EPA
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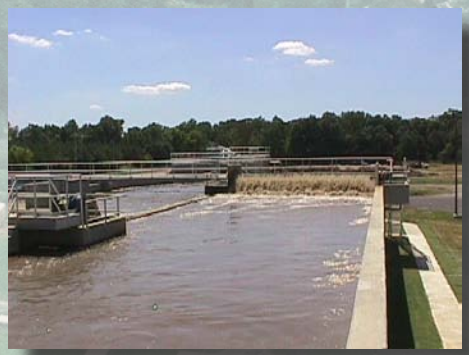
Evaluation of Energy Conservation Measures

for Wastewater Treatment Facilities



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Cover photo:
Bucklin Point WWTF, MA. Photo courtesy of Narragansett Bay Commission.

Cover insert photos (left to right):
High Speed Magnetic Bearing Turbo Blower at the De Pere WTF, WI. Photo courtesy of Green Bay Metropolitan Sewerage District.
Oxidation Ditch with Aeration Rotor at the City of Bartlett WWTP #1, TN. Photo courtesy of City of Bartlett Wastewater Division.
Variable Outlet Vane Diffuser. Photo courtesy of Turblex, Inc.

6.4.2 Pulsed Large Bubble Mixing

An innovative mixing technology by Enviromix called Bio^{M}x reduces energy required for anoxic or anaerobic zone mixing by firing short bursts of compressed air into the zone instead of mechanically mixing it. Uniquely designed nozzles produce a mass of large air bubbles, ranging from marble to softball size, which mix the water as they rise to the surface (Randall and Randall 2010). The large air bubbles, much larger than those made by coarse bubble diffusers, are designed to minimize oxygen transfer and maintain anoxic or anaerobic conditions. The system includes a PLC to manage the timing of the air control valve firing, which gives the operator flexibility to respond to different conditions within the tank. The manufacturer reports that the system has non-clogging, self cleaning in-tank components that require no maintenance. See Figure 6-4 for a typical installation and the manufacturer's website for additional information (http://www.enviro-mix.com/biomx.php).

Figure 6-4. Typical BioMix^{TM} Installation
Source: EnviroMix. Used with permission

An independent study at the F. Wayne Hill Water Resources Center in Gwinnett County, Georgia compared the performance and energy use of Bio^{M}x to submersible propeller mixers (Randall and Randall 2010). The plant, treating 30 mgd on average with a design flow of 60 mgd, operates up to 10 parallel treatment trains each with anaerobic, anoxic, and aerobic zones for biological nitrogen and phosphorus removal. In the spring of 2009, the Bio^{M}x system was installed in two anaerobic cells of one treatment train. The system consisted of an Ingersoll Rand 5 – 15 hp variable speed rotary screw compressor, piping, controls, and floor mounted nozzles. Findings from the technology evaluation performed in January 2010 are summarized below.

- Dye tracer tests showed similar mixing for the Bio^{M}x and submersible mixer systems.
- Total suspended solids (TSS) profiles showed that the Bio^{M}x unit is capable of mixing to homogeneity similarly to the submersible mixing units, although variability in the Bio^{M}x cells was slightly higher.

- Continuous oxidation reduction potential (ORP) measurements over periods of 12 to 28 hours showed 95th percentile ORP values of less than -150 millivolts (mv), which is indicative of anaerobic environments. Given the success in anaerobic environments (< -100 mv), the technology is also applicable for use in anoxic environments.

- Power analyzer readings taken simultaneously showed that energy (in kW) required to mix one anaerobic cell using the Bio^{M}x system was 45 percent less than the energy required by a submersible mixer. When operated in three cells using the same compressor, 60 percent less energy was required (0.097 hp/1000 cf)

The manufacturer also presents test results conducted from April 2009 through February 2010, available online at http://www.enviro-mix.com/documents/FWayneHillEnergySuccessStory2009-091001.pdf.

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