

# Rock Creek Maintains Optimal DO Levels to Reduce Energy Consumption

By Bob Dabkowski

*When the Rock Creek Public Sewer District wastewater treatment plant (WWTP) first went online in 2004, operators at the facility manually controlled the three 100-hp blowers that aerate the plant's four 1.2-million gal per day (mgd) sequencing batch reactors (SBRs).*

*Dissolved probes use luminescence technology to continuously monitor DO levels and maintain energy-efficient blower operations*

Since then, blower operation has been automated, using new sensor technology that continuously monitors and controls dissolved oxygen (DO) levels in the reactors. The result has been a significant drop in energy consumption required for aeration, providing more than \$10,000 annual cost savings for the plant.

The 4.8-mgd WWTP can continuously process influent because the SBR technology incorporates an intermittent cycle extended aeration system (ICEAS). The ICEAS process eliminates the need to divert flow from the basin during settling and decanting phases. Instead, the time-based control system provides equal loading and flow to all basins.

When the plant first began operations, blower operation was strictly manual. "Air on, air off," said Don

Daniel, plant operations manager. But with this method, the DO levels would often reach 6 to 7 mg/L—much higher than necessary.

"It was a waste of money," Daniel said. "The blowers are the biggest power consumers at the plant. We were running our DO levels high to play it safe, but we needed to operate our blowers more efficiently."

## Optimizing DO control

The staff began evaluating new technologies for DO monitoring and control that would allow them to maintain optimal DO concentrations while reducing operational costs. After contacting other plants for recommendations and taking a close look at the DO probes available on the market, they decided to install Hach luminescent dissolved oxygen (LDO) technology sensors in each reactor basin. Since the installation in July 2005, the LDO probes have had "zero problems," according to Daniel.

"Installation was very easy," he said. "We followed the manufacturer's instructions. The probes plug into Hach sc100 controllers mounted on the hand railing at the side of each tank."

The probes themselves are attached to PVC stanchions and submerged about 10 ft below the surface of the reactor basins. The basins are approximately 129 ft long, 60 ft wide and 20 ft deep. The staff determines the parameters for blower operation, and these are input at the sc100



The staff at Rock Creek WWTP has seen a significant reduction in energy costs after installing the LDO probes and Hach controllers. Automating aeration based on current DO levels has brought an estimated power cost savings of approximately \$3,500 per year per basin, or a total of about \$14,000 per year if all four basins are operated.



controllers on the basins, or they can be adjusted from the plant SCADA. “We programmed all four controllers to turn the blowers on and off at a specific DO level,” Daniel said.

### 24/7 treatment cycles

Average daily flows at the plant currently run about 2.4 mgd. The plant receives flow 24 hours a day, and the SBR system goes through the same cycle every four hours: a two-hour fill-and-aerate period, which is now controlled by the LDO probes; a one-hour settling period; and a one-hour period of decanting.

The average biochemical oxygen demand (BOD) of the influent is 240 mg/L, which is reduced to 3 to 4 mg/L during the treatment cycle. The concentration of total suspended solids averages 200 mg/L coming into the plant and is reduced to 2.0 mg/L prior to the decanting phase. The water is also treated for concentrations of ammonia, phosphorous, total and organic nitrogen and pH. The clear water decanted from the top of the reactor is discharged into the Mississippi River.

The LDO probes are set to maintain a concentration in each basin. However, the blowers are not shut down instantly when the DO reaches 4.0 mg/L. Instead, the probes continue tracking the reading for four full minutes. If the DO concentration falls below 4.0 mg/L at any time during the four-minute interval, the timing is reset

and a new four-minute interval begins.

“This helps ensure that the 4.0 mg/L reading represents actual conditions in the tank, not just a spot reading,” Daniel said. After four consecutive minutes with readings at the 4.0 mg/L level, the blower is turned off until the DO level drops to the predetermined trigger point.

### Using LDO sensors

The LDO sensors offer specific advantages in accurate DO monitoring and control that membrane-type sensors do not provide. Because there is no membrane, there is no replacement due to fouling and no need to monitor and replace electrolyte solution. Unlike membrane sensors, the LDO probes do not consume oxygen in the process of measuring it, so measurement accuracy is improved.

The LDO sensor is coated with a luminescent material that responds to blue light transmitted from a light-emitting diode. In response to sensing the blue light, the sensor emits a red light. The duration of time the red light is emitted corresponds to the amount of DO present in the water. As the DO concentration increases, the amount of time required for the red light emission decreases. The measurement process is continuous so that the risk of over-aeration is minimized. The operation of the sensor is unaffected by the presence of hydrogen sulfide, wastewater chemicals, heavy metals or fluctuations in pH levels.

Maintenance has been minimal with the LDO sensors at the Rock Creek WWTP. “We follow the manufacturer’s recommendation for preventive maintenance,” Daniel said. “Once a month we pull them up and wipe them off. The probes have operated without problems since we put them in.”

The Hach sc100 controllers continuously read the LDO probes and communicate via a 4- to 20-mA signal to the plant’s SCADA system. Each controller also has a built-in data logger that collects measurements at user-selectable intervals (1 to 15 minutes), along with calibration and verification points, alarm history and instrument setup changes for up to six months. Each LDO probe is connected to a separate controller. Although each controller is designed to receive data from up to two sensors simultaneously—and plug-and-play capabilities and multiple-parameter functionality will allow operators to easily switch probes between different processes—the plant elected to use one controller with each LDO probe to provide back-up in this critical process.

### Energy cost reduction

The staff at Rock Creek WWTP has seen a significant reduction in energy costs after installing the LDO probes and controllers. Automating aeration based on current DO levels has brought an estimated power cost savings of approximately \$3,500 per year per basin (based on \$0.03/kwh) or a total of about \$14,000 per year if all four basins are operated. Since energy costs are generally the highest operational expenses at a WWTP, there can be a significant savings while the control of the process is improved as a result of optimum aeration. **WWD**

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