Membrane Thickening Aerobic Digestion for Class B Biosolids: A Better Mousetrap

Case History Review

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What is Aerobic Digestion?

Aerobic Digestion is a biological process similar to Activated Sludge with the exception that…..

Activated Sludge (Growth)

Aerobic Digestion (Decay)

How Does That Happen?

- Biological Sludges contain hungry BACTERIA
- Aerobic Digesters don't have a food supply
- Strong Cells (bacteria, protozoa, etc.) eat weak cells under Aerobic Conditions

Results

- Carbon Dioxide
- Water
- Ammonia NH_3
  - NO_2 & NO_3
- Less Volatile Solids

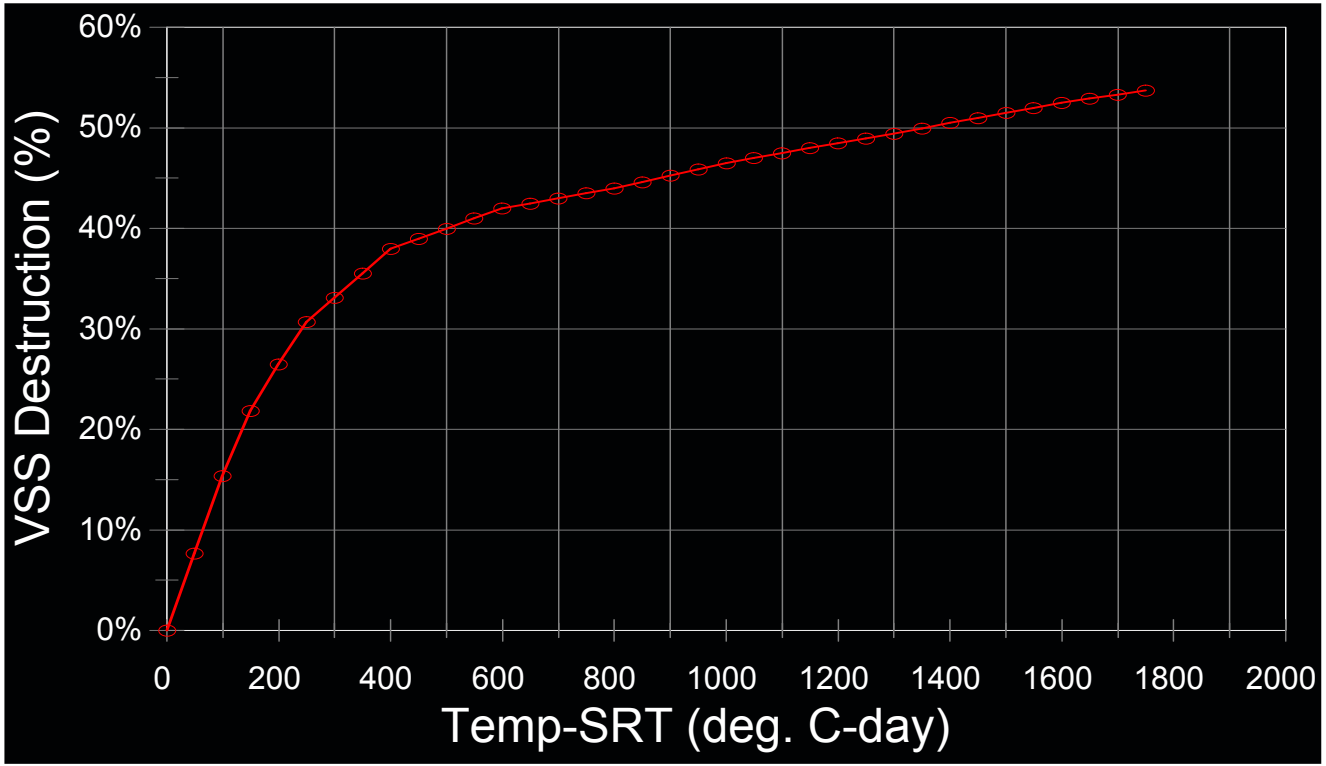
Why Do We Digest Sludge?

