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Class A& B BiosolidsTreatment for Vector Attraction Reduction

Case Studies

Wisconsin Biosolids Symposium

Steven Point, WI

March 22, 2022

Rick Treleven Biosolids Regional Manager

Agenda

- Introduction: Class A& B Biosolid Treatment Challenges & Options
- What is Vector Attraction Reduction?
- EPA 503 Biosolid Treatment Requirements for Regulatory Compliance
- Options for meeting VAR Requirements
- Case Histories of Wisconsin WWTF's with Varying VAR Programs
- Alternative New Class B treatment Case History Results
- Q&A

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Challenges Regarding Class B Biosolids

Current Challenges

- Stability
- Nuisance Odors
- Disinfection
- Mass Reduction
- Nutrient Return
- Application Bans/Moratorium
- Aging Infrastructure
- Economic Impact
- Throughput Constraints
- Sustainability

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Biosolids & Their Classifications

Biosolids are solid or semisolid organic material obtained from treated wastewater.

Biosolids are currently classified as B, A, AA or AA/EQ by the Federal Government, through the EPA and are regulated under CFR 40 Part 503.

These Classifications have stringent requirements to ensure the reduction of pathogens and VAR.

Class B Biosolids	• *Limited Land Application Disposal Options* • *Pose a minimum risk to Public Health or the Environment*
Class A Biosolids	• *Limited Land Application Disposal Options* • *Pathogens are reduced to Class A limits as defined by Part 503*
Class AA or EQ Biosolids	• *<u>Unlimited</u> Land Application Disposal Options* • *Meet the Class A standards*

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40 CFR EPA Part 503 Biosolids Rule

Creates incentives for beneficial use of biosolids &

Establishes requirements for the final use or disposal of sewage sludge (biosolids) when biosolids are :

- Applied to land to **condition** the soil OR
- **Fertilize** crops or vegetation grown in the soil OR
- Placed on a surface disposal site for final disposal OR
- Fired in a Biosolids Incinerator (OR Pyrolysis)

- **Each Biosolids Treatment Option provides varying levels of conditioning and fertilizing for increasing the health the soil. Some options sequester or capture Carbon and Nutrients providing energy , moisture retention and slow- release fertilizer to the soil, significantly reducing GHG emissions.**

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Subpart D: Covers Requirements for Pathogen & Vector Attraction Reduction

- Subpart D Alternatives concern the designation of biosolids as Class A or Class B in regard to pathogens. **Pathogens**: Disease causing organisms (Bacteria, Viruses)
- And VAR: Vector Attraction Reduction or Reduction of Attractiveness of Biosolids to ***Vectors such as rodents, flies, mosquitos and other potential disease causing organisms.***

Guidance on meeting Pathogen & VAR requirements are provided in another EPA Publication EPA/625-R-92-013

Applies to any person who applies the biosolids to land and to owner operator of the surface disposal site *and to any* ***person who is the preparer of the biosolids*** *for use, incineration or disposal.*

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Pathogen Treatment Criteria

Biosolids are categorized by the pathogen content for health and safety purposes.

	CLASS AA/A	CLASS B
MICROORGANISM		
Fecal coliform	$<10^3$ organisms/g TS	$<2 \times 10^6$ org/g TS
Fecal Coliform Reduction	5 log reduction	2 log reduction *
PATHOGEN		
Bacteria	See above	2 log reduction*
Salmonella	< 3 MPN/4g TS	1.5 log reduction *
Viruses	< 1 PFU/4g TS	2 log reduction*
Protozoa	BDL	NR
Helminth	< 1 viable egg/4g TS	NR

NOTES: NR—No Requirement BDL—Below Detection Limit TS—Total Solids

*based on 257 Regulations for PSRP

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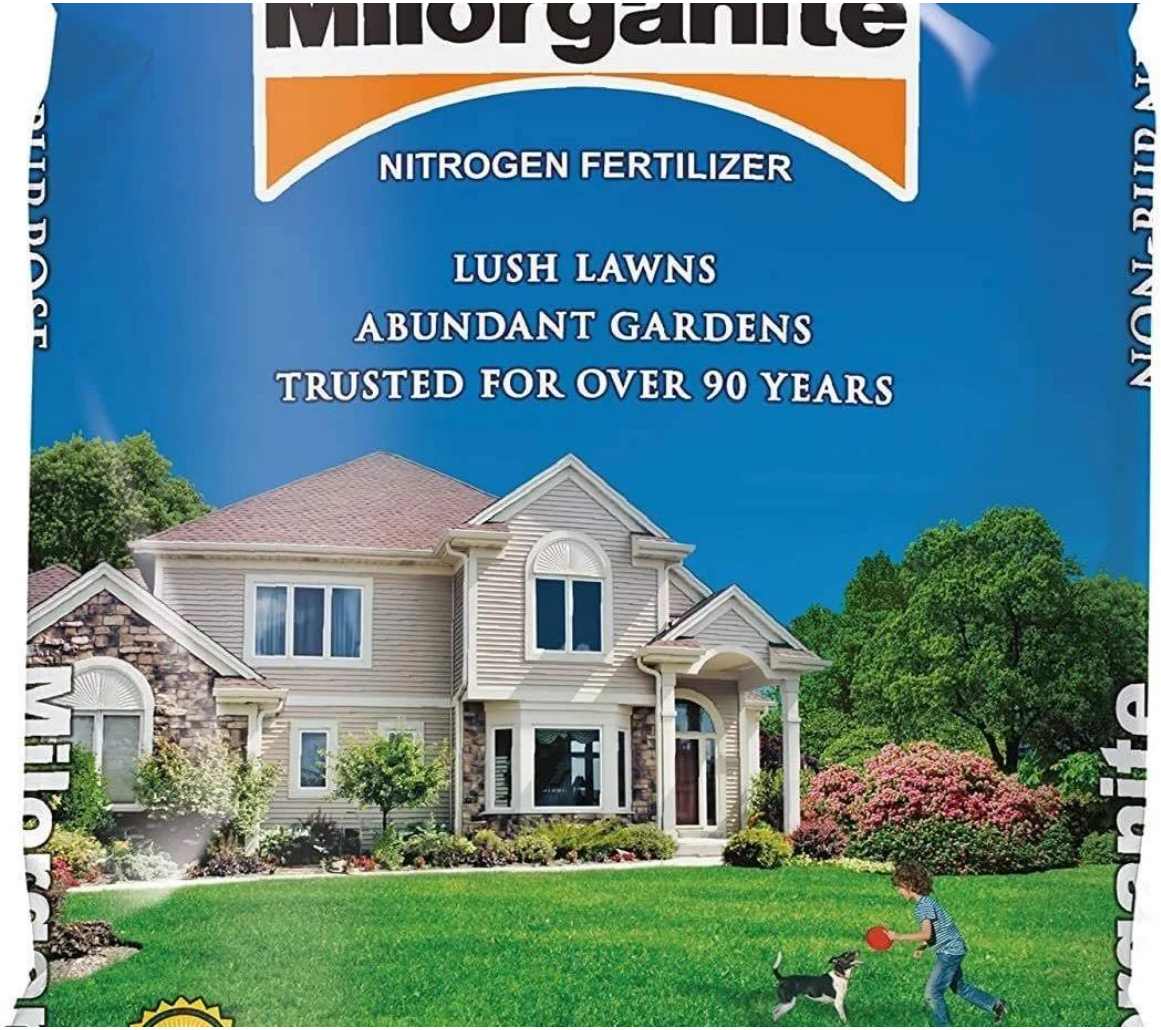
EPA Part 503

Designed to protect public health and the environment from any reasonable and anticipated adverse effects of certain pollutants and contaminants that may be present.

Ideal Goal: *Create a valued organic fertilizer or resource from waste with captured carbon & nutrients*

Milorganite sells for $5.00 per bag; Dried Biosolid from MMSD



Current Methods Regarding Class B Biosolids

Current (most common) Class B practices

“Excellence in Compliance through Optimal Technical Solutions”

Municipal Technology Branch

- Aerobic Digestion
- Anaerobic Digestion
- Chemical Lime Stabilization
- New Aerated AO Disinfection/VAR

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Chapter 5:Class B:Corresponds to 40 CFR Part 257 PSRP (Process to Significantly Reduce Pathogens)

- Alt 1: Mean of 7 samples need to be less than 2M CFU's per gram of total solids.
- Alt 2& 3 Biosolids treated in PSRP or Process Equivalent

Aerobic Digestion: Agitated with air between 20 Deg. C (68 Deg F) @ 40 days to 15 Deg C (59 Deg. F)at 60 days. Or Option 1 (38% VSR)

Anaerobic Digestion: Absence of air for 15 days between 35 and 55 Deg. C and 60 days at 20 Deg. C. Or Option 1 (38% VSR).

