STRAND ASSOCIATES®

*Excellence in Engineering*SM

Wisconsin Wastewater Operator Association

October 23, 2024

Considerations for Maintaining the Correct Biosolids Stabilization Process for Your Current Situation

Ryan Yentz P.E., Strand Associates, Inc. ®
Jonessa Ruhl, Strand Associates, Inc.®

Wisconsin Wastewater Operators Association

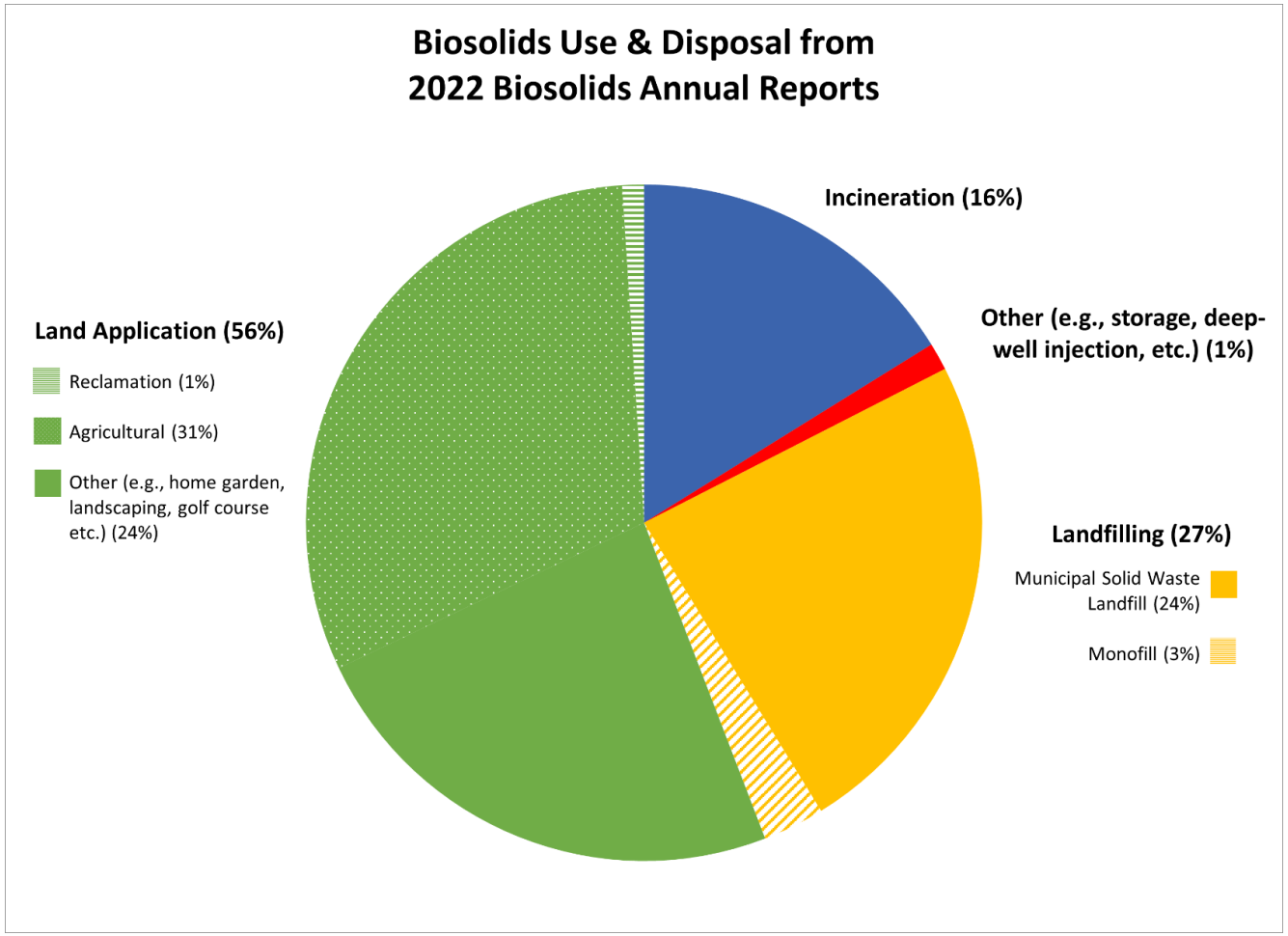
Outline of Presentation

- Definition & Importance
- Factors Influencing Process Selection
- Biosolids Stabilization Methods
- Changing Existing Processes
- Conclusion

Definition & Importance

STRAND ASSOCIATES®

Biosolids Stabilization is the Process of Treating Wastewater Sludge to Make it Safer and More Accessible for Reuse or Disposal



Source: US EPA

- Types of treatments:
  - Biological
  - Chemical
  - Thermal
- Stabilization benefits:
  - Reduces health risks
  - Fertilizer applications
  - Reduces biosolids volume
  - Helps control odor

STRAND ASSOCIATES®

Factors Influencing Process Selection

STRAND ASSOCIATES®

Stabilization Processes Can Be Selected Based on Plant Size, Energy Use and Recovery, and Disposal Method