- Minimize Odors During Storage
- Reduce Sludge Quantities
  - Reduce VSS (Volatile Suspended Solids)
- Improve Thickening & Dewatering
- Regulatory Requirements
  - Beneficial Reuse
  - Landfill Disposal
- Reduce Pathogens
- Reduce Vector Attraction

The Basic Controls

- Sludge Wasting
  - Take Solids from Waste Treatment Process to Digester
- Aeration
  - Oxidize the Solids with Air and Biomass
- Settling & Thickening
  - Leave the solids, take the water
- Remove the Solids
  - Haul liquid or Dewater to cake
- Repeat

The Basic Controls



Ref: WEF MOP No. 8, Vol II, 1992

Tank Size

- Solids Retention Time at 1.5% Solids
  - 150,000 gal x 8.34 x .015 = 18,765 lb. Solids
  - 18,765 lbs. capacity / 1,000 lbs. / day wasted = 18.8 days
- Solids Retention Time at 3% Solids
  - 150,000 gal x 8.34 x .03 = 37,500 lbs. Solids
  - 37,500 lbs. capacity / 1,000 lbs. / day wasted = 37.5 days

Class B Biosolids Requirement: Design Criteria

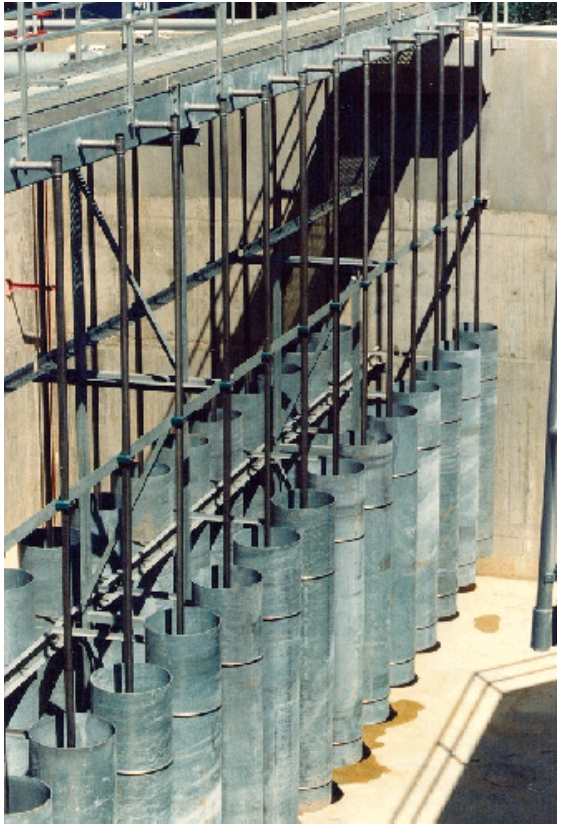
Class B biosolids requirement – landfill disposal
(25 PA Code Article 273.513 & 271.932 – 12/00)

- **Pathogen Reduction**:
  - Fecal coliform ≤2 million MPN / 1 g dry TS
  - Solid retention time ≥ 40 days @ 20°C or ≥ 60 days @ 15°C
  - Operate in series (CREDIT)
    Reduced sludge retention ≥ 28 days @ 20°C
    or ≥ 42 days @ 15°C
    - (EPA Manual – 625/R-92-013 Rev. 10/99)
- **Vector Attraction Reduction:**
  - VS reduction ≥ 38%
  - SOUR ≤1.5 mg/L oxygen / hour / g TS

Waymart Triple WWTP Capacity

- Plant Upgrade to Include Federal and State Prison Connection
- SBR, Intermittent Thin Waste Sludge
- Class B Sludge
- Minimize Sludge Production
- Winter Operations

Waymart Project Details



- Construct 0.715 SBR
- Upgrade 3 Tank Aerobic Digesters (22,000 Gal. each) to Gravity Thickening / Holding
- 2 New Aerobic Digestion Tanks
  - 150,000 gallons each
- Ovivo Cover with Air Beams
  - Shear Diffusers
  - Covers for Heat
- Belt Filter Press
  - Biosolids to Landfill

Waymart Plant Background

Waymart Aerobic Digester Operation Data

(January 2006 Thru December 2007)

Parameters	Primary Digester	Secondary Digester
Monthly average SRT (days)	56 days Annual	Avg. Combined
Temperature (^oC)	12 – 32	14.67 – 35
F. Coliform – Class B ☒ million / g TS	9,000,000	2,400,000
Date Fecal Sample, Feb. 13, 2008		
Average NH_3-N (mg/L)	0.02 – 40	
Average NO_3/NO_2-N (mg/L)	0.3 – 75	
pH range	6.4 – 7.4	5.2 – 8.1
Average alkalinity (mg/L)	100 – 310	
Pounds Dry Solids Disposed per Pound BOD Influent	Avg. 2007	0.348