Lime: Sufficient lime to be added to raise pH to 12 after 2 hours.

Composting: Temp of 40 Deg C for 5 days with 4 hours at greater than 55 Deg. C

Air Drying: Dry on pad for 3 months with 2 months > 0 Deg. C.

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Summary of Class B Options for meeting VAR

Biosolids treated to meet one of the below VAR Options may be land applied in accordance with pathogen classification restrictions.

- 1.Meet 38 % reduction in VS content using Aerobic or Anaerobic Digestion
- 2.Demonstrate VAR w/additional AD in bench scale unit
- 3.Demonstrate VAR w/ additional Aerobic Digestion in bench scale unit
- 4. Meet a specific oxygen uptake rate for aerobically digested biosolids
- 5.Use aerobic conditions at > than 40Deg. C for 14 days or longer (104 Deg F)
- 6.Alkali addition under specified conditions
- 7.Dry biosolids with no un-stabilized solids (digested) to at least 75% solids
- 8. Dry biosolids with unstabilized solids to at least 90% solids
- 9.**Inject biosolids beneath soil surface**
- 10.**Incorporate biosolids into soil within 6 hours of application to or placement on land.**
- 11.Cover biosolids on surface disposal site with soil at the end of each operating day
- 12. Alkaline treatment of domestic septage to pH 12 or above for 30 minutes wo adding more.

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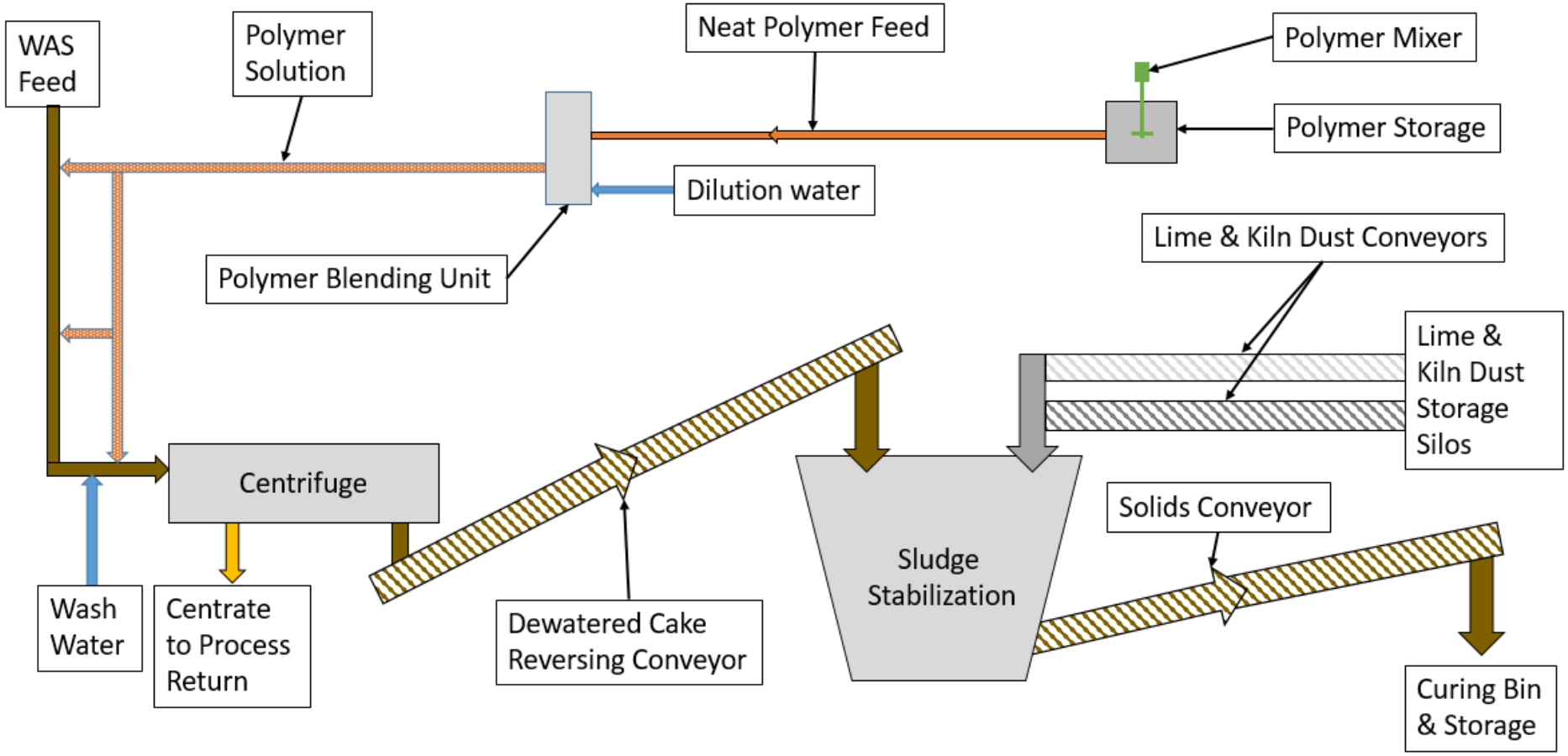
Case History: Alkaline Chemical Treatment for Class A Treatment Option 6/12 : City of Baraboo, WI Biosolids Processing Unstabilized Biosolids



Biosolids Processing Schematic

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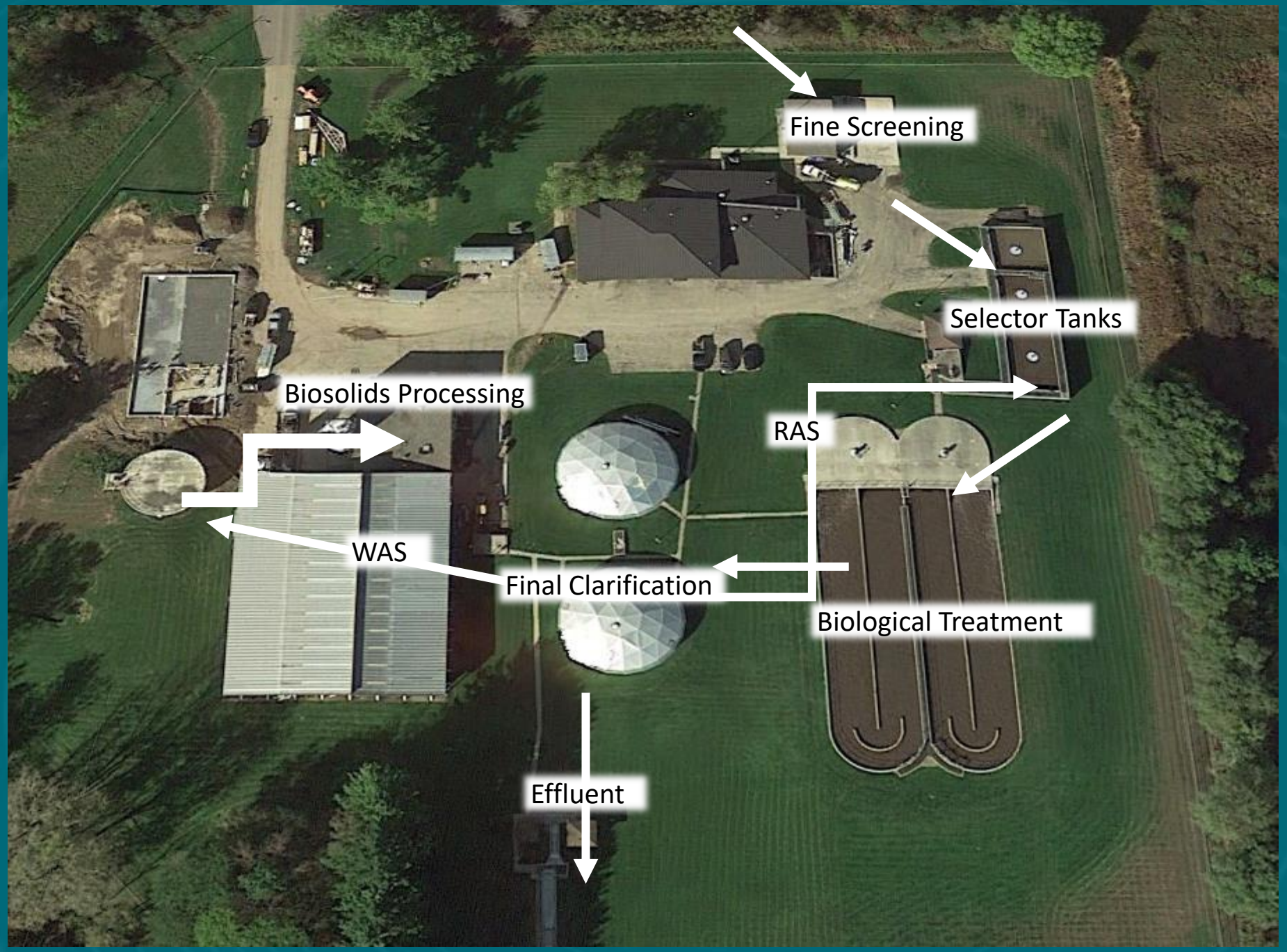
Fine Screening
Selector Tanks
Biosolids Processing
RAS
WAS
Final Clarification
Biological Treatment
Effluent

