City of Bowling Green Water Pollution Control Division
Wastewater Treatment Plant Improvements
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The City of Bowling Green was faced with the challenges of an aging aerobic digestion system along with local opposition of their Class B biosolids land application program. These improvements focused on providing innovative solutions under some unique conditions that has enabled the City to produce Class A biosolids for the same cost of a Class B system.

Plant History

The current Bowling Green Wastewater Treatment Plant (WWTP) was placed into operation in 1982 and is rated by the Ohio EPA as a Class IV Facility. Treatment is achieved through primary, secondary and tertiary treatment processes with aerobic digestion of waste biosolids. The plant had a capacity of 8 MGD dry weather flow with a peak hydraulic capacity of 16 MGD.

All separate and combined wastewater is screened and pumped to the treatment plant by the East Poe Road Pumping Station using four variable speed, vertical centrifugal pumps with a total rated capacity of 24 MGD. Also at the pumping station is a 4 MG holding tank and combined sewer diversion chamber to handle excess wet weather "first flush" combined wastewater and stormwater flows. Approximately 35% of the sewer system in the City of Bowling Green is combined sewers.

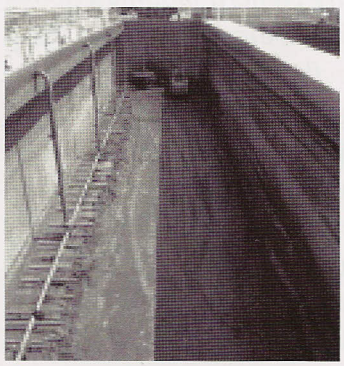
The WWTP had served the City well since 1982 but eventually began to show its age. In the late 1990's the city replaced the chlorination system with UV disinfection. In 2003 a plant study was completed that focused on solids handling issues they were experiencing. This article primarily focuses on how the City approached and eventually addressed their solids handling needs.

The Problem

The four existing aerobic digesters were nearing design loadings and would experience occasional upsets during cold winter months which resulted in odor problems. In addition, after nearly 20 years of operation, existing aeration equipment was in need of replacement. The primary goal was clear - increase the solids handling capacity of the WWTP with a process capable of performing effectively in a cold climate, while meeting US EPA 503 Sludge Regulations. Secondary goals included increasing the average day plant capacity from 8 to 10 MGD, converting the aeration tanks to Biological Nutrient Removal (BNR) with anoxic selector zones, the addition of a high efficient variable vane blower and provide a new septage receiving station.

Existing Conditions

The Bowling Green WWTP processed waste primary and secondary sludge using a course bubble diffused air, aerobic digestion process.



Coarse Bubble Diffusers

The primary advantage of the existing aerobic digestion process was its relatively simple operation. Plant staff had experience with aerobic digestion at its previous facility and at the time, electrical energy costs were relatively low since the city operates its own electric co-op. Near the end of its design life, the ever increasing cost of electrical energy became a significant disadvantage. Operating near design loadings, the process's simplicity greatly limited their ability to perform during colder months. With the only control

being the amount of air applied, the operator had limited control of the digestion process and when an upset became imminent, there were few options available to avoid the problem and even worse, limited abilities to correct the problem, once it did occur.

During its last few years of operation, the WWTP was unable to achieve Class B biosolid regulations of 38% volatile solids reduction for up to six months during the colder months of the year. The cold temperatures were suppressing the biological activity of the aerobic digestion process.

Alternatives Evaluation

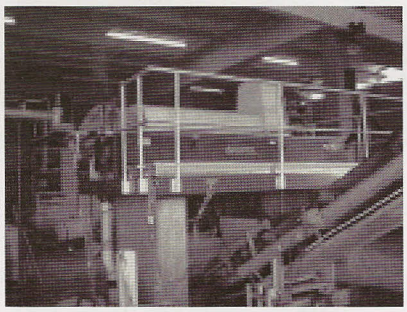
Several aerobic digestion alternatives were studied between 1999 and 2003, ranging from traditional Class B processes similar to what they had, to advanced Class A processes. During the evaluation the City encountered significant pressure from a local faction to eliminate their Class B liquid land application program due to perceived health concerns. As a result, the City took a second look at a then newer 2nd generation Autothermal Thermophilic Aerobic Digestion (ATAD) system that eliminated the need for batch tanks and provided improved process control using ORP probe technology. Other alternatives evaluated included jet aeration, traditional ATAD (using batch tanks), dewatering with centrifuges vs. liquid land application and landfill disposal.

solids destruction associated with the Class A biosolids. The ATAD alternative also offered some non-tangible benefits that included easing local health concerns and the beneficial reuse of the Class A biosolids as a top soil product.

