

Abilene constructing new SBR technology wastewater plant

The city of Abilene with a population of 6,600 is in the process of constructing an Aqua- Aerobics Sequencing Batch Reactor, commonly called a SBR. The Abilene plant will consist of a 1.5 million gallon per day Aqua-Aerobics 4 Basin Aqua SBR. Although there are other SBR plants in Kansas, there is only one other Aqua SBR plant of this type in Kansas. It is located in Coffeyville.

The Abilene sewer plant project started in 2003 when the city came under a state administrative order for failure to meet the discharge permit limits. The city had been failing the limits for six out of 12 previous months. This was primarily due to the

substantial industrial growth and residential growth associated with it in Abilene and the immediate surrounding community. The city is currently treating waste with a system utilizing anaerobic digesters and trickling filters.

This system was originally built in the early 1960s and was upgraded in the late 1970s. Disinfection by use of UV light was installed in 1999. The city will utilize the existing UV disinfection as part of the new SBR treatment system.

Need for a new plant

The state administrative order included a dateline for the

completion of the project. The Abilene Public Works Department contracted with Bucher, Willis and Ratliff Corporation (BWR), Salina, to assist with a project time line and the engineering for the project.

“Completion of this new plant should dramatically improve the city’s treatment process to ensure compliance with the state’s KDHE discharge requirements,” Public Works Director Cliff Gibbs said.

Plant costs

The Abilene Public Works Department advertised for construction bids in July 2006. The Walters Morgan Company, Manhattan, was awarded the construction contract and started



The new plant basin is under construction. Inside forms are in place with wall strengthening steel being tied-in before the outside forms are set.

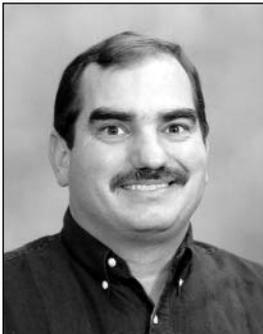
construction in mid-September 2006. The estimated project completion date is April 2008. The BWR engineering estimate for the base bid and alternates was for

\$9,617,000. The actual bid with alternates was \$9,382,000. The alternates included a concrete drive around the facility and demolition of the existing plant.

“Another contracted item is for two phases of operator training. We will train operators before plant completion in a primary training segment, and then after we’re up and running, we’ll send our people to secondary training,” Gibbs noted.

Funding and rates

The project is being funded with a \$1 million EPA special appropriations grant, administered by the EPA, with



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Abilene City Manager Mark Arbuthnot (sitting) and Cliff Gibbs, public works director, review plans of the new Aqua-Aerobics Sequencing Batch Reactor plant under construction.

the balance provided through a KDHE Clean Water Loan (SRF).

The city has needed to increase rates several times since 2004 to meet the anticipated loan repayments. Abilene sewer rates

are set by using the winter water usage figures. The rates in 2004 were a \$7.25 base rate, with a \$1.82 per 1,000 gallons rate for inside the city and a \$10.85 base rate with a \$2.73 per 1,000 rate for outside the city. The rates increased to a \$12 base rate with a \$.38 per 1,000 rate for inside the city, with the outside city rate set at an \$18 base rate and a \$.57 rate

and infiltration has been reduced steadily over the years by a progressive manhole rehabilitation program. The city has also utilized cured-in-place pipe and pipe replacements in several areas of



From inside the plant basin, form sets and bracing pieces are seen being readied for pouring the 25 ft. tall concrete walls.

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The wastewater system has an average flow of 550,000 gallons per day and increases to 750,000 during a heavy rain. The inflow and infiltration has been reduced steadily over the years by a progressive manhole rehabilitation program.

per 1,000 for outside. Another increase is anticipated in October 2007. The base rate will stay the same but the per 1,000 gallon charge will increase to a \$.50 rate per 1,000 for inside the city and a \$.75 rate per 1,000 for outside the city for both residential and commercial.