VAR Option 6/12

Alkaline treatment under specified Conditions

Lime Addition to WAS(Kiln Dust, lime, fly ash): Use of Option 6/12:

WPDES Permit Treatment Requirements:

pH > 12 ;

Solids over 50%

Fecals < 100

Temperature over 52 degrees for 72 hrs.

Disinfection Results: Fecals < 10 CFU/ GM TS

Class A VAR: Proven pH over 12 with temperature probe reading over 52 degrees for 72 hours.

Note: Farmers love product with fields with stable pH between 6.2 and 7.0:

Issues: Odor; Potentially high polymer-lime use. Hauling Cost with volume increase.

Case Study: Thermal Drying for Class A
Wisconsin Dells - Lake Delton WWTP

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Wisconsin Dells: Class A VAR Treatment

WI Dells/ Lake Delton WWTF Design Flow: 1.2 – 5 MGD, seasonal: Aerobic Digestion for Solids Stabilization followed by Thermal Drying for Class A Pathogen and VAR Control

List 4 Requirements- Vector Attraction Reduction: Shall be satisfied prior to or at the time of land application

- **4.2.1.1 Class A Vector Attraction Monitoring:**

Annual sampling of 7 samples with Geometric mean< 1000 Fecals C/ GM TS.

1. (1) Sample within 15 minutes of first discharge from dryer
2. (5) samples :During each 4 hours of operation
3. (1) sample during last 30 minutes of solids discharge

- **4.2.1.2 Class A Vector Attraction Reporting**

VAR Option 8 : Dry with Stabilized Biosolids to Class A, >75% solids, land applied. Permittee shall report and measurements less than 75% TS with dates/ times of exceedances.

Results: Fecals less than 10 CFU/GM & Solids 89-95% TS. Product in high demand with WWTF Dells spreader used to assist in application. Fertilizer license required to sell product.

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Case History: City of Marshfield , WI WWTF: Extended Aeration for Class B Biosolids: VAR Option 9 (Soil Injection)

- TWAS Using (1) 3-meter gravity belt thickener.4-7% Solids
- Biosolids stored in open air storage tanks: 2 million gallons each.
- Two (2) hauling events: spring before planting and fall after harvest.
- 4.9 million gallons biosolids produced and hauled yearly.
- TWAS pumped to one of the holding tanks until full, then begin feeding the other. The next hauling event (spring or fall) removes biosolids from the tank that was filled first. Total retention time of biosolids is between 6 months to 1 year.

Marshfield, WI WWTF Pathogen& VAR Monitoring

- **Pathogen Control met by Fecal Coliform Testing (3 years)**

- *Results: Ave of 7 samples(Geometric Mean)tested:2019-2021 quarterly)(CFU/GM TS)*

- Fall: Ave. 1472, <3, 814
- Summer: <1, 15,480 <1
- Spring: 57,000, 222,793, 18,597
- Winter: 84,768, 865,475, 298,249

- VAR met by Option 9:Inject Biosolids below soil surface

Case History: City of Waupaca, WI WWTF

Class B VAR Option 1

Anaerobic Digestion to 38% VSR

- Sludge Composition: 50% WAS, 20% Primary, 30% Grease
- Ave. HRT is 32 Days
- Variable HRT from 21 Days to 48 days.
- Operating Temp varies from 96 degrees F in Winter to 99 Deg. F in summer

- Ave Solids In = 5.5% TS
- Ave Solids Out= 2.82% TS
- Ave VSR= 56.76 - Well above 38% requirement for VAR.

Test Results for VSR vary from 36% to 70% showing high degree of variation in volatile solids destruction throughout the year.

City of Waupaca WWTF

Anaerobic Digester Process Comments

- Use grease trap waste to supplement our process WWTP is underloaded.
- Do not produce enough sludge to feed to our anaerobic digester all the time. At times there is not enough gas in winter months, so rely on the grease to increase biogas to minimize use of natural gas for the sludge and building heat boilers.
- Heat two buildings at the WWTP with the methane produced in the digester during the winter. In summer months, any excess gas is flared off

Case History: City of Kewaskum, WI Class B with Option 1 Aerobic Digestion

- WWTF Process: Primary Clarification followed by three(3) Aeration Basins and three Final Clarifiers with solids to Three(3) Aerobic Digesters.

- Biosolids Production: Average of 6000 gallons are wasted daily plus any gallons from the scum pits.

- Amount of Class B processed. 2 million gallons annually with Aerobic Digestion in (3) Digesters using 75HP blowers.

- % Solids Average 4%

- Hauled at what 3-4% solid? Will turn on 2 pumps to mix the tank for at least the week before contract hauling.

City of Kewaskum WWTF Pathogen and VAR Monitoring

- Fecal Coliform Bacteria test Results, monthly or just before load out? Fecal was average was 2 weekly. Switching to E coli and average was 10 a week
- VAR: SOUR (Surplus Oxygen Uptake Response) None
- VSR Reduction: None
- Hauler Uses Option 9 or 10 (Soil Injection or Incorporation into Soil within 6 hours

New PSRP Approved Class B CleanB® Process Description

- Plug-flow addition of Chlorine Dioxide (ClO_2) to WAS
- Combination of Sulfuric Acid (H_2SO_4)with Sodium Chlorite ($NaClO_2$) to form Chlorine Dioxide.
  - ClO_2 is a strong oxidant with a good combination of selectivity and reactivity
  - 100 times less dose than Chlorine (2.5 times stronger Oxidation reduction potential.
    - Performs extremely well as a disinfectant for municipal biosolids.
    - Effective odor control against sulfides, phenols and mercaptans.
  - An oxidant removes electrons from other chemicals or pathogens.
    - Removal of electrons from other chemicals can change them from volatile to non-volatile forms, preventing the offending chemical from escaping into the atmosphere.
  - The ClO_2 is reduced to chlorite (ClO_2-).
  - The chlorite is reactive and reduces to chloride (Cl^-)
    - No disinfection by-products are formed

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New Class B Process CleanB® Process
Class B Biosolids in 10 minutes

- What is it?
  - Class B biosolids disinfection (4 log Reduction) process that greatly reduces odors from biosolids (2009).
  - National EPA approved PSRP Class B Equivalent Process (2015).
  - Highly scalable process - 80gpm to 270 gpm - WAS feed
    - 800 to 2,700 dry lbs/hour
    - Flow rates of 0.5 to 22 MGD
  - Digestion not required (secondary sludge feed).
  - Small footprint.
  - Automated process control, remote data monitoring & logging.

- What does it do?
  - Disinfects to Class B Standards.
  - Reduces or eliminates odors associated with biosolids processing.
  - Reduces nutrient loading (N and P) return to the plant by capturing Nutrients
  - Reduces energy consumption by 98%.
  - Enhances dewatering - decreases polymer consumption while increasing cake solids.
  - Creates Class B in 10 minutes compared to 20-90 days in digesters.

