ENVIROMIX

Warren, MI WWTP — Case Story of Success

Warren, MI Retrofits Conventional Activated Sludge Process with an A/O Process Including BioMix™ Compressed Gas Mixing System to Reduce Chemical Cost

Location: Warren, Michigan	Solution: BioMix™ Compressed Gas Mixing
Design Engineer: Johnson Controls/AECOM	Design Flow (ADF): 36 MGD
Application: BNR Mixing	Compressors: Two (2) 15 HP Rotary Screw
Mixing Efficiency: 0.1 HP/1000 FT^3	Quantity of Mixing Nozzles: 160

The Warren WWTP in Warren, Michigan formerly utilized a conventional activated sludge (CAS) process prior to being upgraded to an A/O process in the spring of 2014. The plants conventional activated sludge process was not designed for biological nutrient removal so phosphorus was removed through costly chemical precipitation with $FeCl_3$ addition. Incorporating biological phosphorous removal (BPR) could save the plant over $150,000 per year in chemicals.

Johnson Controls Inc. contracted with the City to enter into an Energy Savings Performance Contract (ESPC), for which EnviroMix provided its BioMix™ Compressed Gas Mixing technology to mix anoxic and anaerobic biological treatment cells created within the existing footprint of the four operating process trains. The BPR process provides operational savings through the elimination of hazardous and costly phosphorus precipitation chemicals.

Twelve hyperbolic style mechanical mixers at 36 connected horsepower were originally considered for the project; however, capital and installation costs exceeded the project budget needed to provide a valid ESPC business case. The solution offered by EnviroMix reduced capital and installation costs and reduced the load to less than 15 horsepower. In addition, the low maintenance requirements of the operating compressor coupled with overall energy-efficiency of BioMix™ enabled a short payback term for the mixing system installation.

Numerous process modeling simulations were performed to determine the optimum biological phosphorus removal process to balance process performance with the cost for modifying the activated sludge process and mixing energy. It was determined that a process consisting of equal size pre-anoxic and anaerobic zones, representing a total of 20% of the process volume with 75% return activated sludge recycle would produce the desired results. Furthermore it was determined that the introduction of a minimal amount of compressed air would not have a measurable effect on the biological phosphorus removal mechanism, and field performance reflects that.

During the process conversion from chemical phosphorus removal to BPR, parallel trains of each process regime were operated and the results compared one to the other. It was determined that the BPR process with the BioMix™ Compressed Gas Mixing System allowed the process to achieve phosphorus removal more efficiently and consistently than the conventional chemical precipitation process. By example the BPR process trains provided 50% more total phosphorus removal than those removing phosphorus through chemical precipitation alone.

Comparative Operating Performance 2014	Bio-P Removal w/ BioMix™	Chemical P Removal w/ $FeCl_3$
Raw TP (mg/l)	3.6	3.6
Effluent TP (mg/l)	0.7	1.4
Effluent Sol. P (mg/l)	0.4	1.2
Effluent NO_3N (mg/l)	7.1	8.4
Effluent NH_3N (mg/l)	0.1	0.1

EnviroMix's BioMix™ Compressed Gas Mixing System at the Warren WWTP is an example of a cost effective, energy efficient alternative to mechanical mixing technology and is fully compatible with a biological nutrient removal processes.