Plant Size

Energy Use & Recovery

Disposal Options

Landfill

Land Application

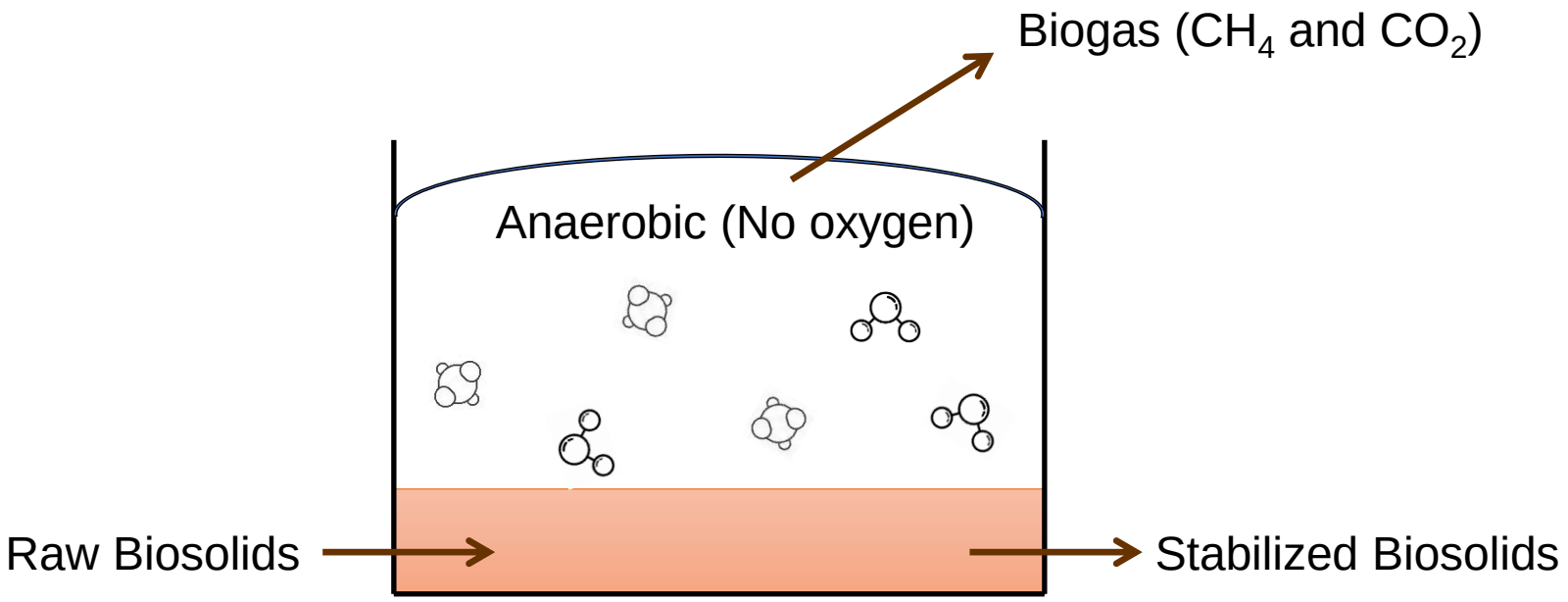
Incineration

STRAND ASSOCIATES®

Biosolids Stabilization Methods

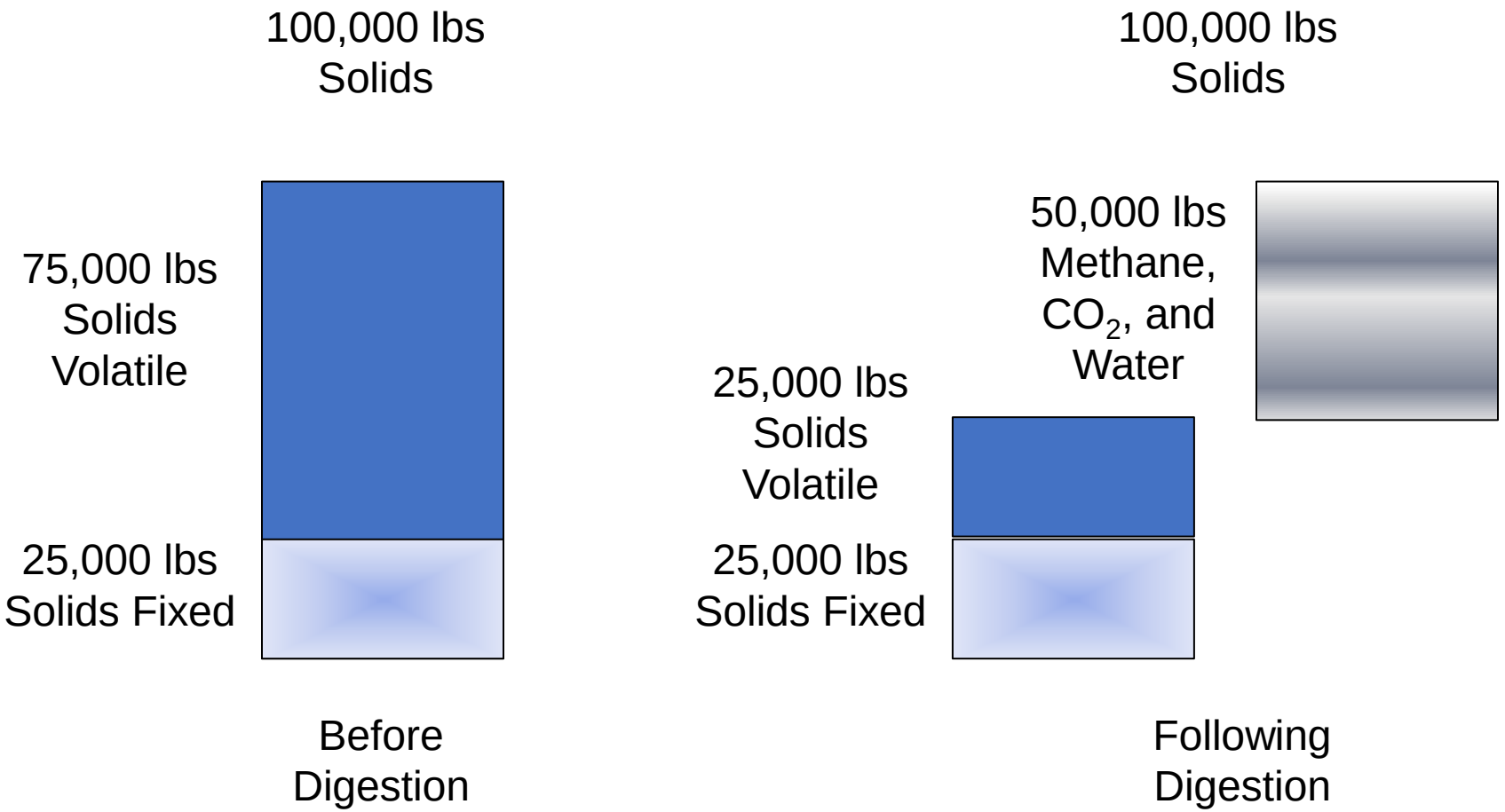
STRAND ASSOCIATES®

Anaerobic Digestion Breaks Down Organic Matter to Produce Stabilized Biosolids and Biogas



- Commonly used at large facilities
  - Handles high volumes
  - Produces stable product
- Volume reduction
- Major benefit is the production of biogas