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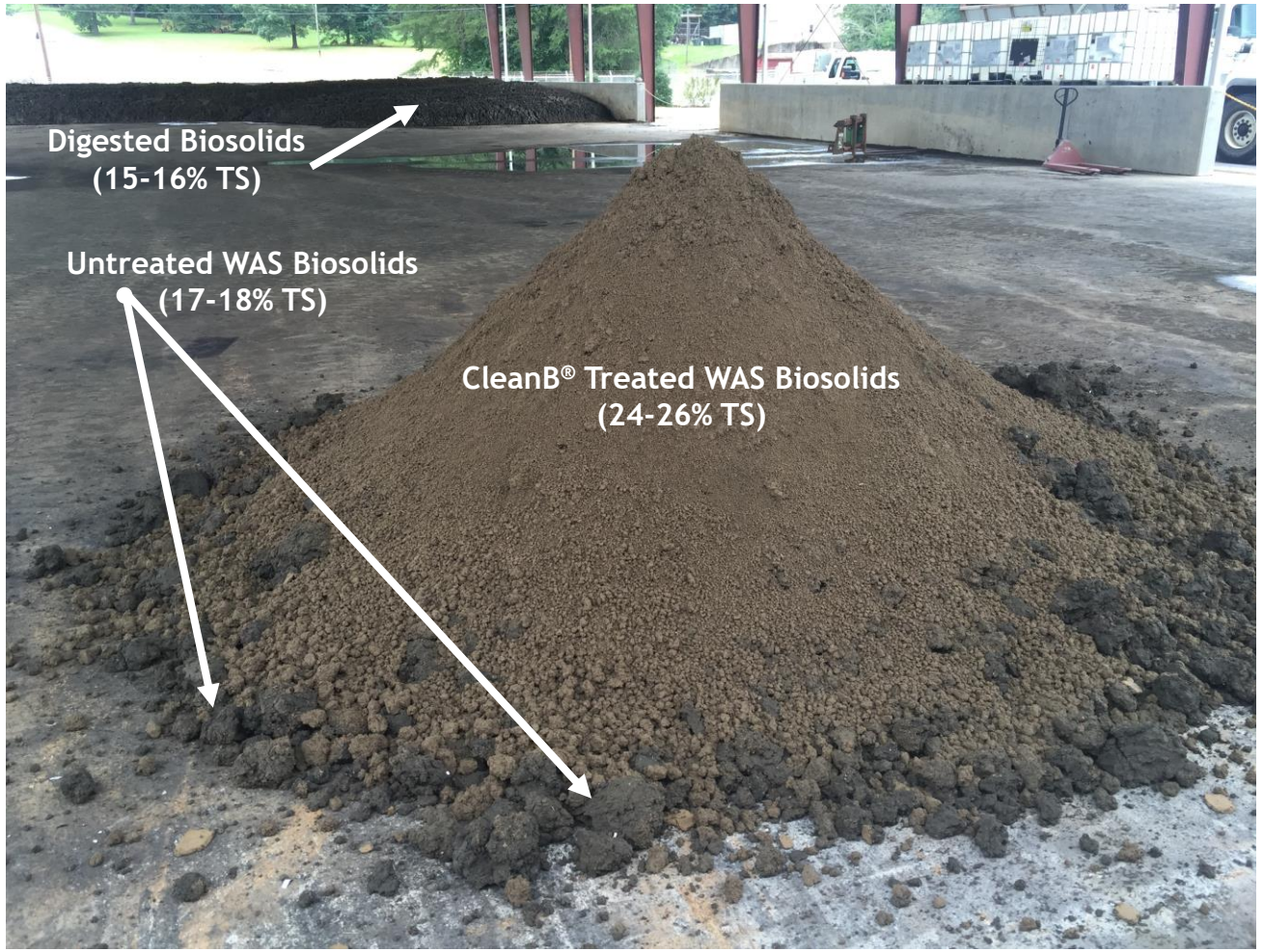
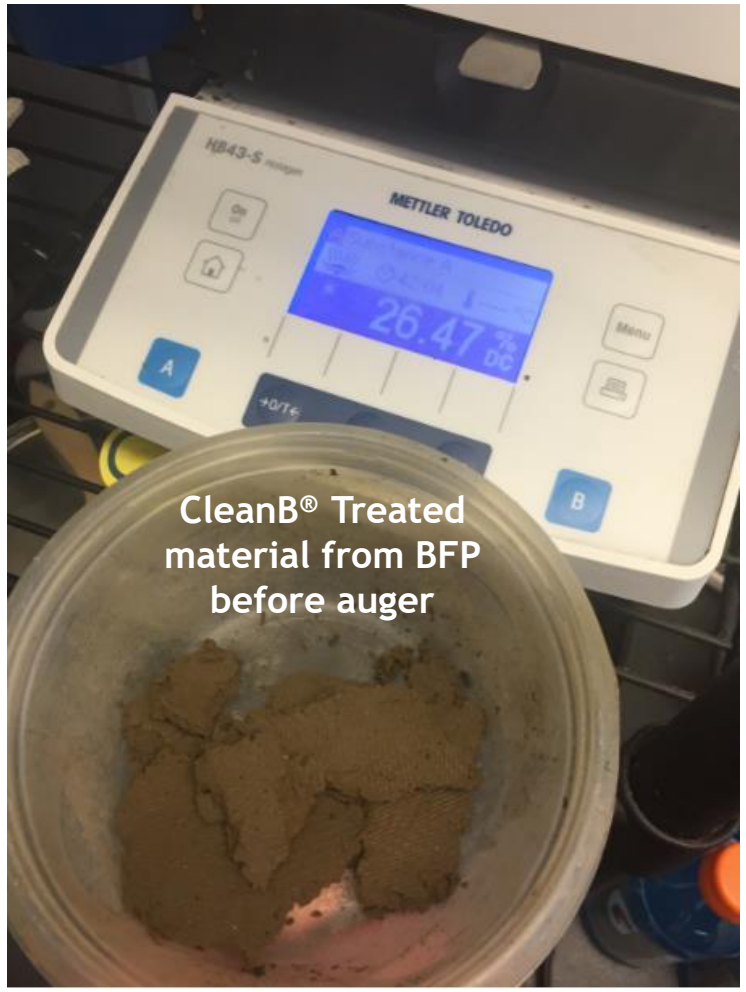
CleanB® Enhances Dewatering, Lowering T&D Costs





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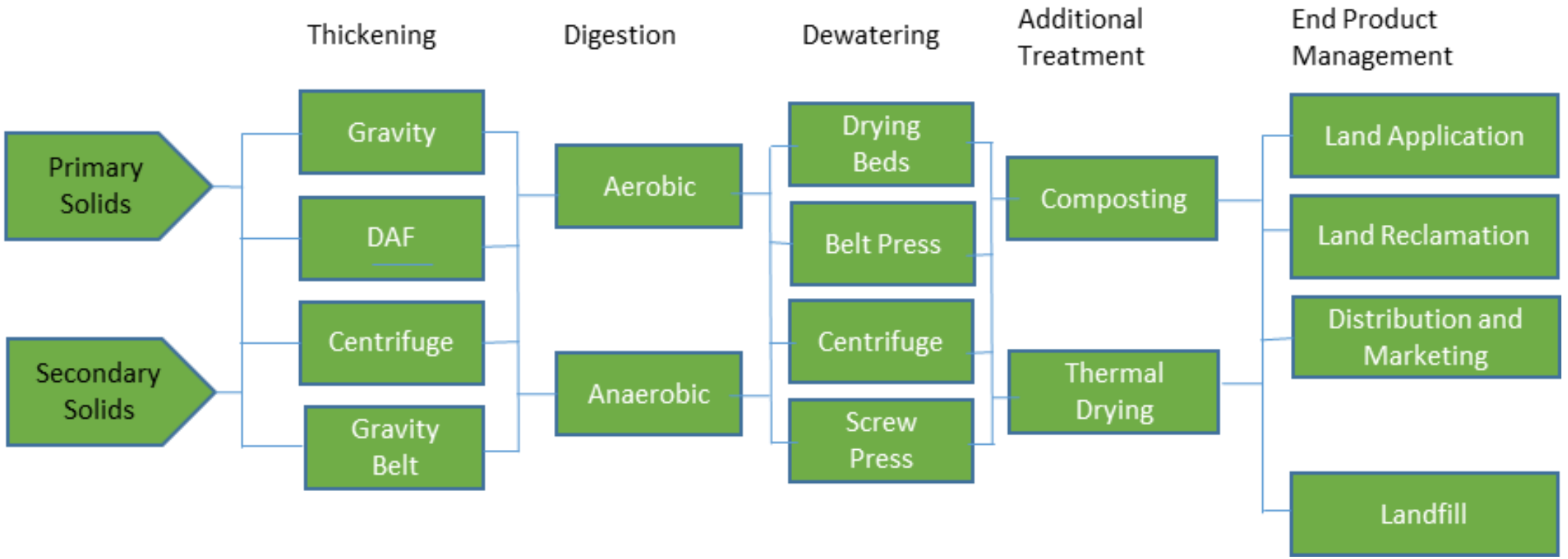
Eden, NC Demonstration. Dewatered using belt filter press (BFP) and transferred to pad via auger system. Polymer was continually dialed down after treatment to achieve >26%TS cake.

