

SOLIDS TREATMENT AND HANDLING SYSTEMS OVERVIEW

BOARD OF DIRECTORS | NOVEMBER 23, 2024

OUTLINE



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Solids 101

Introduction to how solids are produced, AlexRenew's solids goals, permit requirements, and risks

AlexRenew's Solids Systems

Detailed review of existing solids systems and proposed upgrades as part of the Solids Upgrade Program

Asset Life and Renewal

Discuss the typical life of an asset and review existing solids equipment reliability

New Solids Drying Facility

Overview of proposed solids drying facility

Safety Brief and Site Tour

Tour of WRRF solids treatment and handling systems

TERMS OF THE ART



DEWATERING ≠



DIGESTION ≠

CAKE ≠



THICKENING ≠



SOLIDS ≠

RAGS ≠



ALEXRENEW WRRF TREATMENT PROCESSES

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Nutrient Management Facility BEFRE

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Secondary and Biological Nutrient Removal

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UV and Post-Aeration

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Preliminary and Primary Solids

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Building L Mechanical thickening, blending, dewatering, and biosolids handling and storage

Building A Digester gas utilization and flares

Building 20 Digestion Complex

Building 55 Pasteurization

Building C Gravity Thickening ⁴

ALEXRENEW LIQUIDS PROCESS DIAGRAM









WHAT ARE WASTEWATER SOLIDS?

Wastewater solids refers to the settled organic and inorganic solids that have been accumulated and separated from the liquid stream during the different phases of wastewater treatment.

SOLIDS SYSTEM GOALS

Separate liquids from solids

Remove as much water content as possible from solids.

Support efficiency of liquids treatment

Keep the biological nutrient removal process in a happy place

Kill pathogens

Allows solids to be beneficially reused.

Destroy organic solids

Stabilizes biosolids, allows beneficial reuse, reduces odor and volume of biosolids, and can produce bioenergy.

Reduce solids volume

Reduces storage, trucking, and disposal costs.

Generate energy

Leverage solids processes to create renewable energy to support other wastewater processes.

Inorganic = 50 mg/L Sand, silt, sediment, etc.



Wastewater solids concentrations

BIOSOLIDS REGULATORY CLASSIFICATIONS



Biosolids regulations are established in the Clean Water Act and administered by the Virginia Department of Environmental Quality (VDEQ) through AlexRenew's VPDES permit. VDEQ also regulates the land application of biosolids through separate permits with contractors like Synagro.

CLASS B

- / Meet basic treatment requirements
- / Contain some detectable levels of pathogens
- / Pathogen and vector attraction reduction
- / < 2 million MPN/g fecal coliform
- / Can only be used on permitted locations

CLASS A

- / Receive additional treatment over Class B
- / Treated to remove pathogens to undetectable levels
- / Comply with the most stringent limits for pollutants
- / < 1,000 MPN/g fecal coliform
- / Can be used as fertilizer or soil conditioner
- / Can be sold to the public

ALEXRENEW SOLIDS ROADMAP



of certain biosolids

ALEXRENEW SOLIDS PROCESS DIAGRAM







GRAVITY THICKENING

- / Reduce water content of solids
- / (3) duty, (2) standby thickening tanks
- / Tanks installed in the 1970s
- / Motors and drives installed in the 1980s
- / Covers installed in 2005
- / Motor control center (electrical) installed in the 1980s
- / Solids Upgrade:
 - New rake drives, piping, scum collection, covers
 - Replace electrical and control systems
 - Decommission Gravity Thickener #1

THICKENING CENTRIFUGES

- / Thicken/concentrate solids by using centrifugal separation – think about a washing machine on spin cycle
- $\checkmark~$ Increase solids concentration from 0.5% to 8%
- / (4) Alfa Laval Sharples XM706 units
- \checkmark (3) duty, (1) standby
- / Installed in 2003
- / Solids Upgrade:
 - Add (1) new thickening centrifuge and replace (4) existing units
 - Replace obsolete drive motors







THICKENED SOLIDS EQUALIZATION TANKS

- Blend thickened solids from centrifuges and gravity thickeners
- Provides buffer between thickening and downstream processes
- / (2) duty, (1) standby
- / Installed in 2003
- / Solids Upgrade:
 - Pilot new mixers to minimize ragging and enhance mixing efficiency
 - Replace all mixers

SECTION VIEW OF TSETS

RSBT Mixers

TSET Mixers



Legend:

- Raw Solids Blending Tank (RSBT)
- Thickened Solids Equalization Tank (TSET)



SOLIDS SCREENING

- Remove trash and debris greater than 5 millimeters from thickened solids to prevent accumulation in downstream equipment and improve aesthetic quality of biosolids
- \checkmark (1) duty, (1) standby
- / Installed in 2005
- / Solids Upgrade:
 - Upgrade to align with new BRB wasting rate