- Market for selling biogas to local utility

Anaerobic Digestion Gas Production at Lexington-Fayette County



STRAND ASSOCIATES®

Anaerobic Digestion Offers Multiple Options for Energy Reuse and Recovery With Conditioning

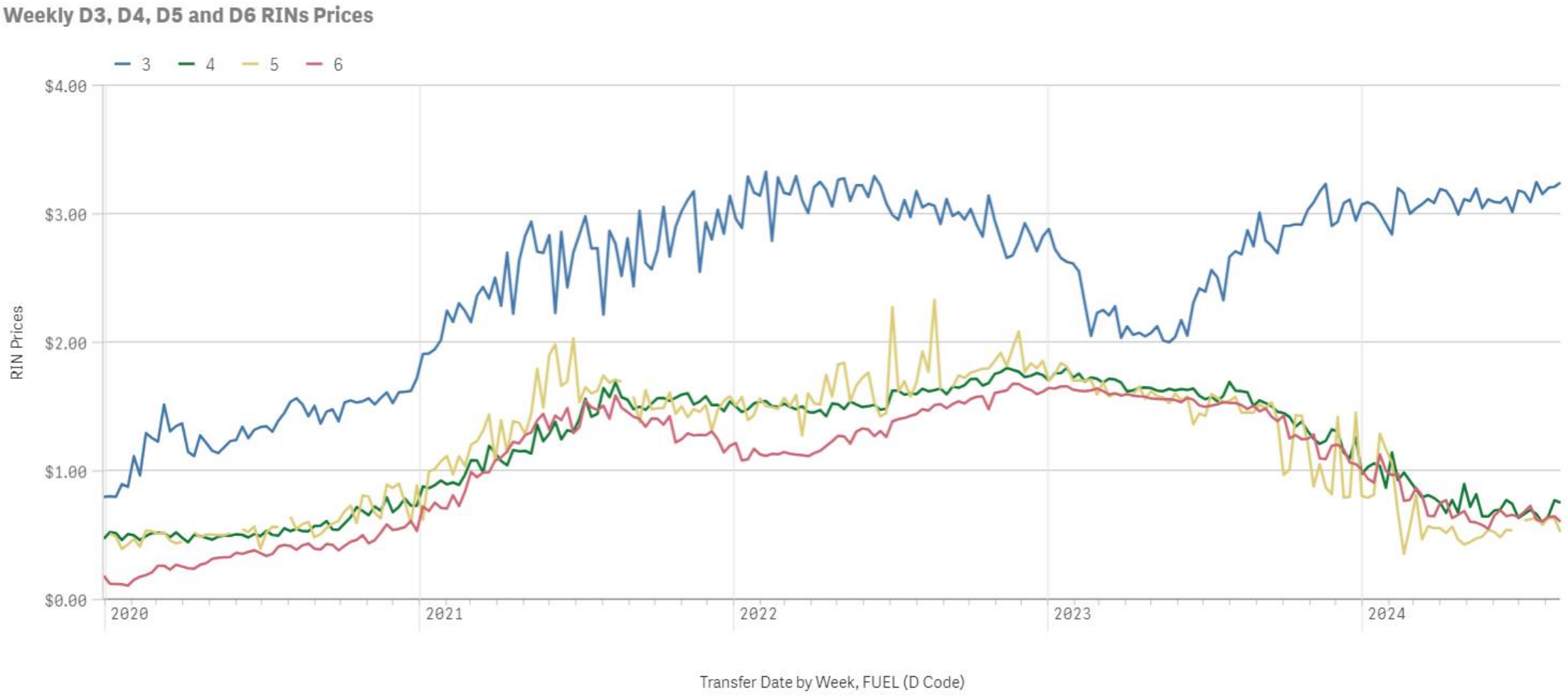
Co-Generator

Microturbines

Digester Boilers

STRAND ASSOCIATES®

Biogas Can Be Injected Into Utility Lines and Sold on the RIN Market



Source: US EPA

STRAND ASSOCIATES®

Mesophilic and Thermophilic Digestion Offer Distinct Advantages Depending on Process Goals