CleanB® Process Integration

Typical Process Flows



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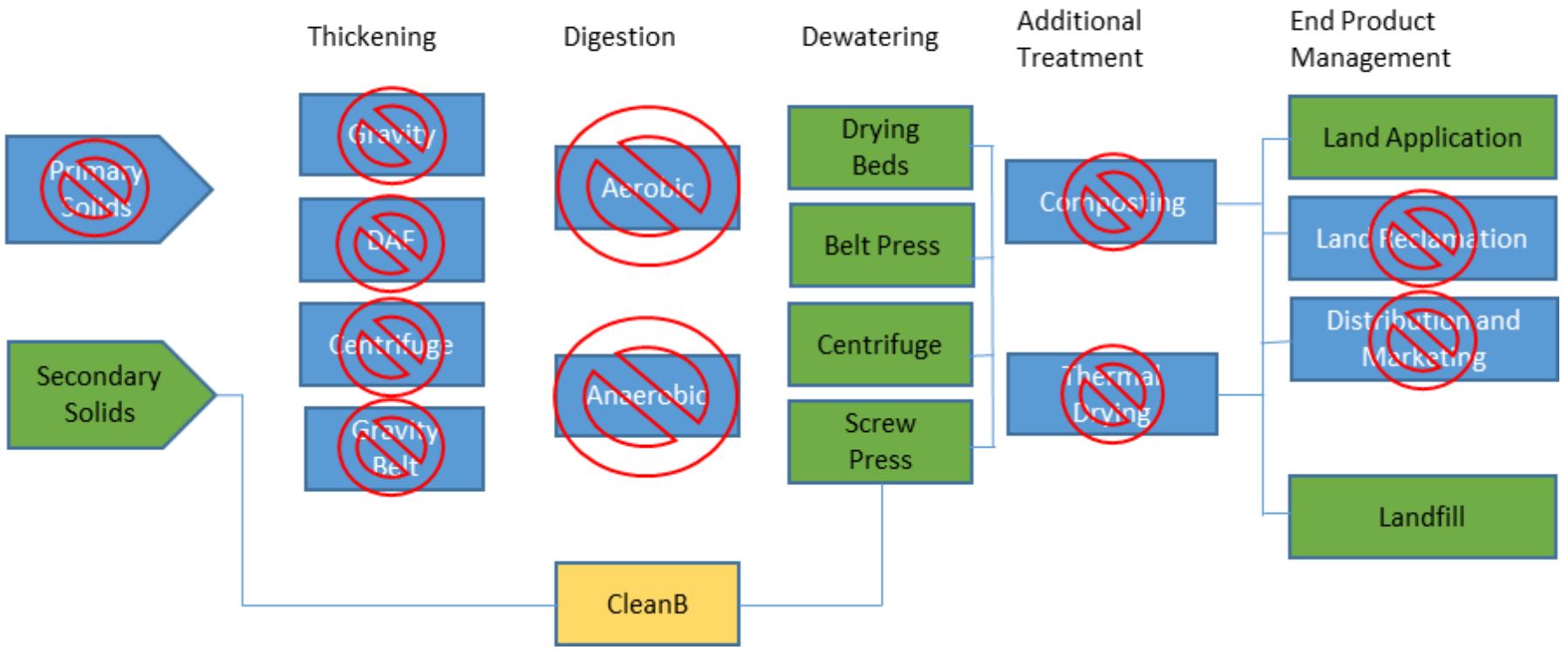
CleanB® Process Integration

CleanB Process Flow - 1 (typical)



Benefits

- **Eliminates Capex and Opex associated with thickening and digestion.**
- **Reduces polymer consumption for dewatering (20-30% reduction).**
- **Increases cake solids (typically 20-30% improvement). Decreases hauling costs.**
- **Reduces nutrient return (looping) of nitrogen and phosphorus.**
- **Reduces or eliminates Odors typically associated with biosolids processing.**

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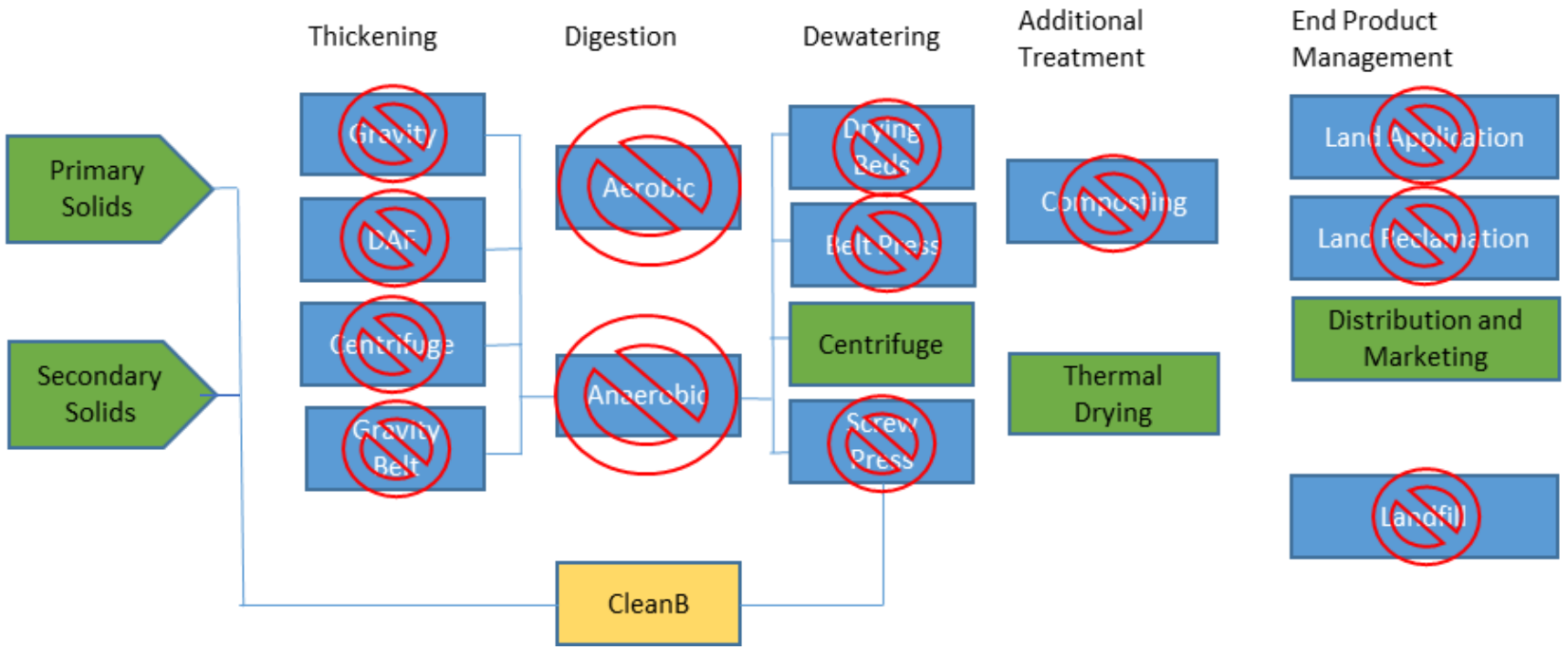
CleanB® Process Integration

