Source Water

Tackle Harmful Algal Blooms With Near-Surface Circulation

A Georgia county is winning the battle with blue-green algae (cyanobacteria) on its surface water supply through near-surface circulation. Circulators paid for themselves in three years, cut the need for chemicals, restored water quality and the natural food chain, and eliminated taste-and-odor issues for potable water customers. **BY JOEL BLETH**

Lake Varner in Newton County, Ga., about 35 miles east of Atlanta, has been plagued with harmful cyanobacteria (blue-green algae) blooms since the reservoir was built in 1992. At an average depth of 10 to 12 ft, the shallow lake water warms quickly in the spring, creating ideal breeding conditions for the blue-green algae blooms, which can contribute to taste and odor problems and be potentially toxic to fish and wildlife.

The 850-acre lake offers prime fishing and is a source of drinking water for 150,000 people. For years, county water officials treated the lake with costly doses of copper sulfate. The treatment took care of the algal blooms, but rising chemical costs prompted Newton County water production staff to search for a less-costly and more Earth-friendly solution. Water Production Manager James A. Brown and his staff knew of and proposed using a circulation machine that could reduce taste-and-odor problems without chemicals. For Lake Varner, an added challenge was to remove cyanobacteria in a large area.

**CIRCULATORS CUT CHEMICAL COSTS**

It was a significant investment—12 floating circulators to treat 360 acres in front of the drinking water plant. After extensive research, county officials approved the purchase. Not only did the treated part of the lake show marked improvement the first year, but the circulators paid for themselves within three years instead of the estimated eight years.

The circulation machines operate on a simple biological principle: gentle, long-distance circulation of the epilimnion (the upper water through which light penetrates) allows “good” green small-celled algae to outcompete blue-green algae (BGA). *Daphnia*, or aquatic crustaceans, then graze the green algae, allowing the...
Lake Varner’s circulators treat 360 acres out of 850 acres total, treating a three-week supply of water in front of Newton County’s treatment plant, which is usually enough to avoid toxins and taste and odor problems from blue-green algae blooms.

BIG RESERVOIR WATER CHALLENGES
All of Georgia’s lakes are man-made, and Lake Varner is one of the state’s top five fishing lakes. The watershed is one of the most protected in the state. The lake has to look good, support aquatic life, and taste good downstream for a three-county area.

Cost is important, too. The not-for-profit Newton County water system wholesales its water as one of two providers in the state. Other municipalities purchase its water for their use. The more cost-efficient the water treatment process, the more savings Newton County can pass on to its municipal customers. The ever-increasing cost of chemicals was threatening to increase water costs.

Maintaining water quality with chemicals required two different applications. To kill BGA, water operators sprayed copper sulfate on the water surface: 160 gal twice a week at $16–$18/gal, April through October. But dead and decaying BGA create an “earthy or dirt” taste and a “musty or mildew” odor. To counteract taste and odor, the water in the treatment plant was treated with 15–18 ppm of powdered activated carbon during the six-month warm season.

There was also a third step: decaying BGA must be removed from the water treatment plant. However, because of the size and weight of the cells, BGA doesn’t settle out of the water. Instead, it’s caught in the filters, which reduces filter efficiencies and requires excessive filter backwashing, thereby increasing costs.

MAINTAINING HIGH STANDARDS
Newton County regularly scores high on state water inspections and sanitary surveys, and plant operations staff have won numerous state honors for excellence in water treatment. Maintaining high water quality standards is a priority for the county water department. But achieving those high standards while keeping costs in check had become increasingly harder to do.

“Chemical costs were increasing every year,” said Brown. “We’re always seeking ways to operate cost-effectively while keeping our water rates stable.”

Brown and his staff estimated that circulators for treating BGA and reducing taste-and-odor issues would cut chemical use by 50 percent and provide an eight-year payback. Even this conservative estimate isn’t the norm for the water treatment industry. Typical returns on investment for equipment costs are from 10 to 20 years.

EXCEEDING EXPECTATIONS
However, the county was able to reduce the use of chemicals (copper sulfate and powdered activated carbon) by 90 percent. Within three years, the savings on chemicals equaled the dollars invested in the circulator machines.

“We still had to battle blue-green algae a little bit the first year, and we expected that,” said Brown.

That’s because as soon as the machines were installed, the county had to stop using copper sulfate. Copper sulfate kills all algae, both good and bad, and the basic premise of long-distance circulation is to allow good algae to predominate and restore water quality.
We also had to control taste and odor the first summer,” said Brown. “It took a year for the water to show full results, and the water quality becomes better and better every year.”

Use of the circulators currently saves the county about 30 percent of its total chemical budget. Chemicals are still used for coagulation, sedimentation, disinfection, and corrosion control. The quantity of powdered activated carbon used is down to about 2–3 ppm in the summer.

“We still use a little bit, and could probably turn it off during most of the year,” said Brown. “Taste and odor isn’t a threat to health, but it’s unpleasant, and we get the most phone calls when the water tastes or smells bad.”

The circulators treat 360 acres out of 850 acres total, treating a three-week water supply in front of the plant, which is usually enough to avoid toxins and taste and odor problems from blue-green algae blooms. Water treatment tolerances and restrictions have become tighter since the Lake Varner reservoir was constructed, but the circulator machines help meet the restrictions. Also, operating costs have been reduced. Finally, Lake Varner water quality has been restored for all to use and enjoy.

A healthy predator relationship maintains a pond’s ecosystem. Green algae, the primary producers, convert nutrients into usable energy. The algae are consumed by zooplankton, which in turn are consumed by fish.