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Water Quality Technology & Treatment Products
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WATER QUALITY TECHNOLOGY & TREATMENT TECHNIQUES

New rule costing some communities millions

Water utilities scrambling to comply with new arsenic rule

PHOENIX (AP) — Cities and private water companies across the country and here in Arizona are under the gun to build plants and install systems that will make Arizona's water safer.

The large municipal water plants run by Valley cities, treating surface water and some groundwater, are shelling out millions to meet a new federal requirement to reduce arsenic in drinking water that begins Jan. 23.

But rural Arizona will be hit the hardest. There, hundreds of small private water companies pumping groundwater, which tends to have more arsenic. Those firms have less cash to treat water than a big city operation and will be more likely to pass the cost on, regulators and industry experts say.

In 2001, the Environmental Protection Agency slashed the federal standard for arsenic in water from 50 parts per billion to 10 parts per billion to protect the public against the cancer-causing substance.

But that's little comfort to small-town residents who may have to dig deeper to pay for water.

"I heard if they have to put in more equipment, they will have to raise the bills," said Leroy Hunter, a 70-year-old

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Dam nearly collapses

Near disaster. Water rushes over the Whittenton Dam on the Mill River in Taunton, Mass. recently. City officials were watching the 173-year-old wood dam carefully, fearing it might break and flood downtown Taunton with six feet of water. The dam has now been strengthened and repaired.

Workshop — Thorough mixing crucial to healthy potable water storage tanks

DICKINSON, N.D. —Increasingly stringent regulatory standards for potable water quality are causing suppliers to review their reservoir/tank treatment, mixing and cycling operations for both chlorine and chloramine-based systems.

Of interest to anyone who manages potable water storage facilities, recent tests and analyses have provided a breakthrough in water circulation technology that enables not only meeting higher standards, but also the improvement of overall health and quality of potable water treated through chlorination or chloramination.

For the most part, potable water in North America is still treated by chlorination. However, much of that water comes from lakes, which often contain a substantial degree of organic matter. Organic matter translates to chlorine demand.

So, in order to maintain the desired residual chlorine level throughout the area supplied by the tank/reservoir, a higher level of chlorine is often injected into potable water that originates from lakes. This is particularly the case during warmer months.

Chlorine applied to organic matter can produce un-

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Mixing workshop

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healthful disinfection byproducts (DBPs) including trihalomethanes (THMs) and haloacetic acids (HAAs). Because of its substantial organic content, the potable water of many communities using lake water as a source are often approaching or exceeding the chlorine limit of 80 ug/l — at least during peak periods.

To comply with the DBP ruling and stay within chlorine limits, an increasing number of communities with potable lake water supplies are changing over to odorless and tasteless chloramine systems.

Chloramine, composed of chlorine and ammonia, is an effective treatment that does not produce DBPs. However, when autodecomposition of chloramine occurs in water storage reservoirs/tanks, some of the ammonia component is set free, creating the potential for nitrification.

Nitrification can lead to methemoglobinemia, a blood disorder caused when nitrite interacts with the hemoglobin in red blood cells. (Sometimes called Blue Baby Syndrome, the methemoglobin formed in this interaction cannot carry sufficient oxygen to the body's cells and tissues.)

A practical remedy for such ammonia problems in potable water is breakpoint chlorination, whereby chlorine is injected until the ratio of chlorine to ammonia is 7.7 to 1. With that proportion of chlorine, any free ammonia is oxidized.

But, it is virtually impossible to accomplish breakpoint chlorination in a large storage tank unless a very effective water mixing system is used. Otherwise, the injected chlorine does not disperse sufficiently to destroy all of the free ammonia.

Cycling, or turnover, is another problem common to stored potable water. The temperature differential between water flowing into the tank and that already present causes stratification, which becomes compounded over time. With chlorine systems, this results in loss of residual chlorine in layers of water that are "old" from lack of turnover, which can result in the propagation of deadly organisms such as giardia.

With chloramine systems, the problem is more serious; stratification makes it highly likely that autodecomposition will create free ammonia in old water, and, for the same reason, breakpoint chlorination cannot be performed effectively.

The common denominator to these problems with chlorine- and chloramine-treated potable water storage is the need for effective mixing.

Until recently, mixing was done using one of two popular technologies: water check valve systems, and propeller-driven water mixer systems. Unfortunately, both technologies are problematic.