CleanB Process Flow - 2 (probably the most efficient)



Benefits

- **Enhances dewatering results with less energy required for drying.**
- **1°/2° feedstock results in high BTU value in sludge.**
- **Reduces nitrogen content in biosolids.**
- **Reduces or eliminates Odors typically associated with biosolids drying.**
- **Decreases net energy (~30% reduction) required to dry municipal biosolids.**

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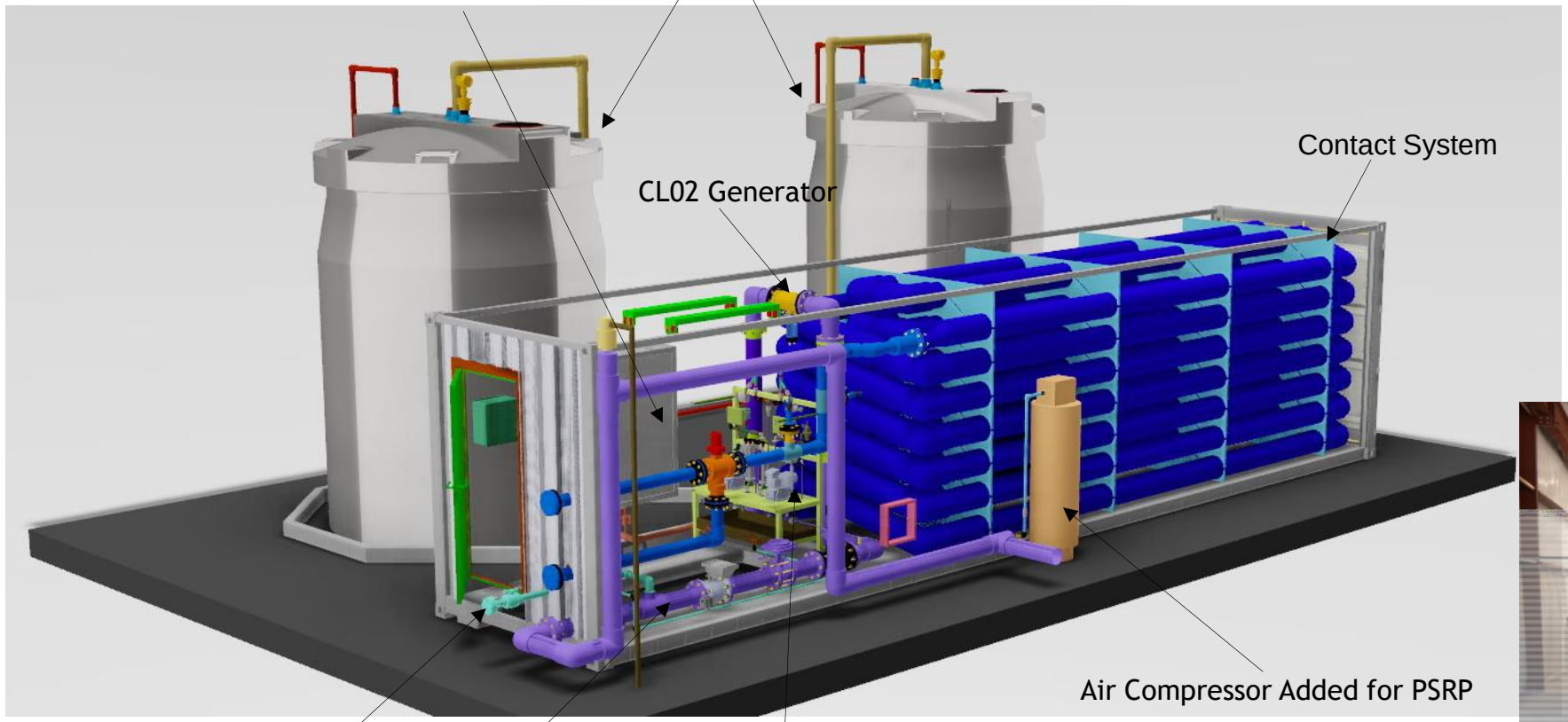
Standard CleanB® Components - Modular Design Package



Loganville, GA

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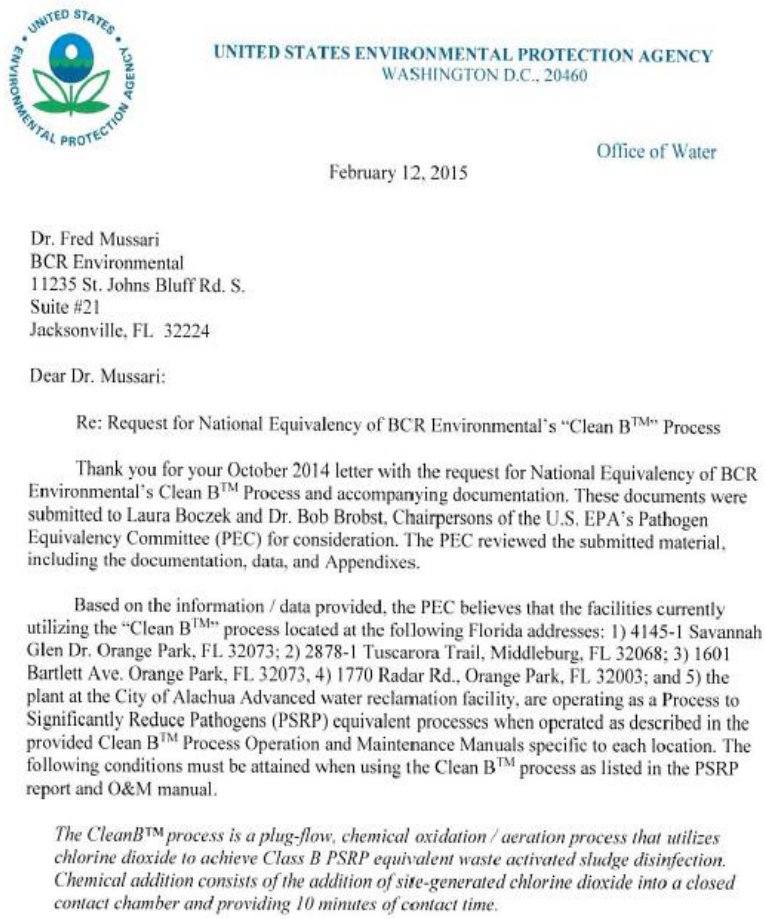
Simple, Scalable, Modular Low cost Class B alternative

CleanB® Regulatory Compliance – EPA PSRP Equivalent Process with Automatic Approval



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

Office of Water

February 12, 2015

Dr. Fred Mussari
BCR Environmental
11235 St. Johns Bluff Rd. S.
Suite #21
Jacksonville, FL 32224

Dear Dr. Mussari:

Re: Request for National Equivalency of BCR Environmental's "Clean B™" Process

Thank you for your October 2014 letter with the request for National Equivalency of BCR Environmental's Clean B™ Process and accompanying documentation. These documents were submitted to Laura Boczek and Dr. Bob Brobst, Chairpersons of the U.S. EPA's Pathogen Equivalency Committee (PEC) for consideration. The PEC reviewed the submitted material, including the documentation, data, and Appendixes.

Based on the information / data provided, the PEC believes that the facilities currently utilizing the "Clean B™" process located at the following Florida addresses: 1) 4145-1 Savannah Glen Dr. Orange Park, FL 32073; 2) 2878-1 Tuscarora Trail, Middleburg, FL 32068; 3) 1601 Bartlett Ave. Orange Park, FL 32073, 4) 1770 Radar Rd., Orange Park, FL 32003; and 5) the plant at the City of Alachua Advanced water reclamation facility, are operating as a Process to Significantly Reduce Pathogens (PSRP) equivalent processes when operated as described in the provided Clean B™ Process Operation and Maintenance Manuals specific to each location. The following conditions must be attained when using the Clean B™ process as listed in the PSRP report and O&M manual.

The CleanB™ process is a plug-flow, chemical oxidation / aeration process that utilizes chlorine dioxide to achieve Class B PSRP equivalent waste activated sludge disinfection. Chemical addition consists of the addition of site-generated chlorine dioxide into a closed contact chamber and providing 10 minutes of contact time.

"EPA's Office of Science and Technology acknowledges that the CleanB process… is a National PSRP equivalent process as described in CFR 503.32(b)(4)."

