

Class B Disinfection To Replace the need for expensive digestion

THE ISSUE WITH DIGESTION



High capital required with high ongoing operational costs and repair and maintenance



Long holding times solubilize nutrients, sending a nutrient loaded filtrate to the headworks requiring high energy retreatment costs



Digested filtrate is highly loaded in TN, TP and ammonia, requiring high upstream retreatment costs



Highly energy intensive process



Very large footprint required



Polymer requirements are increased due to solubilization



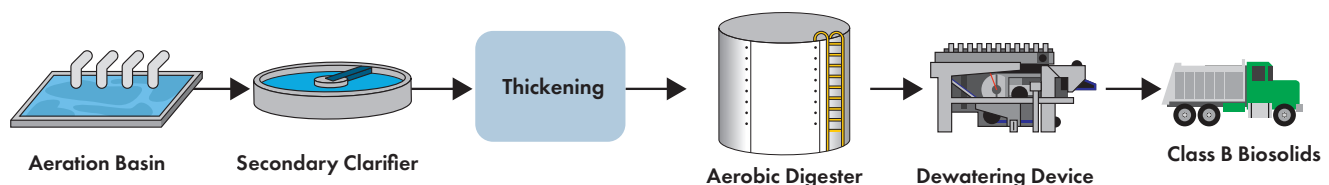
With a finite capacity expensive capital may ensue



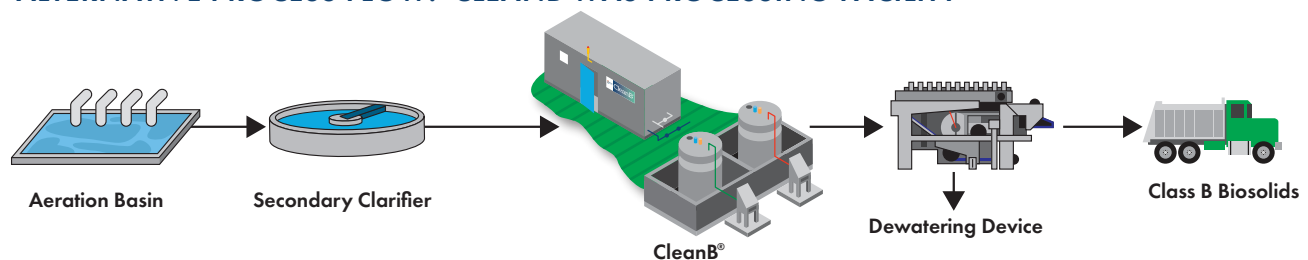
Ineffective dewatering (polymer utilization and total solids capture rates)

THE SOLUTION: ELIMINATE DIGESTION AND TREAT WAS WITH CLEANB®

TYPICAL PROCESS FLOW: WAS DIGESTION (AEROBIC OR ANAEROBIC) FACILITY



ALTERNATIVE PROCESS FLOW: CLEANB WAS PROCESSING FACILITY



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WHY CLEANB®?

- CleanB® captures 90%+ of total nitrogen and total phosphorus; ammonia is not generated within the process
- CleanB® utilizes a patent chlorine dioxide chemistry to disinfect, stabilize and deodorize in a simple plug flow orientation allowing for seamless integration into a wastewater facility
- In 2015, the EPA approved the CleanB® as a Process to Significantly Reduce Pathogens (PSRP) equivalent process
- The CleanB® can destroy bacteria with a 2-log reduction (99%) using BCR's patented chlorine dioxide generation
- BCR's CleanB® system meets vector attraction reduction (VAR) requirements for land application using the soluble oxygen uptake rate (SOUR) method (Option #4)
- CleanB® is highly effective in eliminating odor (99+% reduction in hydrogen sulfide, mercaptans and phenol compounds)
- The system can treat solids up to 3% total solids. Completely eliminates the need for expensive digestion and consumes less than \$500 annually in energy (up to 99% reduction vs. digestion)

3RD PARTY PREPROCESS VALIDATION

CleanB® has been evaluated by third parties to assess its effectiveness in performance, economics and environmental impacts.

Table 1: CleanB® Qualitative Advantage vs. Industry Average Processes

Criteria	CleanB®	Aerobic Digestion	Lime Stabilization
Lifecycle Costs	5	3	1
Energy Costs & Sources	5	4	3
Proven Process	4	5	4
Current Regulatory Compliance	4	3	3
Future Regulatory Compliance	2	2	2
Mechanical Simplicity	4	4	3
Mechanical Reliability	5	4	2
Site Requirements	5	3	2
End Product Marketability	2	2	1
Independence for Client	4	4	4
Local Environmental Impact	2	2	1
Total Rank (Max 55)	42	35	26
% of Max	76%	64%	47%

¹ Results provided by ConEdison Solutions (NYSE:ED) in a recent engineering evaluation report.