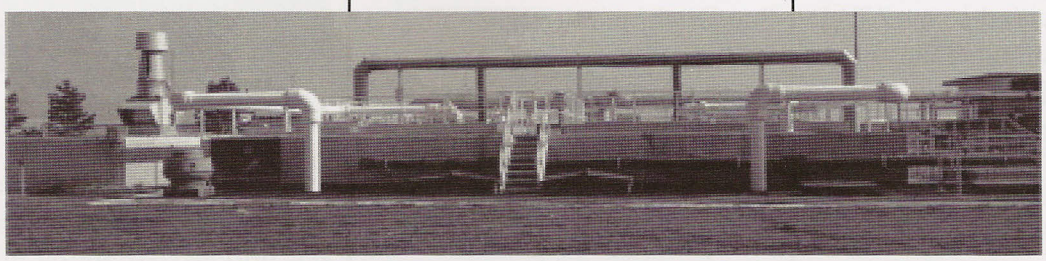
Aerobic Digestion Alternative	Average Equivalent Annual Cost	Digestion Alternative Opinion of Probable Construction Cost	Opinion of Probable Total Construction Cost
1. Jet Aeration (Class B)	$592,000	$4,275,000	$7,180,000
1A. Jet Aeration w/Dewatering (Class B)	$610,000	$3,440,000	$7,210,000
2. Jet Aeration (Class B Convertible to Class A)	$641,000	$4,875,000	$7,780,000
3. ATAD Liquid (Class A)	$680,000	$5,125,000	$8,030,000
4. ATAD w/Dewatering (Class A)	$665,000	$5,530,000	$8,440,000
5. Existing w/Dewatering to Landfill (Class B or less)	$702,000	$2,995,000	$5,900,000
6. 2nd Generation ATAD Jet Aeration w/Dewatering (Class A)	$573,000	$4,580,000	$8,230,000

Selected Plan and Improvements

Digestion System - 2nd Generation ATAD ranked highest, based on Average Equivalent Annual Cost. Unique factors that favored this alternative included a system that produced higher than normal primary solids of 4 -6%, (therefore not requiring thickening before feeding into the ATAD reactors), reduced power requirements and reduced handling costs due to higher



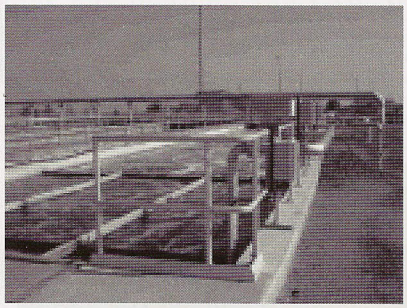
Biosolids Centrifuge



ATAD Reactors, Cooldown Tank and Biofilter

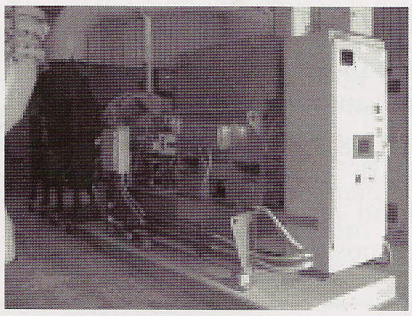
To provide flexibility in handling and enable the city to market reuse of the Class A product, a 100 gpm dewatering centrifuge rated for 2,100 dry lbs/hr was included in the project.

Secondary Aeration Tanks – Secondary activated sludge treatment process was changed from 4 tanks in parallel to 2 tanks in a 3-pass plug flow mode. This reduces short circuiting and allowed for step feed operation, improving effluent quality during peak flow wet weather. The new aeration tanks have a selector to improve sludge settleability and provisions for an anoxic zone for nitrogen removal (nitrification/ denitrification).