Heat exchangers heat solids to meet Class A standards, (2) duty, (1) standby







Tanks store solids prior to digestion, (3) duty, (1) standby

PASTEURIZATION

- Destroys pathogens in solids to meet Class A requirements
- Heats solids to 160 degrees Fahrenheit and holds for 30 minutes
- Cools solids to temperatures acceptable to support digestion process in existing digesters
- / Installed in 2005
- / Solids Upgrade:
 - Decommission pasteurization system
 - Demolish facilities to provide space to support long-term solids plan





DIGESTION

- / Meet permit requirements for volatile solids reduction
- / Reduce mass of solids for disposal
- / Produce biogas (methane) that can be used for energy
- / Reduce odors in biosolids



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DIGESTION HEAT EXCHANGERS

- / Provide backup heating of digesters
- Used only if pasteurization system cannot provide heating
- / (4) duty, (0) standby
- / Solids Upgrade:
 - Replace heat exchangers with larger units to provide all digester heating









DIGESTION GAS MIXING

- Methane gas produced by digesters is used for mixing/turning over each digester
- Gas mixing compressors create bubbles for digester mixing, (4) duty, (2) standby
- / (48) bubble mixers perform digester mixing
- / Installed in 2005
- / Solids Upgrade:
 - Decommission gas mixing system and replace with hydraulic jet mixing



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DIGESTION ENERGY RECOVERY

- / Digester gas boilers to produce steam for process/facility heat
- \checkmark (2) duty, (0) standby boilers
- / Installed in 2005
- / Enclosed flares destroy excess digester gas, not used by boilers



DEWATERING

- Further reduce the volume of thickened pasteurized digested solids
- / Increase the solids concentration from 3% to 28%, thereby decreasing volume ninefold
- / (3) Alfa Laval Sharples DS706
- / (1) duty, (2) standby
- / Installed in 2003
- / Solids Upgrade:
 - Add new dewatering centrifuge at current rough-in location



SOLIDS HANDLING

- / Transport and store biosolids until removed from facility
- / Consists of conveyors and (6) silos
- \checkmark (1) duty, (1) standby train
- / Installed in 2005
- Available storage in silos is less than one week; no other onsite storage
- / Solids Upgrade:
 - Incorporate transport and storage of cake and pellets between Buildings L and C



Final biosolids product



Biosolids conveyor

Biosolids conveyor and storage silos

SYSTEMS VS ASSETS

The "thing" providing a specific level of service

Example: Car Solids



System

Example: Drivetrain Dewatering Centrifuges



Asset

Example: Transmission Backdrives, Rotating Assembly



TYPICAL LIFECYCLE OF AN ASSET

Asset condition and performance decrease over time. Condition and performance can be restored periodically through corrective and preventative maintenance, but eventually assets must be replaced. Replacement typically occurs when the cost to maintain the asset exceeds the cost to replace it.



ALEXRENEW SOLIDS EQUIPMENT RELIABILITY

AlexRenew leverages its asset management program to extend the useful life of its assets. In the case of AlexRenew's solids system, many of the assets are no longer renewable, due to age, stress, wear, or availability of parts. This decreases system reliability, increases maintenance requirements, and affects the level of service of the entire solids process.

Component	Year Built	Redundant Units	Equipment Supported?	Key notes (rebuilds referenced, since Jan 2023)	Maintenance and Ops Burden
Gravity Thickening					
Motor Control Center	1980s	0	\otimes	Parts no longer available	
Process Mechanical Equipment	1970s-80s	2	\otimes	1 rebuild, drum/rake circa 1970	
Thickening Centrifuges	2003	2	\otimes	5 rebuilds, 100k operating hours	
Solids Mixing	2003	1	\checkmark	Ongoing issues w/ mixer ragging	
Pasteurization					
Solids Pumps	2005	0	\checkmark	5 rebuilds/replacements	
Heat Exchangers	2005	0	\otimes	Parts unavailable for repair	
Gas Mixing Compressors	2005	0	\checkmark	Main bearing wear issues	
Dewatering Centrifuges	2003	1.5	\checkmark	5 rebuilds, 100k operating hours	

ALEXRENEW NEW SOLIDS PROCESS DIAGRAM



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ALEXRENEW PROPOSED SOLIDS DRYING FACILITY LOCATION

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Building C Proposed Drying Facility Solids

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Building C Gravity Thickening ²⁷

PROPOSED SOLIDS DRYING FACILITY DETAILS

- / Triple pass rotary drum dryer
- / Dual fuel (natural gas, biogas)
- Produces spherical pellets with about 5% water content and about the same size as a crystal of sea salt
- / Virtually no odor
- ✓ Drum dryer is 10-feet tall, a little taller than a typical room



TYPICAL SOLIDS DRYING FACILITY SCHEMATICS



Triple-pass rotary drum dryer



Solids drying facility schematic (courtesy of Andritz)



PROPOSED DRYING FACILITY LAYOUT IN **BUILDING C**

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FORT WORTH, TX SOLIDS DRYING FACILITY



https://www.youtube.com/watch?v=_5VZKQjwV-c



Primary Settling



Gravity Thickening Gravity thickeners and motor control center



Thickening Centrifuges



Pasteurization



Building 20 Digester heating and mixing



L Building Control room Dewatering centrifuges



Future Projects Drying facility

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