Check valve systems attempt to mix water by positioning the water inlet pipe near the top of the tank and the water outlet near the bottom. This separation of inlet and outlet ensures a certain amount of turnover. However, check valve systems also create backpressure that may adversely affect pumps and waste energy.

Also, because many tanks are built to support future population growth, the present day inflow/outflow may be so insignificant that turnover is negligible. If it should become necessary to isolate a tank, then there is no way to continue any amount of mixing.

The other popular mixing technology, propeller-driven "turbulent" mix-

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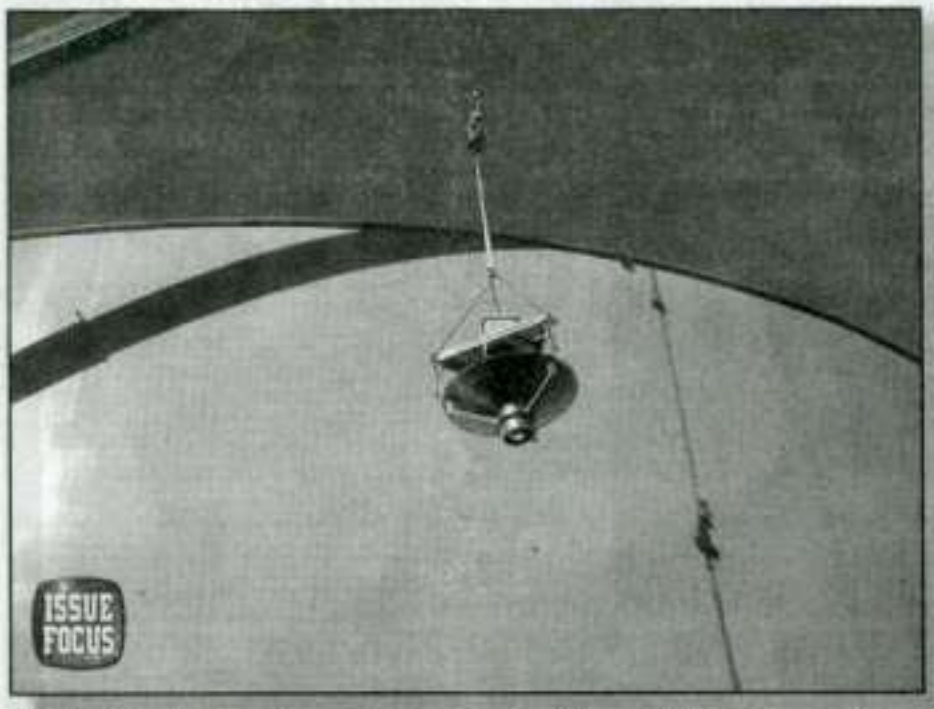

All mixed up. Tank mixing equipment from SolarBee is hoisted into position in this water storage reservoir. Proper mixing of stored water improves the overall health and condition of the water during the treatment process.

Thorough mixing crucial to healthy potable water...

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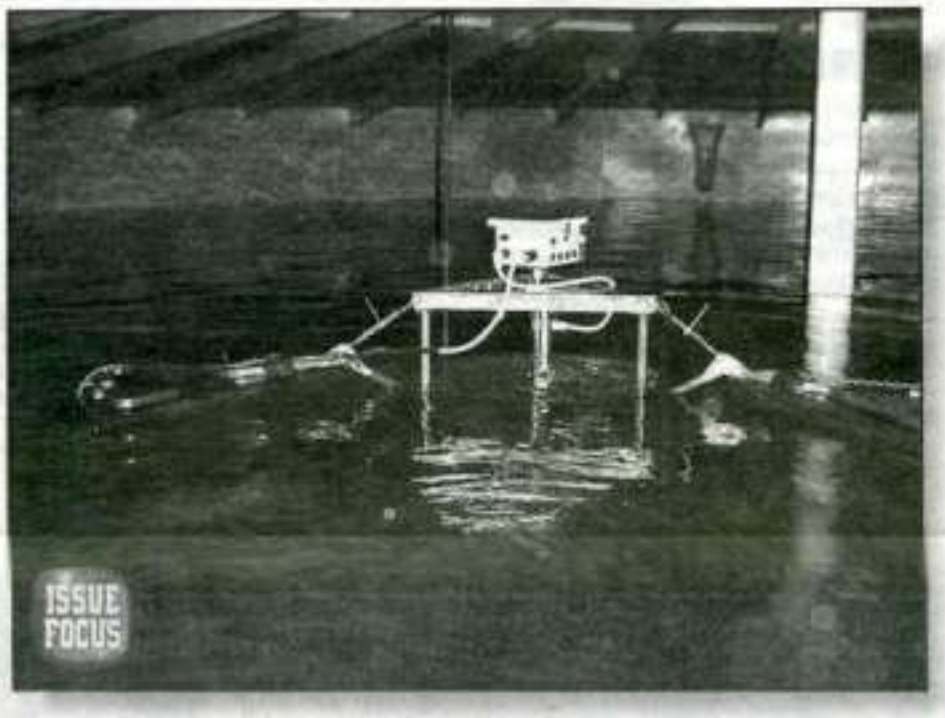
ers, involves electric motors powering six-foot mixing blades on heads that are lowered into the water. While this does achieve a certain amount of mixing, it is somewhat uneven and does not reach the corners and sides of water tanks. Typically, effective water circulation is limited to a radius of 15 meters.