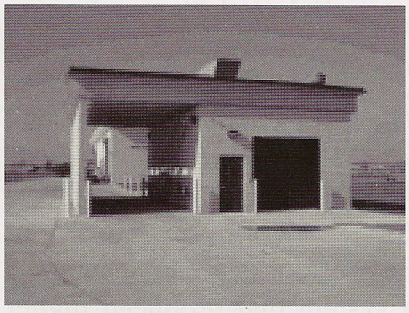
Aeration Tanks

Blower Improvements – A new high efficiency 12,500 cfm variable vane air blower was provided that operates at 80% efficiency between a 40 to 100% flow range. This significantly reduced energy demand and in conjunction with the new ATAD system it is estimated the city is saving over $60,000/year over the old system.



High Efficiency Blower

Septage Receiving Station – A septage receiving station was provided that increased capacity, significantly improved air quality (previous system was simple open, coarse grate), and included a more user friendly unloading station. The City also received the interest rate reduction program equal to the value of these improvements through the OEPA WPCLF financing program.

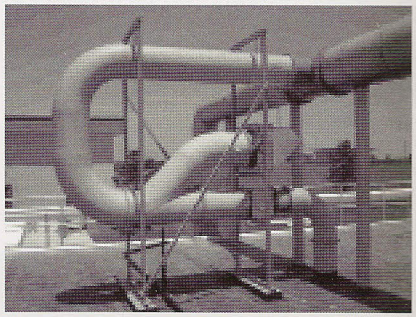


Septage Receiving Station

Effluent Limits - The increase in average day design flow from 8 to 10 MGD for the planned improvements discharging to Poe Ditch, required compliance with BADCT (Best Available Demonstrated Control Technology) for new sources on a limited quality receiving water. For the 2 MGD increase in capacity, the Ammonia limit was reduced from 2.0 to 1.8 mg/l in summer and 5.3 to 4.8 mg/l in winter and Dissolved Oxygen limit was increased from 5.0 to 5.2 mg/l. The 30-day discharge limits remained the same for CBOD at 10 mg/l, Suspended Solids at 12 mg/l and Phosphorus at 1.0 mg/l.

Results

After over a year of operation, the results confirm earlier projections. The new improvements are operating as anticipated. Some of the design innovations of the 2nd Generation ATAD included using Oxidation Reduction Potential (ORP) probes to monitor the status of the Nitrification/Denitrification condition in the cooldown tank and control air supply to the reactors. Also, innovative heat exchangers were provided in the cooldown tank and offgas piping (ATAD temperatures have reached as high as 170 F), and low cost bentonite clay was used to enhance biosolids thickening (decanting) instead of polymers.



Dilution Dampers to Cool ATAD Offgas

Dilution Dampers to Cool ATAD Offgas

Another innovation simplifies design and operation by allowing the reactors to be continuously fed thereby eliminating a batch tank for draw and fill while achieving the required US EPA 503 isolation time for pathogen destruction.

COST

The entire project was constructed for $6,703,000 and was 19% under the original project construction budget estimate of $8,230,000. In the end, it can be said that Bowling Green is achieving a Class A Sludge for the Cost of Class B with this unique system.

Startup Performance

Over the past year, the system is producing a Class A biosolid that is so highly desirable it is being used as a top soil product by a local top soil company.

Class A Product

Total solids reduction has exceeded expectations and has ranged between 60 – 75%. Volatile solids destruction has been outstanding and has ranged between 65 - 80%. Operational costs are also coming in as predicted with a 50% reduction in biosolids disposal costs over

STATE CONFERENCE TEASER

A quick reminder to all of our membership concerning this years OWEA State Conference. The conference will be held in Cleveland, Ohio starting June 23, 2008 with golf and progressing through June 26,2008.

A great technical program has been planned. Networking opportunities include golf, the meet & greet and the banquet. The meet&greet will be a 3 hour cruise aboard Cleveland's Goodtime III featuring a full buffet, open bar, live music and a DJ. The Banquet will host OWEA's first dinner theater in a 20's speakeasy (come dressed to impress). A complete itinerary will be available within the next couple of weeks. Below is information concerning lodging for you early birds who want a jump start on fun and learning.

The Hotel Marriott
Downtown Cleveland at Key Center
$159/night Single or Double
$20/day parking with in and out privileges
Phone: (216) 696-9200