B quality criteria, are applied to agricultural land, further processed within the facility's composting systems, or landfilled.

SEPARATE TRAINS

The Guelph operation uses four separate plants, all at one location, for primary sedimentation and activated sludge treatment. Each plant uses two separate liquid trains with dedicated primary clarifiers, aeration tanks and final clarifiers. Secondary treated effluent is directed to rotating biological contactors (RBCs), then to sandfilters, chlorinated and then dechlorinated before being discharged into the Speed River.

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The solids process is mainly composed of four digesters and a dewatering system that uses mechanical belt filter presses, which yield filter cake with typical solids content of 18 to 19 percent. Feed solids are conditioned with a polymer coagulating agent and further processed through woven mesh filter belts. The plant also operates a combined heat power system to heat its digesters and offset purchased electricity.

For years, the plant's nine operators relied on time-consuming traditional paper filter tests (also known as drying tests) to gauge the level of sludge mass in its primary clarifiers and the biomass in its aeration basins and final clarifiers. As with any plant, the paper filter tests provide accurate suspended solids percent readings. However, the Guelph team chose to augment the traditional test method when it adopted a more strategic approach to measure and balance its biomass in 2006, says operating lead hand Gerry Atkinson.

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Data obtained from process centrifuges are entered into a data management and trending program.

"We sample each of the two liquid streams once a day, which translates to a lot of samples," Atkinson says. "Given the number of samples, it took several hours or more to get the test results, which meant the operators didn't have the appropriate information to make the necessary adjustments in their areas of the plant until midday and they'd sometimes have to wait until the next day to see where more adjustments, if any, needed to be made.

"We wanted a faster way to get an accurate picture of the mass in any given tank so we can quickly determine the necessary adjustments for process control."

Guelph treatment plant team member Mike Innocente checks the amount of sludge that has settled after a centrifuge spin test.

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SPEEDING UP

To speed the testing processes and more accurately assess biomass, Guelph purchased four Raven F-10300 process centrifuges from Raven Environmental Products Inc. The centrifuges are designed for rapid determination of solids concentrations of mixed liquor in aeration basins, clarifier return sludge and waste sludge removed from activated sludge systems.

With the centrifuges in place, operators collect samples using a Raven Coretaker core sampler early each morning. In the lab, the samples are gently mixed and poured into centrifuge tubes. After air bubbles are removed, the tubes are placed in the centrifuge and the device spins for 15 minutes.

With the centrifuge test, solids are compacted to the bottom of the tube, which indicates the percentage of solids in a given tank. Based on the centrifuge percentage reading and the capacity of the tank being tested, operators calculate the sludge or biomass (sometimes referred to as a sludge inventory) in the tank.

Plant operators use the data to adjust various plant processes, such as sludge retention times (SRTs) in the aeration basins, secondary clarifier pumping removal rates in the primary clarifiers, hydraulic retention times, and wasting cycles, as well as return activated sludge (RAS) return rates, if needed. These adjustments help the plant achieve the optimum balance of biomass throughout the plant at all times.

MAKING ADJUSTMENTS

"For example, we used the centrifuge today and determined an abnormal amount of biomass in the final, which could denitrify if left in the final too long," says Atkinson. "We needed to get that biomass out of the final and back into the aeration basin where it needs to do its work. By quickly determining the mass balance, we adjusted our return activated sludge (RAS) rate to remove the excess biomass."

In addition to quickly providing an accurate picture of the biomass, Atkinson says the centrifuges enable the staff to quickly determine the effectiveness of the adjustments made.

"Within a short time of adjusting the pumping rates today, we then checked the mass balance again using the sampling techniques and the centrifuges," he says. "We found our adjustments corrected the problem. In the past, we would have to wait one or two days to see the effectiveness of the process changes, whereas now it takes hours." Whether it's the final clarifier or other tanks throughout the four separate plants, the centrifuges dramatically speed the testing process.

"We can make adjustments first thing in the morning," Atkinson says. "Then we can go back within a couple of hours after getting the results and quickly determine what's going on, whether our adjustments were the right ones, and whether we need to do something different."

In addition to the daily centrifuge tests, the staff continues to perform traditional paper filter tests once per week. It then compares paper filter tests taken over a four-week period with the results of centrifuge tests. To validate the accuracy of the spin tests, a series of conventional tests are performed on one set of samples every week. Doing so ensures the proper correlations are made between the tests, which differ slightly in how they convey results. It also ensures that the centrifuge samples are consistently accurate when compared with the traditional laboratory paper filter tests. The information from the tests is also entered daily into the plant's data management and trending program.

The primary advantage to centrifuge tests, says Atkinson, is daily control.

"Operators don't have to wait all that long to see the test results," he says. "It prioritizes where attention needs to be focused [to] make the appropriate process adjustments, which in turn gives them more control over the plant."

> "You can spend a lot of time testing and waiting for data. With the new centrifuges and sampling techniques, the data is available in minutes. From there, you plug in the information and go."
> **GERRY ATKINSON**

QUALITY DECISION-MAKING

The strategic approach to balancing biomass has proven to be a success. "The program allows us to balance the biomass, which means we know what's coming into the plant, what we're processing at each stage, and what's leaving the plant," Atkinson says. "It's one of many steps we've taken to enhance the overall operation of the plant, while also ensuring we consistently meet or exceed treatment standards established by MOE."

The Raven centrifuges, he says, play a key role in helping the plant accomplish its biomass balance objective. "With the centrifuges, the operator obtains the data needed within 10 or 15 minutes each day, so that he's able to make the necessary adjustments by 10 a.m. versus 2 p.m.," Atkinson says.

"Now, our staff is spending time interpreting data and making the necessary corrections much sooner for better overall biomass control. That gives operators better insight into the decisions they need to make."

Atkinson says the use of process centrifuges was a smart decision. "You can spend a lot of time testing and waiting for data," he says. "With the new centrifuges and sampling techniques, the data is available in minutes. From there, you plug in the information and go." tpo