Operating Modes: PSRP or Non-PSRP Mode

Chemical Oxidation / Aeration Process (PSRP mode)	Chemical Oxidation Process (non PSRP mode)
• Chlorine Dioxide as the oxidant • Aeration to achieve DO > 1.0 mg/L • Total Solids < 2% • Temperature > 9 C (48F) and < 35C (95F) • ORP after 10 min contact time > +300 mV • Minimum ClO_2 addition of 50 ppm	• Chlorine Dioxide addition • Monitoring for fecal coliforms or Salmonella

Standard CleanB® Biosolids Characteristics

CleanB® Biosolids

CLEANB® BIOSOLIDS CHARACTERISTICS	
PARAMETER	VALUE
Percent Solids	22 - 26%
Appearance of Solids	Light brown granular cake
pH	6.5 - 7.5
Odor	Earthy
Lime content	N/A
Total N	4-6%
Total P	2-3%
Total K	N/A
Typical Distribution Method	Truck and spreader
Ground Water Impact	Low nutrient leaching
Water Conservation	Provides water retention in soil

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Consistent Class B biosolids are created in 10 minutes without digestion

Case History : CleanB @ MARENGO, IL WWTF (1MGD) Replacing TPAD Anerobic Digestion System

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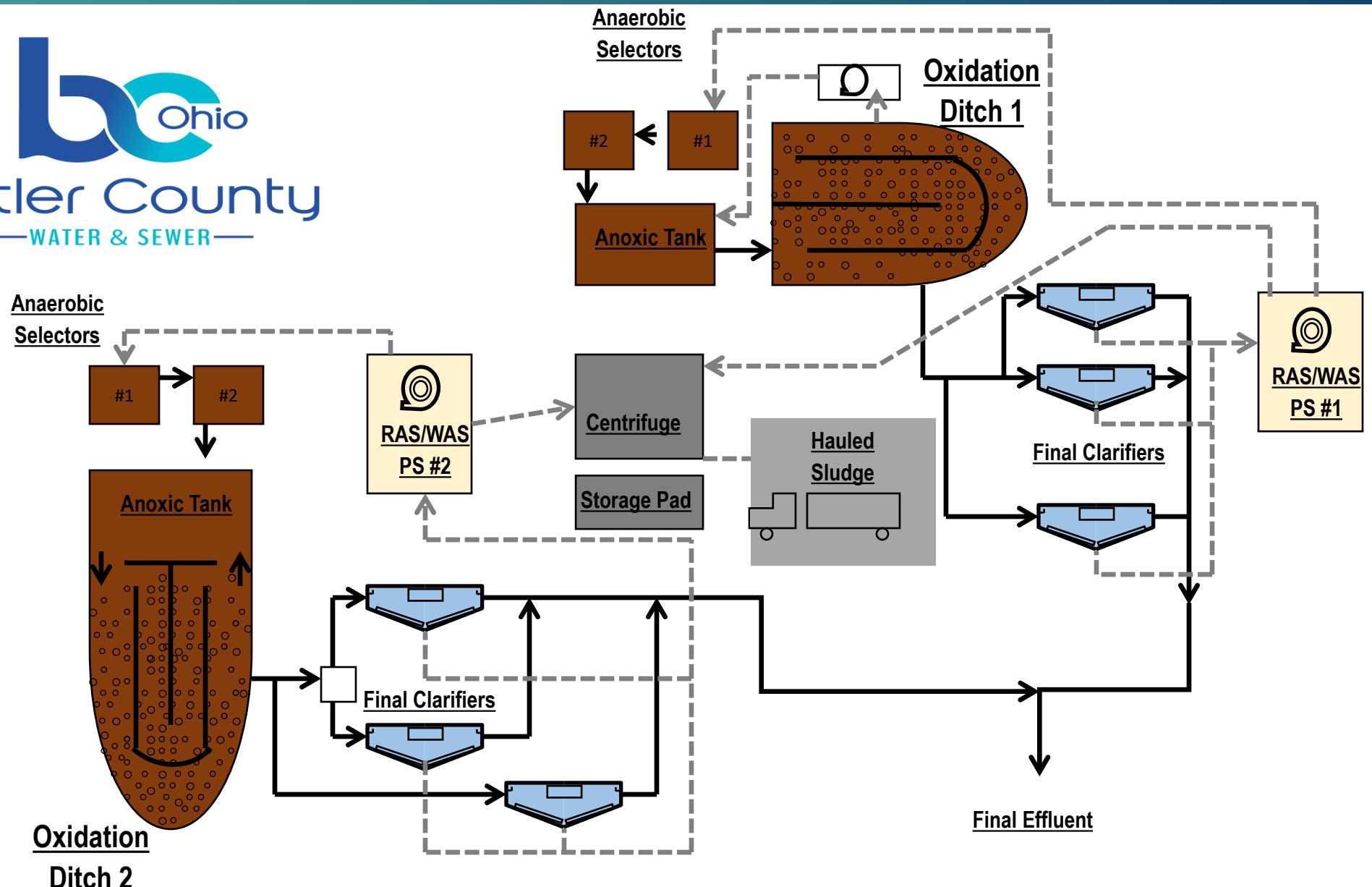
AD or Aerobic Upgrade Options

Upgrade AD Capital Costs of Heat Recirculation Pump, Heater, Mixing Capital, : CAPEX: 2.8 M. High Operation and Maintenance Costs

Aerobic Digestion Option: Blower Capital Costs over 4 million with high electrical energy cost over n$100,00/year in converting solid to gas.

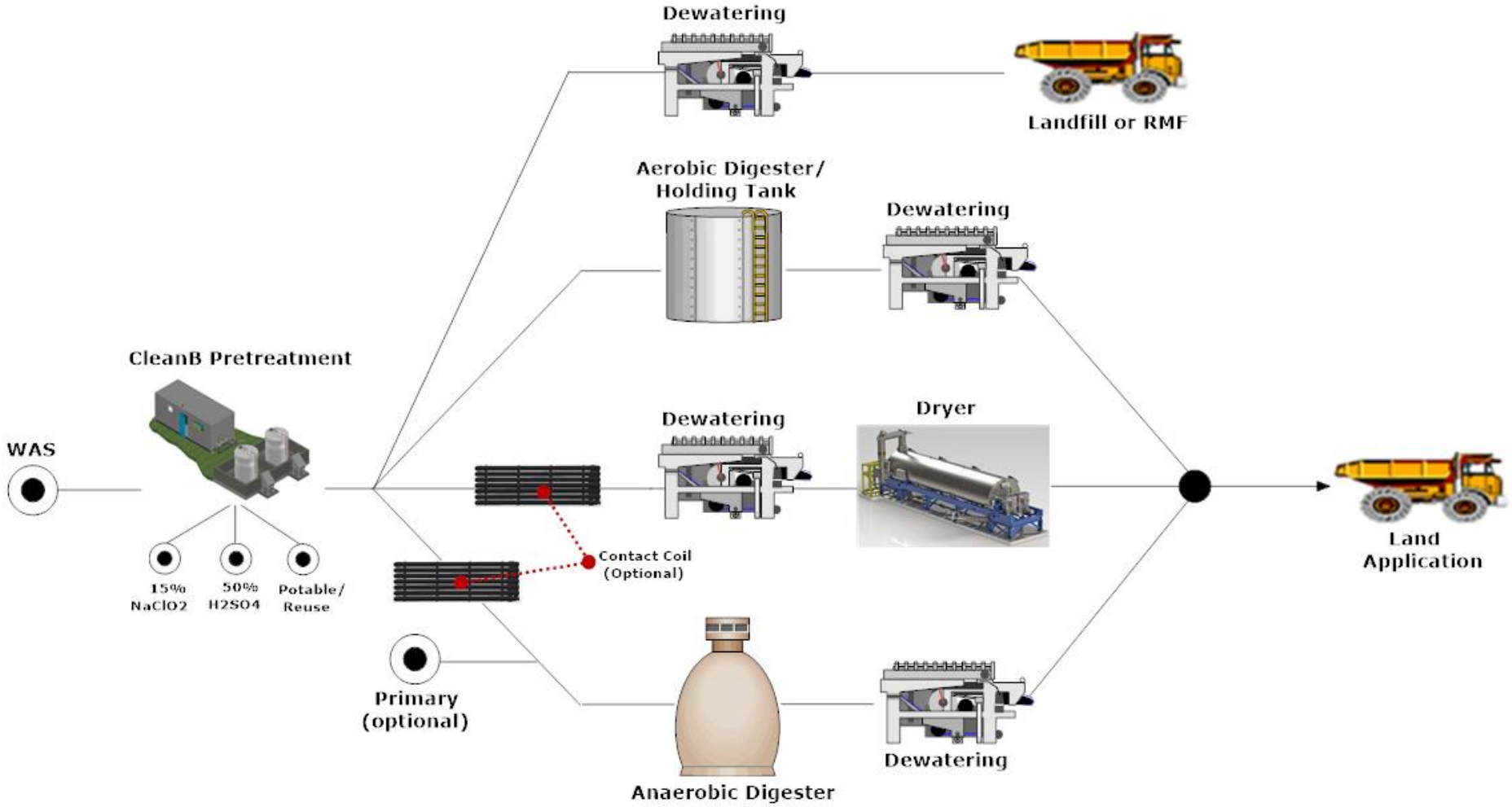
CleanB Benefits: Natural gas boiler eliminated ;13 pumps with motors eliminated with resultant $80,000 per year in electrical and natural gas costs w/ SOUR for VAR and increased N, P and carbon capture for improved Biosolid.

