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THE OFFICIAL PUBLICATION OF THE INDIANA WATER ENVIRONMENT ASSOCIATION

environmentally friendly

By G. Shawn Brown,
Systems Product Manager
Aeration Industries International, Inc.

Sequencing Batch
Reactor Design
**Keeps Noise, Energy
& Capital Costs Low**



Perry Township in Fayette County, Pennsylvania is one of the first SBR plants to utilize a surface mounted process aerator/mixer, which is a significant improvement over the traditional diffused air network designs. The new layout offers substantial capital investment savings as well as significant reductions in noise, operations/maintenance, and energy consumption.

KLH Engineers, Inc., headquartered in Pittsburgh, PA was awarded the contract to provide engineering construction services on the project. KLH has a long history of SBR design, installing one of the first batch reactors in the United States in 1983.

The design of the Perry Township SBR is based on an average daily flow of 100,000 gpd of municipal wastewater. The plant layout consists of three rectangular concrete tanks – two batch reactor tanks measuring 13' wide x 35' long x 20' deep and one sludge holding tank measuring 9' wide x 25' long x 20' deep. Instead of diffused air, one 10 HP Triton aerator/mixer is installed in each

of the reactors. In addition, one 5 HP Triton unit is installed in the 30,000 gallon sludge holding tank to provide aeration and mixing.

Each reactor also contains a decanter. The decanter is a fixed four-sided stainless steel decanter with solids exclusion baffles that is moved up and down via a worm gear driven jack screw to produce a controlled and high quality flow of effluent during the decant phase. The four-sided design allows for a reduction in the overall size of the decanter thereby reducing cost and simplifying installation.

The process aerator/mixers are float mounted units that ride vertically up and down on stainless steel slide pole assemblies as the water level in the tanks change. Polyurethane rollers are integrated into the float assembly and enable the units to move smoothly along the slide poles without binding. This enables the equipment to be easily inspected and maintained from the surface of the tank. In fact, all of the equipment in the SBR is easily accessible

from the top without ever needing to drain the basins for inspection or service.

The aerator used in the design is a unique piece of process equipment which has the capability to mix and aerate in one single unit and to do so completely independently of one another. The aerator is driven by a 900 rpm (60 Hz) motor which significantly extends the life of the equipment. The motor drives a large power mix propeller which produces a high degree of mixing ensuring that the tank contents are completely mixed from top to bottom. The aerators are not self-aspirating. All of the air produced by the aerator is fed by a very quiet on-board regenerative blower which pushes the air down the dynamically balanced hollow shaft of the mixer and injects the air into the water column producing a large volume of fine bubble diffused air. The air is driven deep into the tank by the power mix propeller providing for efficient contact of the air with the wastewater and long bubble hang times thereby maximizing oxygen transfer efficiency.

The result is a much more compact plant that is quicker to install and easier to operate and maintain.

This also minimizes noise at the plant. In fact, the Perry Township installation is located immediately adjacent to a Rails-to-Trails bike path that runs between Pittsburgh and Washington D.C. Terry Soster, President of KLH Engineers, noted that "there are many bikers that pass by the plant and the noise levels are imperceptible." Noise levels within 10 m of the plant are easily < 70 dbA without the need for any special covers or enclosures for any of the equipment.

Each SBR cycle includes 15 minutes of fill and anoxic mix where the mixer only portion of the aerator is in operation, 120 minutes of fill and aeration where the full aerator/mixer is in operation, 45 minutes of settling with the aerator/mixer in standby, and 60 minutes of decant with the aerator/mixer in standby and the decanter in operation for a total of six cycles per day. The current permit limits for the plant are CBOD = 25 mg/l and TSS = 30 mg/l. Average influent quality entering the treatment plant from December 2007 through July 2008 was CBOD = 198 mg/l and TSS = 152 mg/l. Effluent quality during the same period has been far lower than permit limits and has averaged CBOD = 6.4 mg/l, TSS = 6.4 mg/l, and ammonia = 1.3 mg/l.

Since the aerator provides both the mixing and aeration in one unit and since that unit is installed directly in the tank, there is a substantial savings in capital investment both from an equipment supply perspective and an installation perspective versus conventional SBR designs utilizing diffused air. The cost of diffuser networks, piping networks and supports, centrifugal or positive displacement blowers, and blower buildings or enclosures is eliminated and replaced by the process aerator/mixer at a much lower capital cost. The result is a much more compact plant that is quicker to install and easier to operate and maintain. Terry stated, "The use of the aerator devices has allowed the authority to free up valuable building space that would have been used for blowers and to use that space for much needed storage

that they did not have with the original plant design."

Furthermore, as discharge permit requirements continue to get more and more strict throughout the United States, biological nutrient removal (BNR) is a certainty for most, if not all, plants in the future. A big advantage from a process perspective is that the Perry Township plant can be easily upgraded in the future to enable the plant to both nitrify and denitrify as well as facilitate biological phosphorus removal by simply changing the controls programming to allow for anaerobic and anoxic mixing steps during the SBR cycles.

Terry observed that the SBR "provides flexibility in the future for a mixed non-aerated cycle that will allow the facility to comply with biological nutrient removal requirements without any additional capital expenditures."

This new SBR design has provided Perry Township with a cost effective plant that is easy to maintain and operate with low impact on the surrounding environment. And the process flexibility afforded by the innovative system ensures that the plant will be able to meet its permit requirements in a proactive manner well into the future. □



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