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Scanning Success



A multi-parameter analyzer helps a Kentucky treatment plant step up to the plate and meet a new phosphorus limit in its permit

By **Scottie Dayton**



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Scanning Success: A multi-parameter analyzer helps a Kentucky treatment plant step up to the plate and meet a new phosphorus limit in its permit

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In 2001, the Lexington Fayette Urban County Government West Hickman Creek Wastewater Treatment Plant in Nicholasville, Ky., was starting Phase II of its third upgrade since 1972, when the state imposed a phosphorus limit.

Total phosphorus hovered around 6 mg/l, but the permit required 1 mg/l monthly average and 2 mg/l daily maximum from May through October. Engineers from Tetra-Tech, the Lexington-based company designing the expansion, converted the anaerobic digesters to aerated sludge holding tanks and the primary clarifiers to biological phosphorus removal (BPR) fermentation tanks.

They also modified the two-staged activated sludge nitrification system and added two final clarifiers, chlorine contact, and three new 2-meter belt presses to replace the old ones.

As part of phosphorus removal, operators feed sodium aluminate precipitant at Zone 2 in the aeration tanks before the wastewater enters the final clarifiers. "The chemical enhances the BPR process by binding to the phosphorus in the return activated sludge and waste sludge," says Jim Worten, supervisor senior of plant operations.

To monitor phosphorus removal, engineers selected the PHOSPHAX orthophosphate analyzer from Hach Co. and the ChemScan UV-4100 analyzer from ASA Analytics, which measures nitrite, nitrate, ammonia-nitrogen, and orthophosphate at eight treatment stages in real time.

The system also allows the plant to begin denitrification in its clarifiers, returning fewer nitrates to the BPR process and thereby shortening detention times. Today, the phosphorus in the plant discharge to West Hickman Creek averages 0.5 mg/l.

Assembly required

The 270-acre facility has a peak design capacity of 64 mgd, but flows average 22 to 23 mgd. The plant treats more than 8 billion gallons annually, serving a population of 150,000 in Fayette and north Jessamine Counties.

Contractors installed the ChemScan system in four months. "They took tanks and channels out of service, core-drilled through the walls, and installed Bettis (Emerson Process Management) electric valves," says Worten. "Then they synchronized the solenoids to open and close the valves simultaneously and in sequence. An extensive piping system of 1.5-inch PVC Schedule 80 pipe connects everything."

ChemScan representatives programmed the computer and trained the staff, who found the learning curve uncomplicated. "I sat down with the manual and went right through it," says Worten. "It's all keypads and touchscreens."

The analyzer receives samples from eight treatment stages. On a 60-minute cycle, it monitors the influent channel entering the BPR tank, the midway point in the tank, and the effluent end. It draws influent and effluent samples off the first- and second-stage aeration basins, and from the line returning activated sludge to the BPR tank.

Lines flush automatically for three to four minutes to ensure fresh samples. Then the system analyzes ammonia, nitrite and nitrate levels. When analyzing phosphorus levels, the lines flush again before sampling. Monitoring of the four parameters takes eight minutes, and monitoring for only the nitrogen parameters takes five minutes.

The time it takes for samples to travel to the analyzer – as far away as 200 yards – is part of the hourly equation. To fit everything into the 60-minute cycle, the software enabled Worten to eliminate some unnecessary tests at certain stages.

The system does not extend to the final effluent, so the staff monitors its orthophosphate with the PHOSPHAX analyzer filtration system.

Adjustments made

“We had problems with the double-disc supply pump during our first year of operating the system,” says Worten. “Not all the sample points provided a flooded head for the pump, causing damage to the discs from air in the system.” When the staff switched to a progressive cavity pump (seepex), the problem disappeared.

The ChemScan system has two sets of 4-foot-tall cross-flow filter membranes, one element on either side of a U-shaped frame that slips into a fitting. “We run samples through one side of the pumping system,” says Worten. “When that set of membranes starts to blind, we switch to the other side and clean the first set. They’re rotated every two weeks.”

Operators put water and a small amount of bleach in a cleaning station, remove the filter frame and flush the elements. They last about three years before the bleach turns the membranes brittle. A new set costs \$1,200. In 2008, ChemScan representatives did a scheduled complete service overhaul.

New horizon

The phosphorus permit totally changed how the plant operates from May through October. “Everything focuses on phosphorus removal,” says Worten. “When we notice ammonia levels increasing in our first-stage aeration, we know we’re not getting the proper breakdown for good treatment. ChemScan enables us to answer questions such as: Do we need to drop

some tanks? Is our flow too high for the number of tanks we’re using? Do we add a tank to get better treatment?”

Worten also uses the system to monitor trends as microbial action changes with the seasons. “It helps us know when to take out or add tanks,” he says. “By monitoring ChemScan, I can tell where we are not getting proper treatment and adjust accordingly.”

Occasionally, operators pull samples off ChemScan and the laboratory analyzes them to check the machine’s accuracy. “To be honest, the unit is dependable and works well,” says Worten. “The lab numbers usually are close to those from the analyzer, and when they aren’t, the machine comes out on top of the argument.”

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