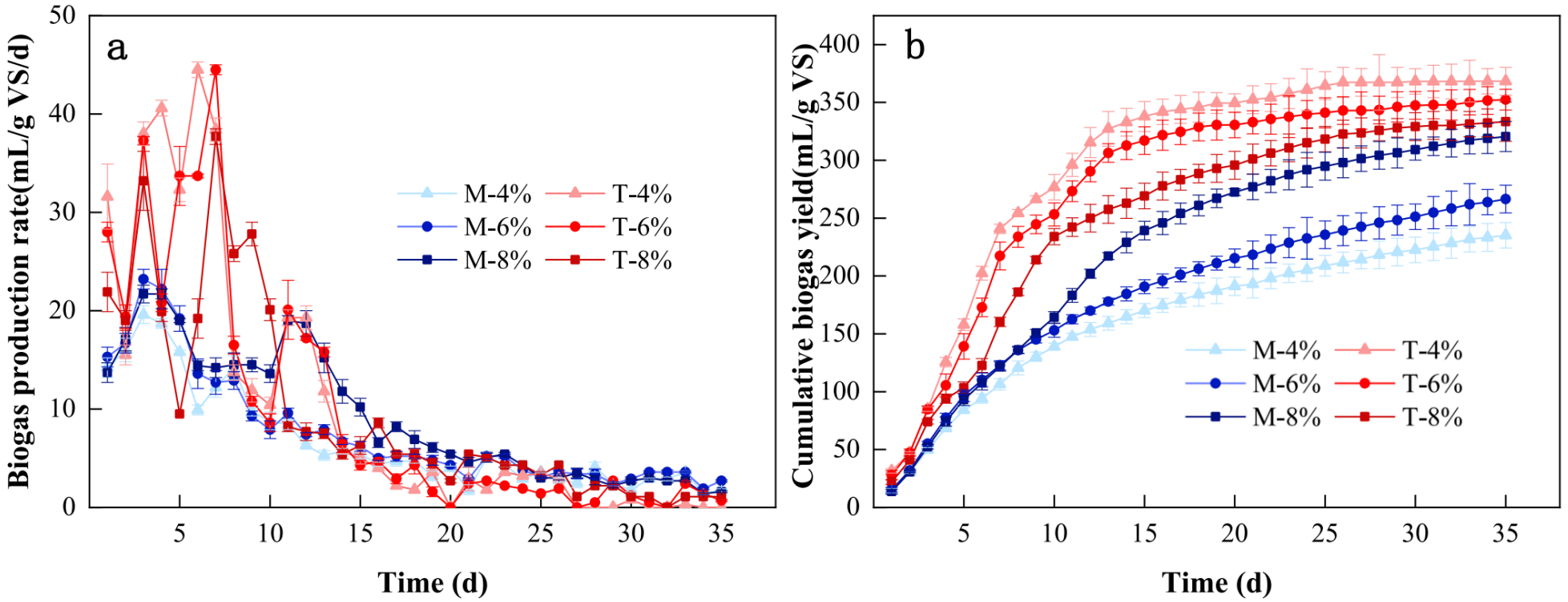
MESOPHILIC

- Operation temperatures between 86-104 degrees Fahrenheit
- Advantages:
  - Stability
  - Lower energy use
  - Less operational expenses
- Disadvantages:
  - Slower digestion rate

THERMOPHILIC

- Operation temperatures between 122-140 degrees Fahrenheit
- Advantages:
  - Faster digestion rate
  - More biogas production
  - Superior pathogen reduction
- Disadvantages:
  - Energy intensive
  - More susceptible to operational changes

Mesophilic and Thermophilic Gas Production Varies



Source: M. Wand, et al. *A comparative study on Mesophilic and thermophilic anaerobic digestion of different total solid content sludges produced in a long sludge-retention-time system*, 2023

STRAND ASSOCIATES®

Aerobic Digestion Has Key Characteristics That Make it Ideal for Certain Applications

- Breaks down organic material with oxygen
- Less complex infrastructure
- Flexible operation
  - Standalone process
  - In conjunction with other stabilization methods
- Low odor emissions
- Direct land application

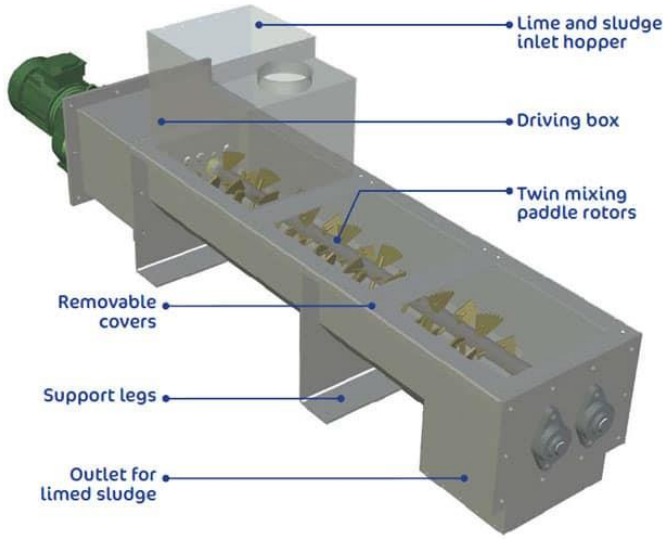
Lake Barrington IL, Aerobic Digester

STRAND ASSOCIATES®

Alternative Methods of Stabilization Can Be Used Instead of or In Conjunction with Digestion