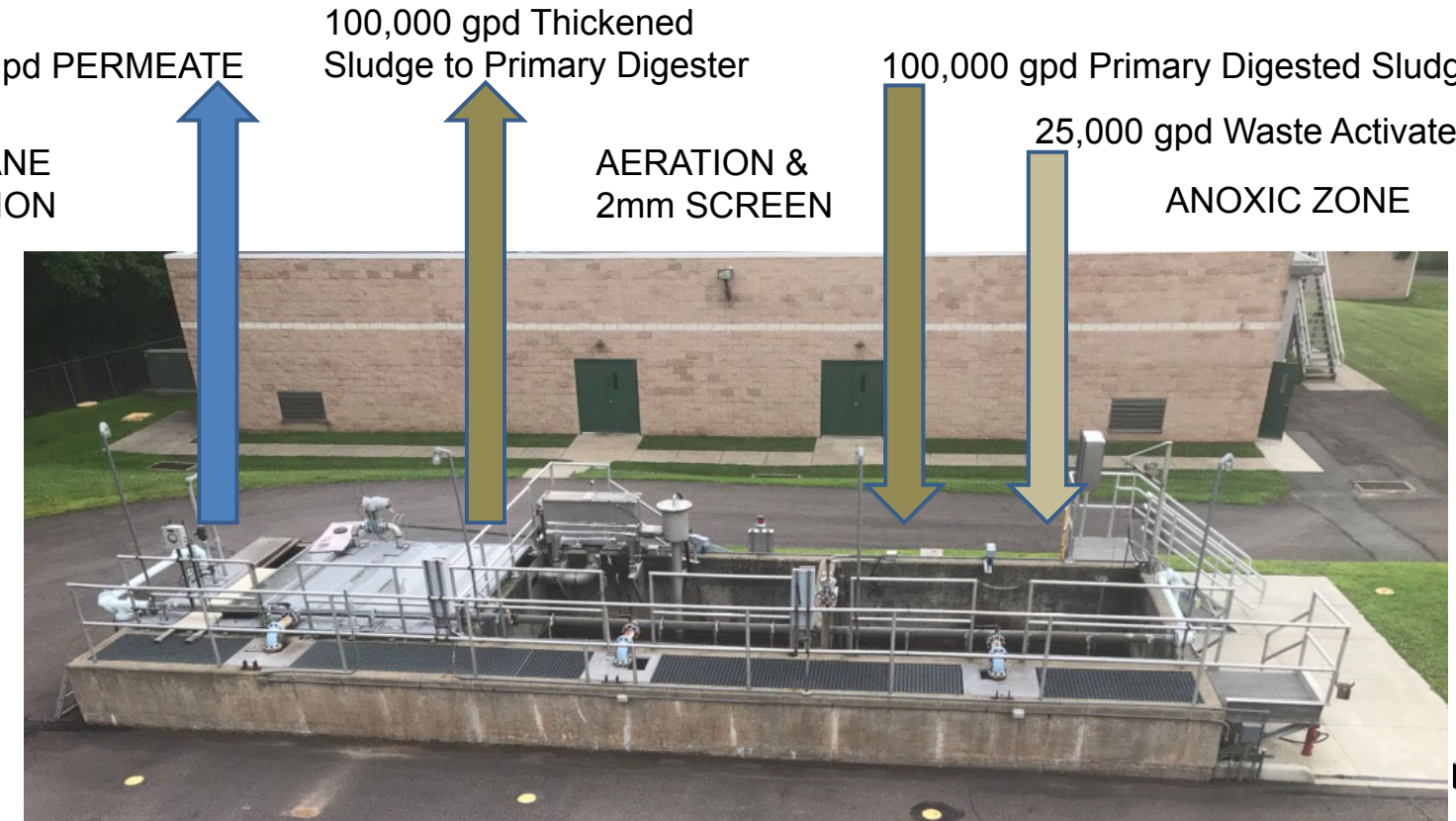
Waymart Results

- Meets Class B
- Excellent Dewatering
  - 18 - 22% Belt Press
- No Odors (Including Cake)
- Excellent Winter Operations
- Non-Clog Diffusers
- Dry Solids/BOD
    - 2013 - 2014 Average = 0.41

Waymart Update

- Installing Ovivo Membrane Thickening
  - Consistent Thickening, Lower Manpower
  - Ease Wintertime Thickening Duties
  - Possible Hauled in Waste Liquid Sludge

Waymart Membrane Thickening



Waymart Aerobic Digester Membrane Thickening

Operational Data (January 2018 Thru June 2020)

Parameters	Primary Digester	Secondary Digester
Monthly average SRT (days)	90+ days Annual	Avg. Combined
Temperature (^oC)	14.8 - 25	
Percent Solids	4.3% - 3.7%	3.1% - 3.4%
Permeate		
Average NH_3-N (mg/L)	4.06 – 0.35	
Average NO_3/NO_2-N (mg/L)	4.6 – 2.7	
Average P (mg/L)	24.15 - 0.87	
Pounds Dry Solids Disposed per Pound BOD Influent		
Avg. 2018		**0.23**
Avg. January 2018 Thru June 2020		**0.32**
Percent Solids Belt Press cake		**18.6% - 16.2%**

