



Aeration System Stirs Up Savings

Aeration Industries International's Aire-O₂ Triton® aeration/mixer system has the unique design flexibilities, oxygenation and mixing capabilities that can result in cost benefits and energy efficiencies. The article outlines the process via a case study in China.

An efficient new aeration technology is saving the Suzhou Fuxing Wastewater Treatment Plant in energy and equipment costs totaling 420 Horsepower. Besides giving this facility located in the southern Jiangsu Province of China a financial boost, the aerators are meeting the strict discharge limitations providing an environmentally safe and pure water discharge.

The Suzhou Fuxing Wastewater Treatment Plant is a part of the Suzhou water environment comprehensive treatment project, serving the southwest region. The design flow for the facility is 160,000 m³/day. The wastewater treatment plant consists of 12 concrete treatment tanks that treat the current flow of 80,000 m³/day.

The Aire-O₂ Triton® aeration/mixer system's unique design flexibilities, oxygenation and mixing capabilities resulted in the cost benefits and energy efficiencies for the Suzhou Fuxing project. All of the aerators used in the project are manufactured by Aeration Industries International, Inc. of Minneapolis, Minnesota, a U.S. company.

The design for the new treatment plants called for

an advanced alternating activated sludge process that requires three separate alternating treatment cycles: aerobic + mixing; anaerobic + mixing; and settling stage. The original plant design called for the use of traditional high-speed surface aerators to be used along with stationary mixers. When Aeration Industries contacted the design institute working on the project with an energy savings alternative, the concept immediately peaked their engineers' interest.

"The Aire-O₂ Triton® aeration/mixer system's unique features and performance capabilities more than suited the plant's design requirements," says Brian Cohen, Vice President of International Sales for Aeration Industries International, Inc. "We immediately outlined that we could save them a minimum 25Hp per aeration tank because of our equipment. With its dual capabilities of separate aeration and mixing modes, we rendered the stationary mixers for this project unnecessary".

Aeration Industries recommended four Triton aerators per tank along with one Aire-O₂ Turbo® surface aerator positioned in the center in lieu of the previous design,

which utilized two surface aerators and two stationary mixers. The result was a savings of 420Hp total on the initial 80,000m³/day plant located in Fuxing. The second stage of this project soon followed in Lou Jiang, thus leading to an additional 420Hp savings!

Despite the fact that each tank was 4.5 m deep, the Tritons could easily keep complete mix. In each concrete tank, the four energy-efficient Triton aerator/



The energy-efficient Triton process aerator's dual mode feature saved a total of 840 Hp at the Suzhou Fuxing, pictured, and Lou Jiang plants.



mixers are strategically positioned to maximize oxygenation and mixing in both the aerobic + mixing stage and anaerobic + mixing stage.

The Aire-O₂ Triton® aerator/mixer is an electric motor-driven air assist propeller-type floating aerator equipped with a regenerative blower. The Triton aerator's primary and secondary propellers inject air in a high velocity stream of bubbles, defined by the U.S. Environmental Protection Agency (EPA) as "fine bubble," below the surface of the water ensuring rich oxygen dispersion performance efficiencies.

"The Triton is an energy-efficient, dual mode process aerator capable of nitrification and denitrification all in one unit," says Cohen. "Because the Triton features two propellers and an onboard regenerative blower, we are able to operate the aerator as either an anoxic mixer with the blower turned off or a very efficient aerator/mixer with the blower turned on."

The Suzhou Fuxing Treatment Plant's current flow has an influent BOD of 180 mg/l, COD 360 mg/l, and NH₃-N 35 mg/l. The aeration system is providing excellent treatment efficiencies with effluent removal rates of BOD 20 mg/l, COD 60 mg/l, and NH₃-N 15 mg/l.