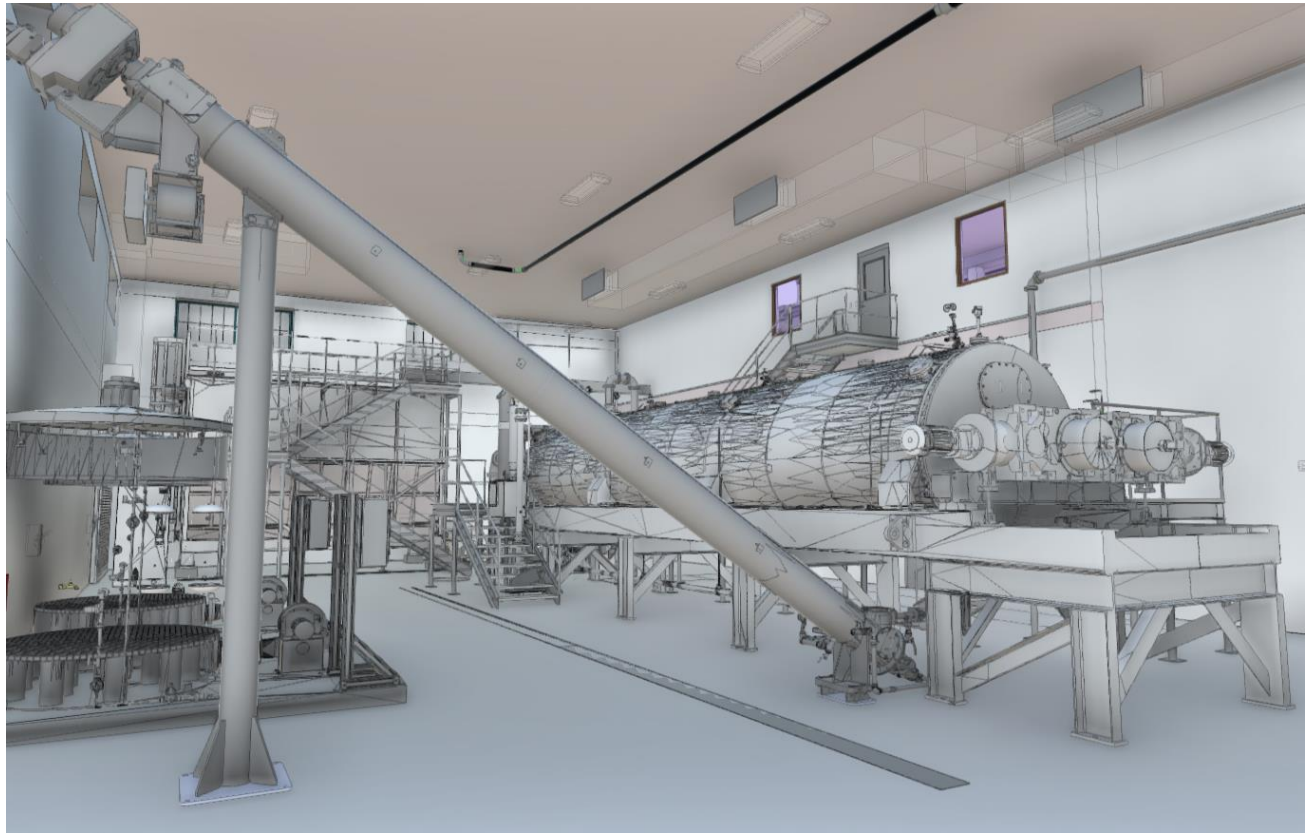
- Alternatives:
  - Co-digestion
  - Chemical Stabilization
  - Hybrid Systems
  - Composting
  - Heat Drying

Feed stock addition for co-digestion



Lime stabilization equipment

Biosolids Drying is an Effective Alternative for Reducing Volume and Enhancing Disposal Options

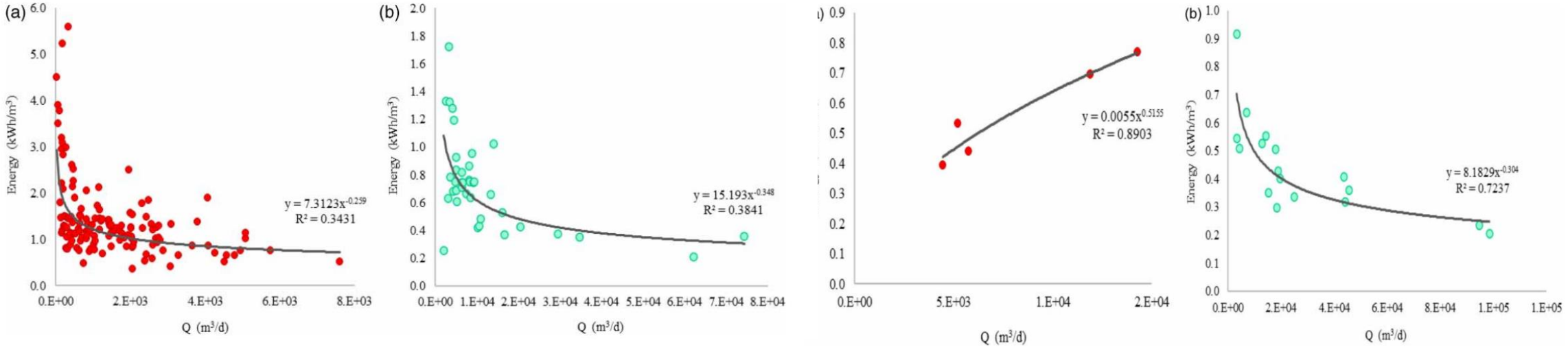


Revit Model for Huntington Sanitary Board Dryer Building

- Significant reduction in volume and weight
- Cost effective transport, storage, and disposal
- Flexible disposal options
  - Land application
  - Fuel source
- Reduces pathogens and odors
- Technological advancements

STRAND ASSOCIATES®

Energy Efficiency Plays a Critical Role in the Selection of Biosolids Stabilization Processes