Improving circulation. A SolarBee tank mixing unit is installed in a water storage tank to keep the water mixed during treatment and storage.

A Southern California solution

"We looked into check valve systems, but the average cost of those was exorbitant," says Jeff Graham, Senior Production Operator at the Santa Clarita Water Division, Santa Clarita, CA, which uses both chlorination and chloramination injection in its 64-million-gallon potable water storage facilities.

"Also, we have 42 tanks in our system, and now that we use chloraminate in 60% of our water (that coming from the state water project) we found that with chloramines that we had too much storage, and that we could circulate the water through the tanks pretty quickly. So we're currently using only 36 of our storage tanks."

"From all of our research on chloramines, we found that the majority of problems occur in the tank. The fact that the water sits there . . . doesn't really circulate in your tanks. So we were looking for a technology that would improve turnover in our tanks."

In order to get the most thorough and efficient mixing of water in potable water tanks, Santa Clarita decided to test a solar-powered circulation system that is in wide use for aerating lakes and reservoirs. Manufactured by Pump Systems, Inc. (Dickinson, ND), these SolarBee™, systems are self-contained floating units that can draw up to 10,000 gallons of water per minute and spread it gently across the surface for 24/7 continuous aeration and mixing.

The SolarBee system can accommodate chlorine and chloramine injection systems, and facilitate thorough breakpoint chlorination whenever necessary. The system is powered by solar panels that may be detached for use on top of enclosed tanks.

"We first saw the SolarBee system at a trade show in late 2004," Graham says. "Everything about the system looked good. Good concept, good machine, good price."

Graham says he was impressed by the open reservoirs and lagoons that were using the SolarBee succesafully, and that the same technology had become available in smaller units for potable water reservoirs.

"We did an initial pilot with one SolarBee unit in February 2005," he says. "The pilot only took a couple of weeks. We put the system in and did some testing with different temperatures throughout the tank. Then we injected some chlorine, and almost within a month, we were very satisfied with the circulation results we were getting."

Mixing improvements at Sunset Reservoir in San Francisco

The ability of this technology to effectively mix large water tanks has also been well documented in a recent installation at San Francisco Public Utilities Commission (SFPUC). At the Sunset Reservoir South Basin the patented SolarBee technology achieved remarkable successes with both chlorine and chloramine systems.

Two tests were performed (with and without the SolarBee system) in 2002 when chlorine was used, and two additional tests in 2003-4 when the reservoir was supported by chloramine. In summary, the study found that three major objectives can be accomplished by using SolarBee mixers in city reservoirs:

[1] eliminate short-circuiting and minimize water age in oversized distribution system reservoirs;

[2] minimize residual loss in reservoirs; and

[3] facilitate emergency disinfection or breakpoint chlorination in a reservoir. The SolarBee units also proved to be reliable, cost effective, and low in maintenance.

Unlike nozzle devices and check-valve inflow-outflow piping, this circulation causes no adverse effect on system flow rate capability, no loss of energy at the nozzle, no losses in pump efficiency, and no changes to other distribution system characteristics.

Compared to turbulent mixers the SolarBee unit mixes the entire reservoir and has far lower operational and maintenance costs. The system can be equipped with SCADA output signals, a chlorine injection system, and with various solar and 24-hour power kits as needed depending on reservoir characteristics. The system's flotation system, together with the variable length intake hose, self adjusts at all times for peak performance regardless of water depth in the reservoir.