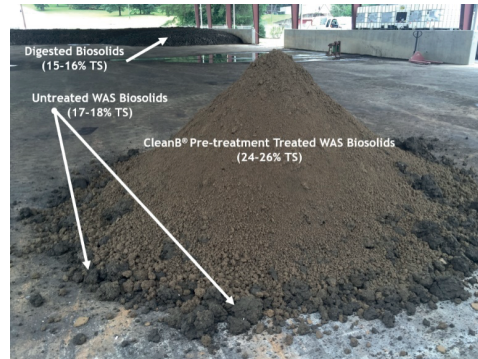
² Scale is 1 to 5 where 1 is least advantageous and 5 is most advantageous

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CLEANB® FULL-SCALE RESULTS FOR BYPASSING DIGESTION (MARENGO WWTF)

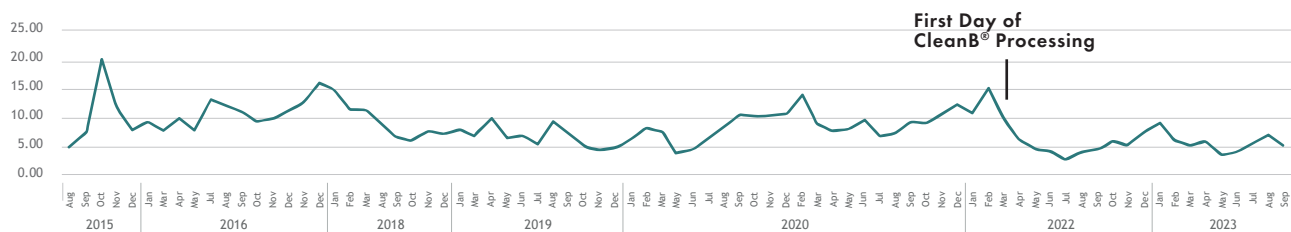
CleanB® installation at Marengo WWTP: Bypass and Decommission of Two Phase Anaerobic Digester

- Simplified operations by eliminating multiple (and shared) unit processes
- Significantly improved throughput capacity (up to 5x more throughput)
- ~\$30k per annum continual OPEX savings (digester energy, natural gas, polymer, and T&D)
- Net \$1.5M capital avoidance by avoiding necessary digester repair and upgrade costs
- Consistently meets Class B disinfection requirements
- Consistently meets VAR option #4, soluble oxygen uptake rate (SOUR)
- 50+% reduction in effluent ammonia, phosphorus and total nitrogen concentrations during demo
- 99+% decrease in centrate ammonia
- 72% reduction in centrate total phosphorus
- 73+% reduction in centrate total nitrogen



- Odor reduction (100% reduction in H₂S mercaptans and ammonia, 99+% reduction in centrate ammonia)
- Significantly reduced polymer consumption (47%)
- 91+% decrease in in total reactive phosphorus
- Safer working environment for facility operators (99+% reduction in ammonia concentrations in building)

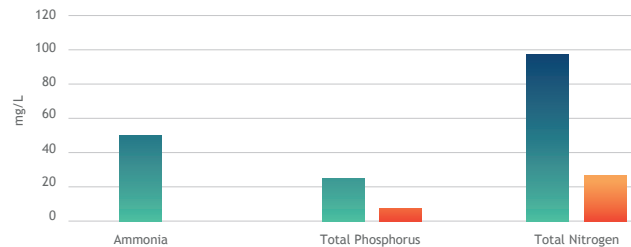
EFFLUENT TOTAL NITROGEN



ODOR PROFILE OF DEWATERED SLUDGE



CENTRATE TN, TP AND AMMONIA CONCENTRATIONS



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CLEANB BENEFITS

 EPA approval as an equivalent PSRP process in 2015;	 Average of 90-95% dewatering capture rates for Total Nitrogen, Total Phosphorus and Carbon – limited solubilization;
 Improve regulatory compliance: Class B disinfection in ten minutes and VAR compliance utilizing incorporation or the SOUR test;	 Destroys >50% of BOD in 10 minutes, reducing BOD loading by >50% via the filtrate;
 Enhanced dewaterability / decreased hauling costs (average 20%);	 Decreases GHG emissions by up to 99% compared to digestion;
 Reduction in energy consumption (average energy cost of only \$450 per year);	 Simplify operations; One-button Start-up/Shutdown;
 Reduction in polymer (average 20%);	 Minimal maintenance and labor demands; Only 8 moving parts (5 MOVs, 1 air compressor, and 2 chemical pumps);
 Reduction of odor;	 Treats facility sizes between 0.5 and 20 MGD;
 Small footprint - Eliminates space requirements for digesters and other equipment;	 Premium end-product readily suitable for Class B land application;

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