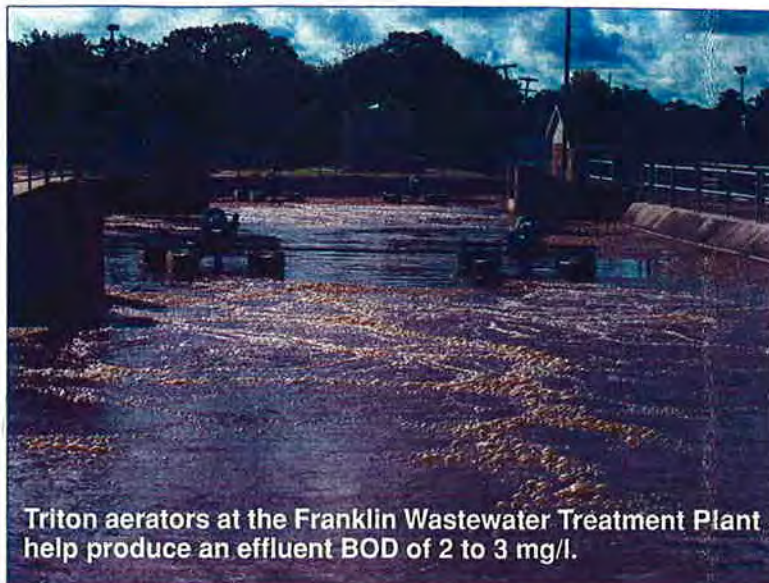
Total equipment at the site are 40 x 20 Hp Aire-O₂ Triton® aerator/mixers, 8 x 15 Aire-O₂ Triton® aerator/mixers, 8 x 150 Hp Aire-O₂ Turbo® surface aerators, and 4 x 125 Hp Aire-O₂ Turbo® surface aerators.

Another cost-effective feature of the equipment is that the total aeration power can be adjusted to various levels to meet the needs. All the equipment is surface-mounted on flotation and anchored by steel cables, making routine maintenance quick and easy. There is no need to drain the tanks.

New Technology

The Triton aerator/mixer is a new and advanced technology patented by Aeration Industries, a company founded 30 years ago. Since the Triton's introduction in 1996, nearly 1,000 units are in operation around the globe providing benefits to customers like the Suzhou Fuxing plant and also, at sites in the U.S. like the city of Franklin, Louisiana.

When its brush rotor system failed, the city of Franklin decided to replace it with an Aire-O₂ Triton® aeration/mixer system, which equalled the ongoing costs of refurbishing the rotors. The aerators met all the city's needs and officials purchased more of the aerators for



Triton aerators at the Franklin Wastewater Treatment Plant help produce an effluent BOD of 2 to 3 mg/l.

its second ditch a year later.

In 2000, the treatment plant consisted of an activated sludge system in two parallel oxidation ovals that used two brush rotors per ditch. When one went down for maintenance, they lost 50% of their horsepower and aeration effectiveness.

The plant receives a total flow 9,085 m³ that splits between the two ovals for treatment. Boat clarifiers are located in each oxidation oval.

The rotors had ongoing maintenance problems, according to John Ford, Franklin's plant operator. "We had so much trouble with the bearings. We had to go out and grease them every day and even on Saturdays."

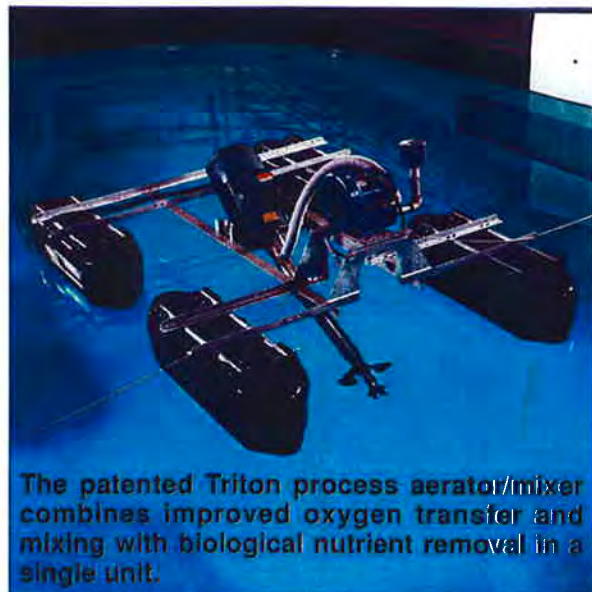
Eventually, the equipment started failing. "The rotor broke in the middle, we lost a lot of manpower hours, and maintenance became very difficult and kind of dangerous," Ford said.