Source: E. Ranieri, et al. *Energy consumption in anaerobic and aerobic based wastewater treatment plants in Italy*, 2021

STRAND ASSOCIATES®

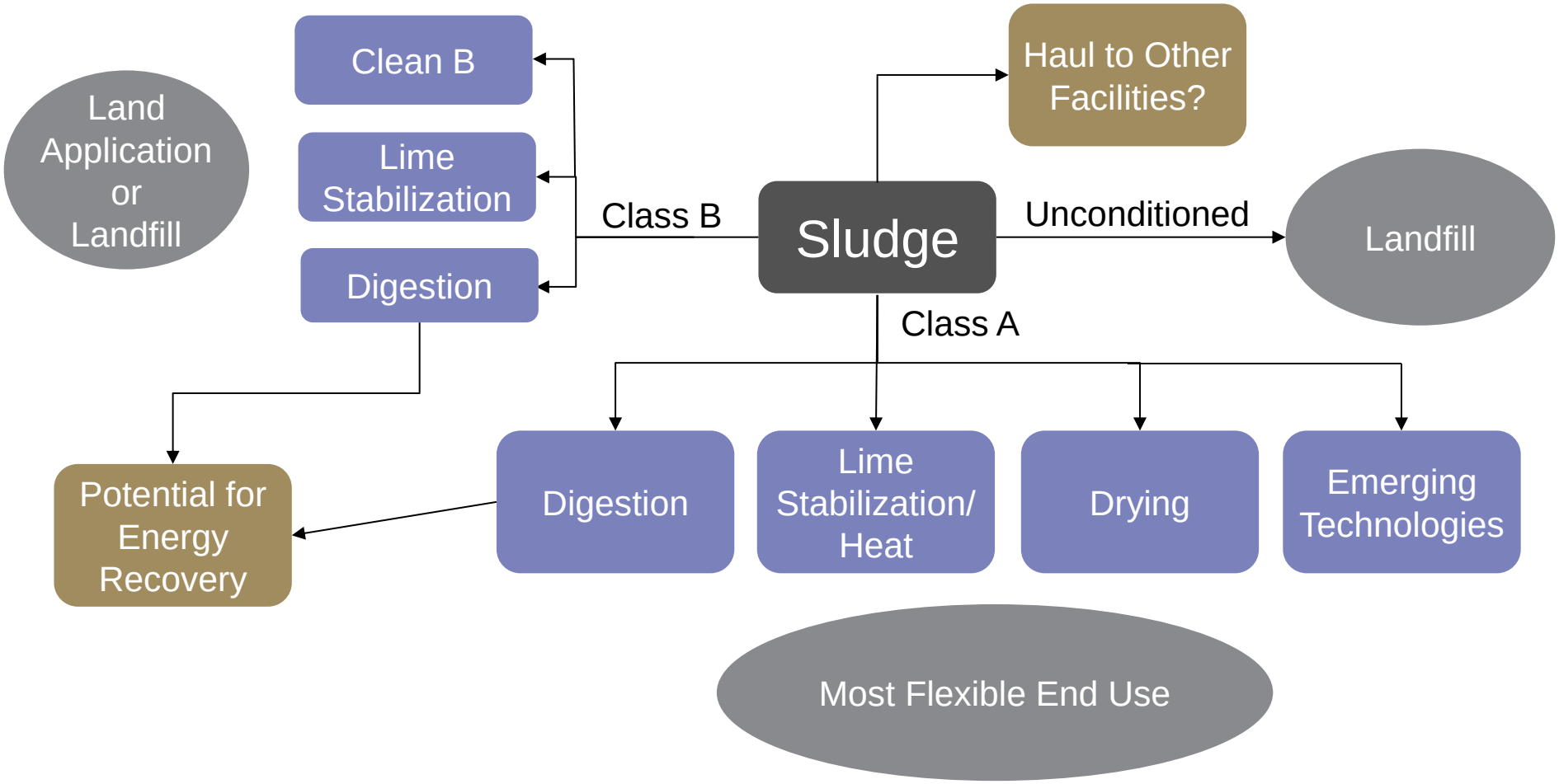
Plant Size and Economy of Scale also Need Consideration

- Anerobic Digestion
  - Better suited for high biosolids loading
  - Large infrastructure investment
  - More operational considerations
- Aerobic Digestion
  - Better suited for lower biosolids loading
  - Low capital cost