Case History: Aerobic Digestion Replacement: Upper Mill Creek Biosolids Schematic



Enhanced Digestion with CleanB® Pretreatment PFD's

- CleanB® Pretreatment Possible configurations (From top to bottom: odor control, enhanced aerobic digestion, enhanced drying and enhanced anaerobic digestion Applications



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Summary of CleanB® Pre-treatment Benefits

- Anaerobic Digestion
  - Increase methane production by up to 30%
  - Decrease odors
  - Increase cake solids
  - Reduce polymer consumption
  - Reduce total energy costs per dry ton processed
  - Increase VSR
  - Increase digester capacity
  - Potentially eliminate the need for expensive infrastructure to meet increasing AADF
  - Reduce the time needed to meet disinfection requirements
- Aerobic Digestion
  - Increase VSR
  - Achieve 38% VSR in less time
  - Increase cake solids
  - Reduce polymer consumption
  - Reduce total energy costs per dry ton processed
  - Increase digester capacity
  - Potentially eliminate the need for expensive infrastructure to meet increasing AADF
  - Reduce the time needed to meet disinfection requirements
- Dryer
  - Increase cake solids
  - Reduce polymer consumption
  - Possibly Illuminate existing odor control
  - Reduce overall energy costs by up to 30%
  - Reduce odors of the process and end-product
  - More consistent dryer operations
  - Decrease tipping fees if brought to dryer RMF
- Odor Reduction- Landfill/RMF (i.e. composting)
  - More consistent end-product
  - Increased cake solids
  - Reduce polymer consumption
  - Reduce hauling costs
  - Decrease the time it takes to meet VAR requirements (composting)
  - Increase compost facility capacity
  - Decreased tipping fees

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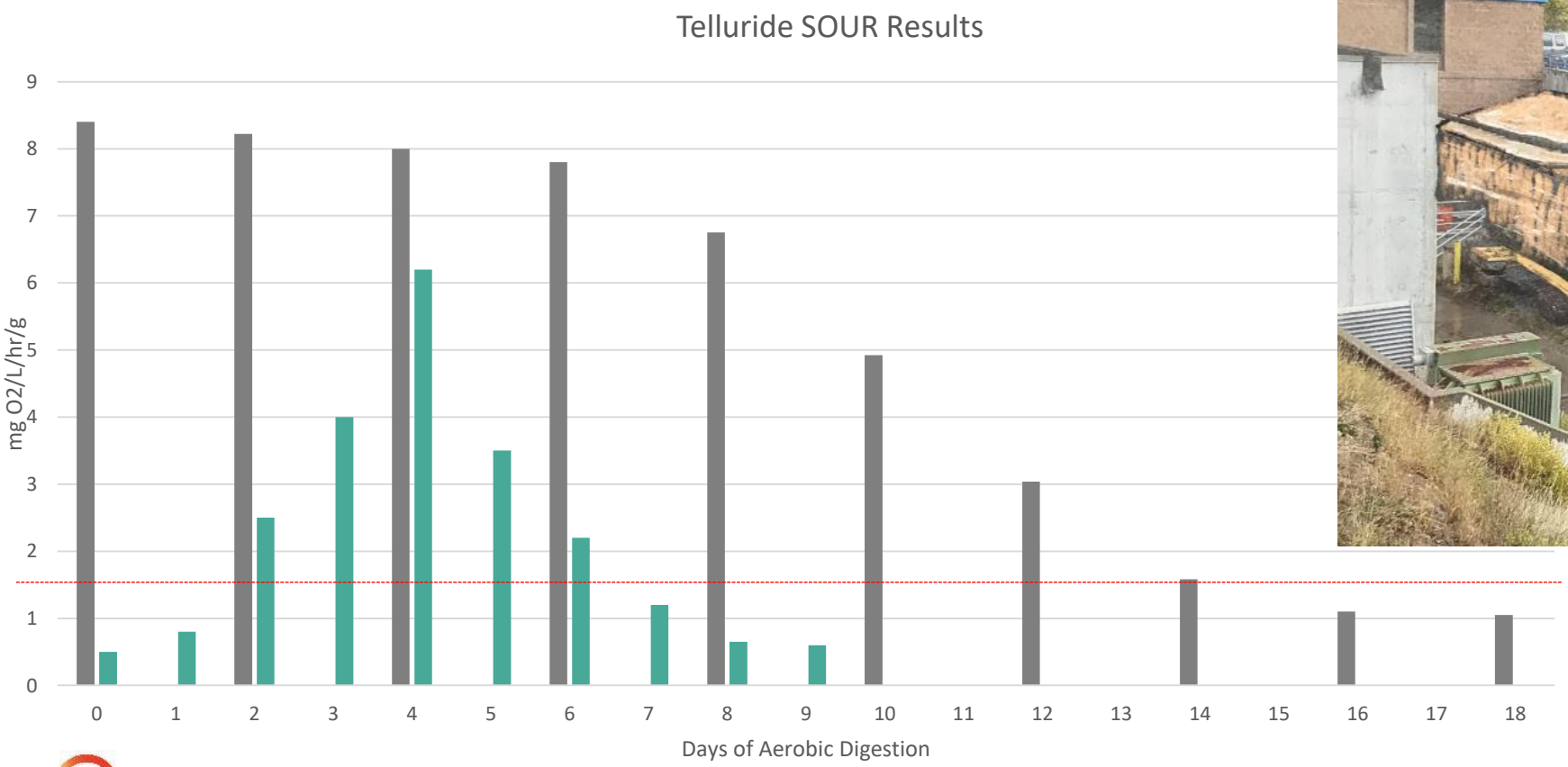
CleanB® Pre-treatment (prior to aerobic digestion)

- VAR and disinfection compliance was achieved in 7 days with CleanB pre-treatment versus 14 days with conventional digestion



SOUR Compliance (1.5)

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Gaps / Challenges that CleanB® Addresses

- Aging digesters which will require costly rehabbing or replacement.
- Lower cost alternatives to digestion to attain Class B.
- Limited space in existing facilities.
- Diverting secondary sludge to provide extra capacity.
- Seasonal increases in WWTP flows.*
- Restrictions on land application of biosolids.*
- Meeting Stricter future P limits in effluent.
- Odors in dewatering, storage, and land app or landfill sites.
- Additional Treatment cost associated with further nutrient (TN, TP) and BOD solubilization & return to head of plant.

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CleanB® Process Benefits

- Reduces energy consumption significantly compared to digestion (uses only **1%**of the energy required for digestion with significantly reduced GHG emissions).
- Enables re-purposing of existing process tanks for equalization, reuse, or storage.
- Eliminates the need to repair or replace aging equipment / processes.
- Integrates and operates seamlessly with any dewatering device; increase of 3-5 percentage points in cake solids with > 20% reduction in polymer usage.
- Class B sludge cake with reduced odor and improved material handling w/ significantly improved conditioning and fertilizer characteristics allows additional disposal outlets including land application, composting, sludge drying, sensitive landfills.

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Questions?

Contact Information

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