SCI Dallas High Liquid Sludge Disposal Cost

- Guaranteed Energy Savings Project at State Prison
- SBR, Intermittent Thin Waste Sludge
- Minimize Sludge Production to reduce disposal costs
  - Annual Volumes Increasing
- Winter Operations

SCI Dallas Project Details

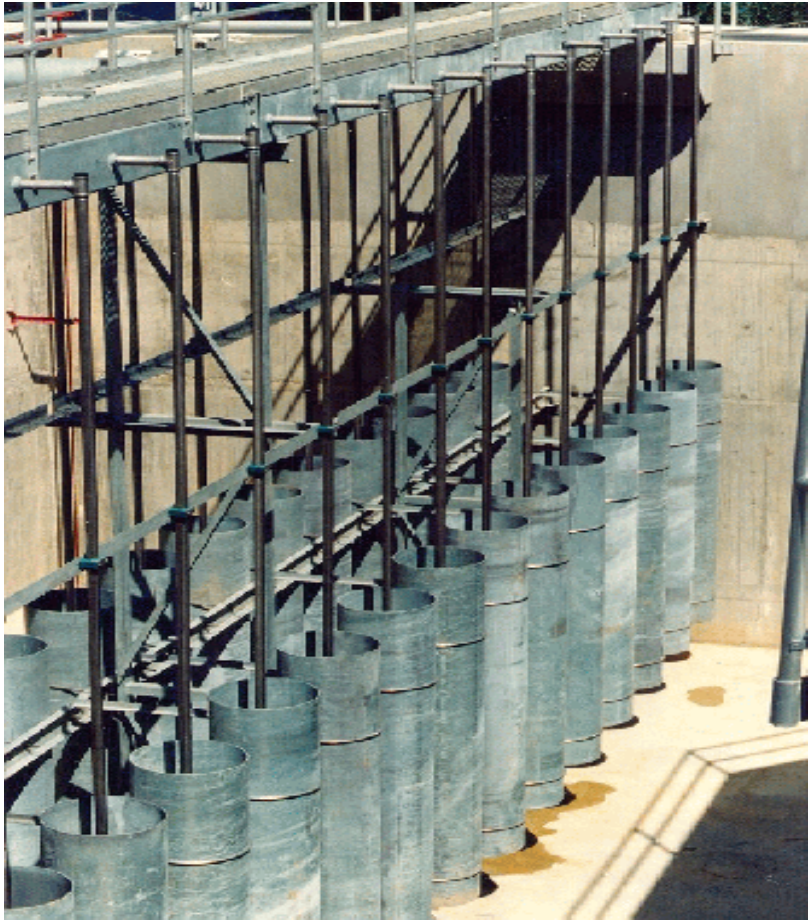
- Upgrade Existing Aerobic Digesters
- Sludge Holding Tank
  - Convert Abandoned Clarifier
- Membrane Thickening
  - Increase Solids Retention Time
  - Reduce Volume for Hauling
- Ovivo Cover with Air Beams
  - Shear Tube Diffusers
  - Retain Heat
  - Improve Winter Digestion
- Continue to Haul Liquid
  - Possible Local Land Application

SCI Dallas Project Details

SCI Dallas Operational Data – Before & After

2015	$ 0.12	per gallon	2017 - 2018	$ 0.12	per gallon	Reduction of 2015 Amount
	gallons	cost		gallons	cost	
Nov-15	160,000	$ 19,200	Nov-17	58,000	$ 6,960	63.75%
Dec-15	240,000	$ 28,800	Dec-17	60,000	$ 7,200	75.00%
			Jan-18			
			Feb-18	63,400	$ 7,608	
			Mar-18	61,500	$ 7,380	
			Apr-18			
			May-18	60,000	$ 7,200	
			Jun-18	61,500	$ 7,380	
Jul-15	149,000	$ 17,880	Jul-18			
Aug-15	165,000	$ 19,800	Aug-18	61,500	$ 7,380	62.73%
Sep-15	240,000	$ 28,800	Sep-18			
Oct-15	160,000	$ 19,200	Oct-18	61,500	$ 7,380	61.56%
6 month hist	1,114,000	$ 133,680				
Annual	**2,228,000**	**$ 267,360**		**487,400**	**$ 58,488**	**78.12%**
Annual Savings			**$ 208,872**			

Questions?



Thank You

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