Source: © BOJOShop – stock.adobe.com

STRAND ASSOCIATES®

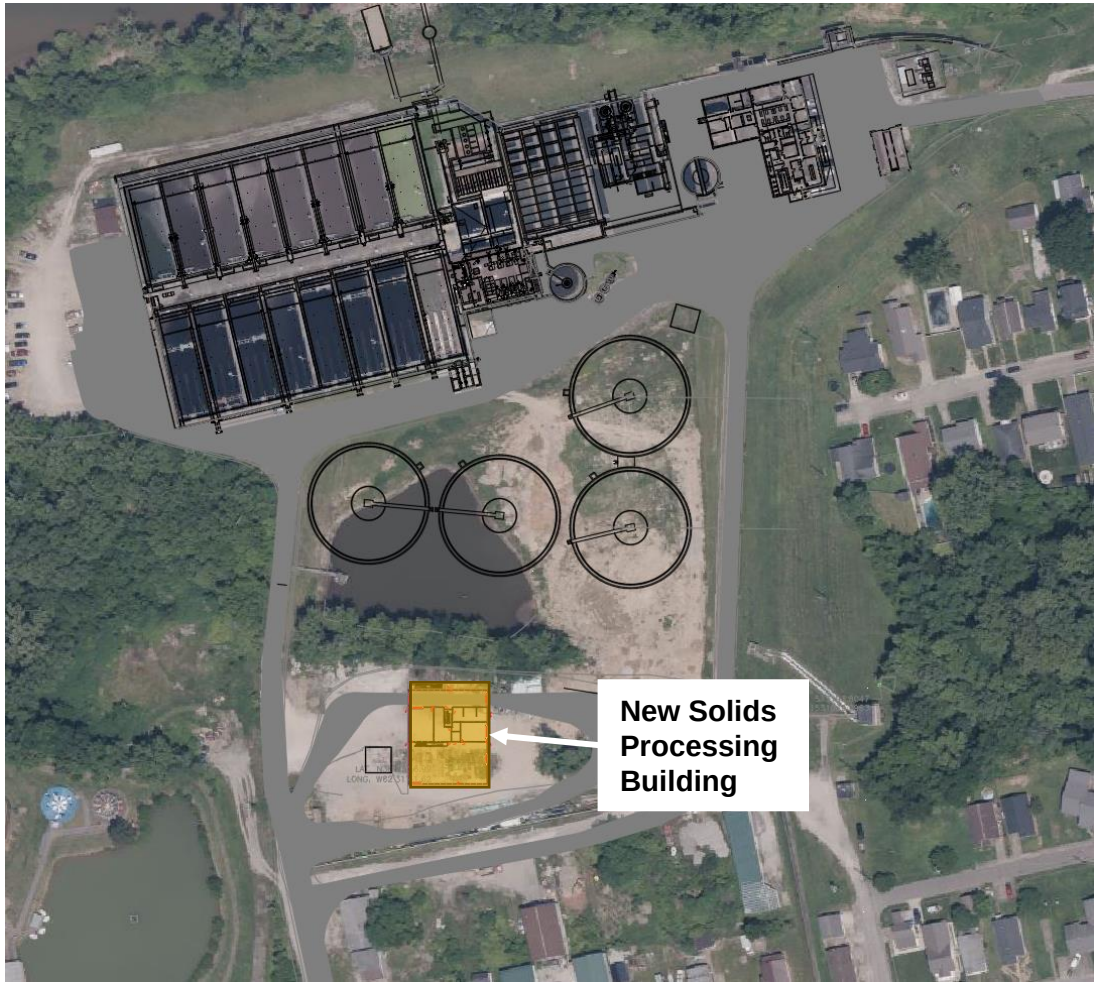
Disposal Options Significantly Shape the Choice of Stabilization



STRAND ASSOCIATES®

Huntington Sanitary Board Elected To Landfill Class A Biosolids

- Concern
  - Metals in sludge limited disposal and use
  - 12,000 – 15,000 wet tons hauled to 3 landfills annually (750 truck loads)
  - Limited sludge storage and aging sludge processing facilities
- Solution
  - Include drying in major WWTP upgrade
  - Construct new solids processing building with centrifuge dewatering
  - Biosolids silo for storage



Improvements in Design for HSB WWTP

STRAND ASSOCIATES®

Gas Safety is Paramount When Using Processes Like Anaerobic Digestion

- Safety Measures
  - Proper gas handling equipment
  - Adequate ventilation
  - Gas sensors
  - Pressure control
  - Regular maintenance

Waste Gas Burner

Gas Accumulators

Changing Existing Processes

STRAND ASSOCIATES®

Process Changes Can Be Necessary After Years of Operation to Meet Updated Regulations or Goals

- Regulatory restrictions:
  - Stricter environmental standards
  - Reduced pathogens
  - Increased nutrient removal
- Changes in restriction at disposal facilities
- Rising operational costs

Source: © magele-picture – stock.adobe.com

STRAND ASSOCIATES®

Aging Infrastructure and Financial Incentives are Other Reasons for Change

- Deterioration of digestion equipment
- Equipment upgrades
- Available subsidies for renewable energy generation
- Wastewater treatment facility grants
- Changes in staff
- Process complications