The decision was made to replace the failed rotor system with a new aeration system in early 2000. John C. Fore, Jr., P.E. of Miller Engineers & Associates, Inc., located in Franklin, was the project manager.

"There were two things we were looking for in a new aeration system," said Fore. "It had to put enough dissolved oxygen into the ditch. And, it had to maintain a certain velocity." Mixing to maintain velocity is important. A rate of 1.0 fps to 1.3 fps in the channel for proper velocity of 0.7 to 1.0 fps at the boat clarifier was required.

The Aire-O₂ Triton® aeration/mixer system was selected to replace the rotors in Ditch #2.

Four 25 Hp aerator/mixers were mounted on floats in sets of two strategically placed in the ditch to allow for optimal mixing and treatment efficiencies.



The patented Triton process aerator/mixer combines improved oxygen transfer and mixing with biological nutrient removal in a single unit.

Mixing Velocity Tests

Velocity testing was performed by United Industries, Inc. on Ditch #2 in August 2000 to ensure that the Triton aerators were providing the proper water velocity.

The report states, "The velocity readings of over 1ft/sec in the vicinity of the clarifier indicate that no deposits are expected to develop here and that the clarifier should function. Inspection seems to indicate that the velocity readings in Ditch #2 (the Triton aerators) tend to be higher than in Ditch #1 (the brush rotors)."

"The Triton aerators have been giving flows in the area we expect since installation because the effluent has been satisfactory," notes Fore. In addition, "only three of the four units are required to provide the desired DO (dissolved oxygen) in the ditch."

In May 2001, the city of Franklin decided to replace the brush rotor system in Ditch #1 with another Triton aerator/mixer system that also included four 25 Hp units.

"The aerators are working really good," says John Ford. "And, they do a very good job of mixing. Now, I don't have to do any maintenance on them except to grease them every six months. That's a big difference than having to grease the rotors every day. And, the Triton aerators run 24-7-365 days a year!"

He reports that the treatment facility has had no trouble meeting its stringent permit discharge limits. The influent BOD is 185 mg/l at the plant. Treated effluent BOD is 2 to 3 mg/l. Total suspended solids (TSS) influent is 90 mg/l with effluent TSS below 15 mg/l.

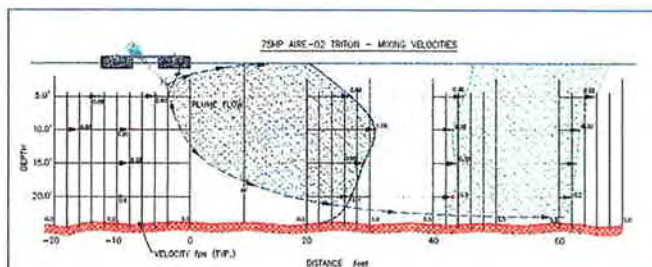
The Triton aeration system provided the equipment solution for the treatment facility in providing good mixing for its boat clarifier in a ditch application, plenty of oxygen transfer to meet removal requirements, and most importantly for Franklin, maintenance is now a simple semi-annual routine check-up.

Independent Tests

The Franklin/United Industries velocity tests were performed on 25 Hp Triton units. Other mixing tests have demonstrated the Triton's capabilities. Independent mixing tests performed on a 75 Hp Triton under actual field conditions showed significant velocities were achieved down to the lagoon's depth of 24 feet and out to its maximum allowable distance of about 60 feet. [Test data is available upon request].

The Triton is an efficient mixer because it has an 'induced flow' rate that is much greater than the prop pumping rates and can be mathematically calculated. Propeller manufacturers estimate that the induced flow rate can be any where from 10 to 20 times that of the 'calculated flow' rate.

"The pumping rate of any given prop can be mathematically calculated based on the following: prop diameter, prop pitch, and prop rpm. One rotation of the prop will pump X gallons of water based on the above



Independent mixing tests on a 75 Hp Triton aerator showed velocities out to 60 feet and down to the lagoon's 24-foot depth.

prop design parameters." Cohen notes, "Another factor regarding prop pumping rates applies to props operating in an open environment compared to props operating within a volute or confined space." **WWA**

This article is written by Cheri D Cohen, Consultant, Aeration Industries International, Inc.

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