

CASE STUDY: Emporia, Kansas WWTP Process Upgrade

Application:	Aerobic Sludge Digestion
Design Flow (ADF):	Expanded from 4 MGD to 5.4 MGD
Mixing Efficiency:	0.15 hp / 1000 ft ³ of tank volume
Compressors:	One (1) 30 HP Rotary Screw
Blowers:	Two (2) 200 HP and one (1) 100 HP Hybrid Rotary Screw
Nozzles:	121
Design Engineer:	Burns & McDonnell
Contractor:	CAS Constructors



Decoupled aeration from mixing

BioCycle-D™ Process Maximizes Sludge Destruction while Minimizing Energy Consumption

In order to meet strict effluent treatment requirements set to take effect in 2022, the City of Emporia upgraded its wastewater treatment plant in 2019.

Burns & McDonnell and CAS Constructors worked collaboratively to provide improvements to meet the upcoming discharge standards. Their primary goal was to upgrade and expand the plant's conventional activated sludge process to an integrated fixed-film activated sludge (IFAS) process with aerobic sludge digestion.

As part of the project, process equipment procurement packages were issued to evaluate and select the most cost-effective technologies. The design team selected EnviroMix's BioMix Compressed Gas Mixing System to mix the BNR selectors in the secondary treatment process. Separately, they compared the process flexibility, operational costs, and total cost of ownership of aerobic sludge digestion technologies before selecting the BioCycle-D Optimized Aerobic Digestion Process for the project.

BioCycle-D provided the lowest total cost of ownership, enabling the city to achieve \$75,000 annual energy savings versus conventional diffused air mixing designed at 30 scfm/1000 ft³ of tank volume.



ENERGY EFFICIENCY

50-70% energy savings versus conventional diffused air mixing (30-year design and startup loading, respectively)



STRAIGHTFORWARD OPERATION

Automatic control within operator selected process parameters



PROCESS OPTIMIZATION

Aerobic aeration phases and anoxic mixing phases controlled through instrumentation feedback



UNPARALLELED FLEXIBILITY

Aeration is decoupled from mixing, allowing precise control for volatile sludge destruction



Valve control module located at the digester controls the mixing intensity



Rotary screw blowers



Level, DO, and ORP instrumentation

BioCycle-D enabled the city to maximize sludge destruction, minimize energy consumption, and optimize process control.

Conventional aerobic digesters use diffused aeration for both mixing and process oxygen demands. This leads to over-aeration, uncontrolled nitrification, depletion of alkalinity, and increased energy consumption. **BioCycle-D controls and optimizes the digestion process, providing energy savings and improved sludge digestion through automated process control.** BioCycle-D offered the flexibility that this project demanded.

- The upgraded aerobic digestion system utilizes a pre-existing 27' deep anaerobic digester that was converted to an aerobic digester and a new 18.5' deep aerobic digester that is about 50% greater in capacity. Even though the sludge loading to the two digesters is dissimilar, as is the operating depth, the BioCycle-D process control system aerates and mixes both digesters to produce optimal process conditions.
- Both digesters have deep conical hopper bottoms, making it virtually impossible to completely mix the tanks with just a diffused aeration system. The BioMix Compressed Gas Mixing System was installed below the aeration system to ensure bottom-up mixing all the way to the bottom of the cone, thereby eliminating the large dead volume that would result in sludge deposition and digester upsets due to septic conditions.

The BioCycle-D system is packaged as an integrated solution with the inherent flexibility to accommodate a wide range of operational conditions.



Contact sales@enviro-mix.com today to discuss the ways EnviroMix can optimize your mixing solutions.