Source: © BOJOShop – stock.adobe.com

STRAND ASSOCIATES®

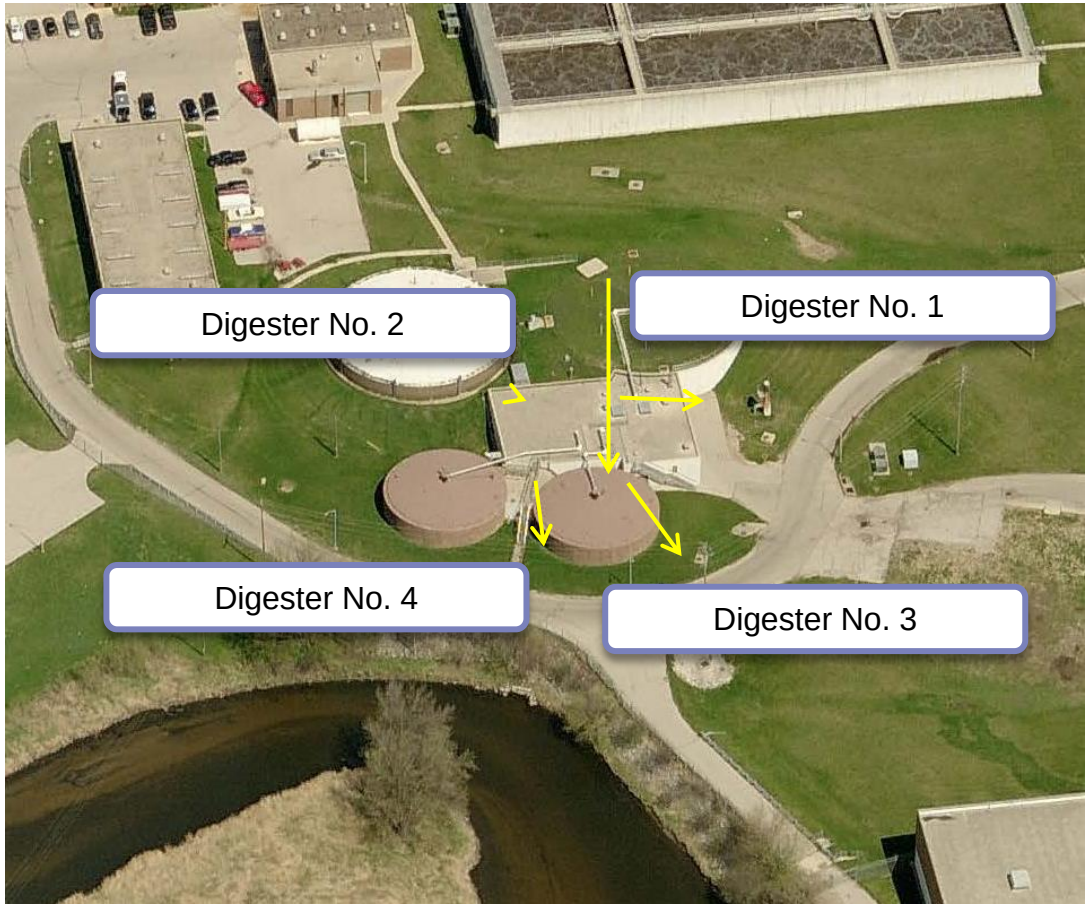
Fond du Lac Switched Two Thermophilic Digesters to Mesophilic

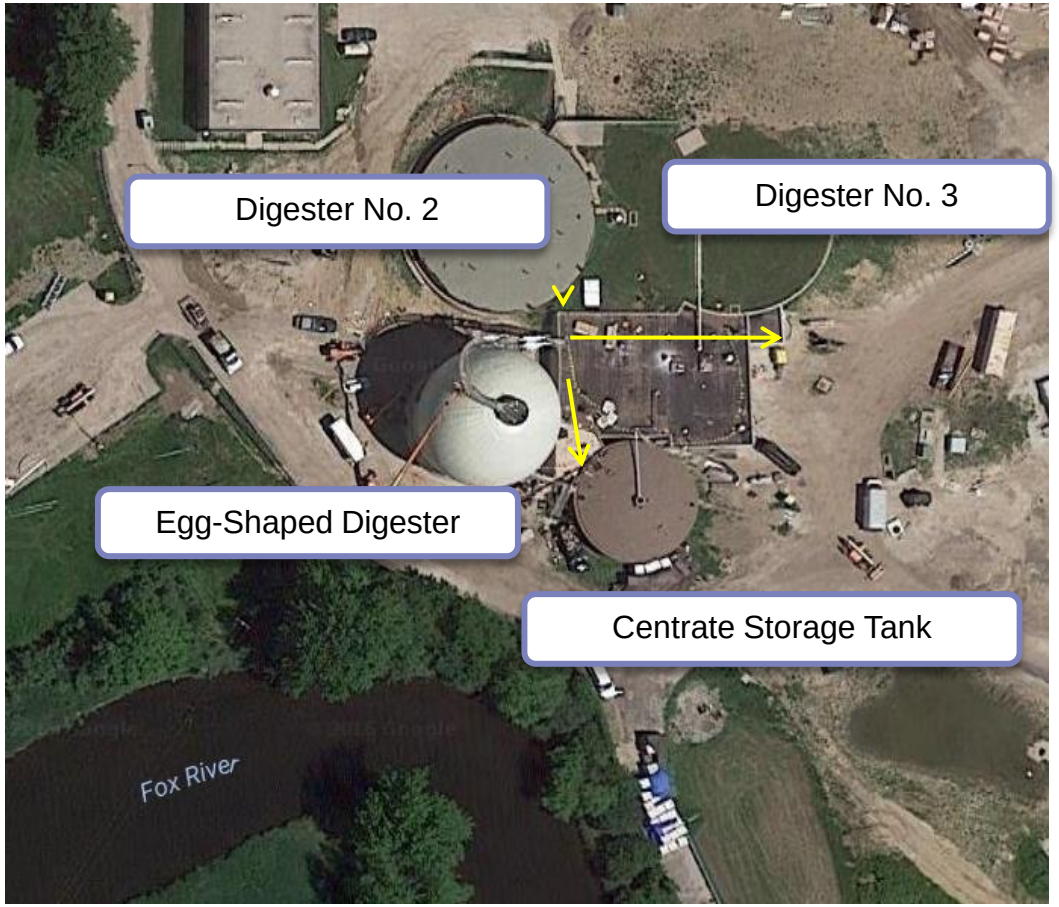
- “Side effect of change”
  - Struvite issue was essentially erased
  - Decreased dewatering efficiency
  - Increased hauling and disposal
  - Reduced biogas production

Anaerobic digesters – Fond du Lac, WI

STRAND ASSOCIATES®

Retrofitting Existing Structures and Equipment Can Salvage Value and Minimize Costs During Process Change





Waukesha, WI facilities retrofitting

STRAND ASSOCIATES®

Conclusion

STRAND ASSOCIATES®

Questions?

Source: © marish – vectorstock.com

Jonessa Ruhl, Strand Associates, Inc.®

jonessa.ruhl@strand.com

608.251.4843

STRAND ASSOCIATES®

STRAND ASSOCIATES®

*Excellence in Engineering*SM