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town. In 2004 the city typically would have a flow rate of over 800,000 gallons per day with only a one-inch rain event.

There are four main stages of the Sequencing Batch Reactor (SBR). They include the fill, react, settle and decant. When one tank is in the settle/decant mode, the other is aerating and filling. Aqua-Aerobics, the design vendor for the Abilene plant, describes their process working stages here. More

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information can be found at their Web site, www.aqua-aerobic.com.

Stages of SBR operation

There are two phases of the *fill* stage; the mixed fill phase is when influent enters and a



Sewer Plant Operator G.D. Hite stands on the three foot thick footings for the basin walls. Rebar is in place ready for forms to be set so the basin walls can be poured.

complete mix of the reactor contents is achieved without the use of aeration. This phase assists with the control of filamentous

organisms and is essential for those systems, which require phosphorus removal. During the react fill phase the influent continues under mixed and aerated conditions. Aeration may be intermittent to promote aerobic or anoxic conditions. Nitrification and denitrification can be achieved. The aeration source may also be operated intermittently during low flow and low organic loading conditions to conserve energy.

The next stage is the *react* stage. Influent flow is terminated, while mixing and aeration continue. Intermittent operation of the aeration system may continue to complete the nitrification/ denitrification process, or to conserve energy.

The next stage is the *settling* stage. Mixing and aeration cease and the solids/liquid separation take place under perfectly quiescent (dormant) conditions.

Advantages of SBR

- Small footprint
- Maximum day flow sizing, not peak hourly
- Can handle large fluctuations in flow and influent quality
- No hydraulic connection between incoming sewage and the outfall
- Flexibility and control
- Deeper tanks, better actual oxygen transfer rate (AOTR)
- Modular, adaptable to retrofits and upgrades
- Full back-up systems

Disadvantages of SBR

- Requires highly skilled team to design and construct the facilities
- Highly skilled operators are needed
- Can have higher operating cost, the cost of power fluctuates.
- Larger disinfection system, batch discharge
- More mechanical equipment

Summary of SBR process

A typical Sequencing Batch Reactor (SBR) involves an activated sludge process designed to operate with fluctuating state conditions. The true SBR system works in a batch mode with aeration and sludge settlement both happening in the same tank. The main differences between an SBR and a conventional continuous-flow, activated sludge system is that the SBR tank moves out the actions of equalization, aeration and sedimentation in a time sequence rather than in the conventional space sequence of continuous-flow systems. Also, the SBR system can be designed with the capability of treating a wide range of influent volumes while the continuous system is based on a static influent flow rate. There is an amount of flexibility with working in a time rather than in a space sequence.

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The final stage is the *decant/sludge* waste stage. The mixer and aeration system remain off and, at this time, the decantable volume is removed by means of subsurface withdrawal. The reactor is immediately ready to receive the next batch of raw influent. A small amount of sludge is wasted with each cycle.

There is one additional stage, the *idle* stage, which occurs in multi-basin systems, such as Abilene's, when flow conditions are less than peak design flows. Idle time varies depending on the actual flow conditions.

2007 Conference & Exhibition

The 2007 KRWA Conference & Exhibition promises to be another great learning event. The technical program is outstanding. A preconference session, "Wastewater Collection System Evaluation and Rehabilitation," starting Tuesday morning, March 27, finishes at 4 p.m. The session

will help in evaluating every aspect of a wastewater system from how a system performs to how much it is costing.

The KRWA Conference is the largest and best in the Midwest. I hope you will plan to be in Wichita at Century II March 27 – 29. Board and council members are particularly encouraged to attend. Their "need to know" has never been greater with new, and many times technical but critical, agency rules and regulations being implemented that need to be understood and dealt with.

I look forward to seeing you there. Check the registration section of this magazine starting on page 60. A registration form can be found on page 82. If you have questions regarding a wastewater system or its performance call the KRWA Office at (785)336-3760 or e-mail krwa@krwa.net.

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