Producing High Quality Biosolids by going Low, Cost – Low Tech:

*The Story of a Small Treatment Plant that’s Looking Back to find its Future*

Presented by Mark Bowman, Manager Gogebic-Iron Wastewater Authority

MWEA Biosolids Conference
March 13-14, 2018
The Gogebic-Iron Wastewater Authority
Ironwood, MI

Members:
• 73% City of Ironwood, MI
• 21% City of Hurley, WI
• 9.3% Charter Township of Ironwood, MI
Service Area
7 Square Miles
Gogebic-Iron Wastewater Authority

• 1977 Facilities Plan
  • Excessive Wet Weather Flow
  • Recommended Hurley form a regions Treatment System with Ironwood
  • 1979 Force main installed and the City of Hurley became a user of the Treatment System

• 1983 Authority formed
  • City of Ironwood, City of Hurley, Ironwood Township

• 1986 Construction of New Treatment Plant Completed
  • $11,000,000 Plant, $10,000 Sewer = $21,000,000 Total
## Capacity Perspective

### Original Design Criteria

<table>
<thead>
<tr>
<th></th>
<th>Design</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>12,390</td>
<td>~7,000</td>
</tr>
<tr>
<td>Average Flow</td>
<td>3.4 MGD</td>
<td>1.2 MDG</td>
</tr>
<tr>
<td>Peak Hourly Flow</td>
<td>8.5 MGD</td>
<td>20 MGD</td>
</tr>
</tbody>
</table>
Timeline of Journey to the GIWA's LCLT Project

- **Awareness of Need**
- **N-VIRO**
- **SLUDGE MANAGEMENT PLAN, MCM**
- **TPAD STUDY**
- **Research of Management Options**
- **MTU SENIOR DESIGN**
- **SAW START**
- **SAW END**
- **CONTINUOUS IMPROVEMENT**
- **MTU SENIOR DESIGN**
- **MTU PARNERSHIP**
- **CHP**
- **MASTER PLAN**
- **MTU SENIOR DESIGN**
- **MTU SENIOR DESIGN**
The Divers and Influences

• Financial
• Unutilized Assets
• Limitations to Residual Management Plan
• Regulations
• Biosolids Characteristics
• Partnerships
• Stupidity
Drivers and Influences - Financial

• Overbuilt Treatment Capacity and population decline result in high user rates
• Treatment plant runs at 35% of loading capacity
• Wet Weather Flow Excessive

Population

<table>
<thead>
<tr>
<th>Design</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,390</td>
<td>~7,000</td>
</tr>
</tbody>
</table>
Drivers and Influences – Collection System

Original sewer separation project in early 1980’s inadequate

All the I/I Studies and corrective work completed in the last 32 years have yet to eliminate excessive flows during wet weather events.
Unutilized Assets
The Divers and Influences – Limitations to RMP

Climate
• Long Winters
• Short, Cool Growing Season

Available Land Application Sites
• Volume of Farmland Acreage Low
• Small Application Sites

Some years Zero biosolids were able to be land applied
They Don’t call us “Big Snow Country” for Nothing

Snow
• Ironwood: 7.0 months, mid-October through mid-May
• Lansing: 4.9 months, mid-November through mid-April.

Snowless
• Ironwood: 5.0 months, mid-May through mid-October
• Lansing: 7.1 months, mid-April through mid-November

Snowfall
• Ironwood: 176 Inches
• Lansing: 45 inches

Short Season to Apply Biosolids
• Ironwood: 3.9 months (119 days), from May 26 to September 22
• Lansing: 5.6 months (170 days), from April 25 to October 12
The climate of the Gogebic County area is one of *short, cool summers with long, cold winters*. On average, the first date of temperature below 32 degrees Fahrenheit can take place anywhere from late August in the eastern part of the County to late September or early October in the western area along Lake Superior. The average date for the last freezing temperature in spring can take place from May in the western area along Lake Superior to early June in the eastern interior.

<table>
<thead>
<tr>
<th>Warmest Month</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Maximum Temperature (° F)</td>
<td>76.1</td>
</tr>
<tr>
<td>Avg. Minimum Temperature (° F)</td>
<td>55.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coldest Month</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Maximum Temperature (° F)</td>
<td>20.3</td>
</tr>
<tr>
<td>Avg. Minimum Temperature (° F)</td>
<td>2.9</td>
</tr>
<tr>
<td>Days Above 90° F</td>
<td>1.1</td>
</tr>
<tr>
<td>Days Below 0° F</td>
<td>38</td>
</tr>
<tr>
<td>Average Annual Precipitation (in.)</td>
<td>34.93</td>
</tr>
<tr>
<td>Average Annual Snowfall (in.)</td>
<td>188.2</td>
</tr>
</tbody>
</table>
Snow is Measured in Feet – 28’ or 390 inches 170” Average in Ironwood
188 Inch Average...

...300 inches is not Unusual
Ironwood Zone 4a
May 15 to August 31
119 day Growing Season
SISI Ski Fest
Annual Bikini Races and Copper Peak, a 40 ski flying jump
Pulling Snow from Biosolids Cake Storage Building
I should write a letter to the Board, this reads like an Opportunity
New Part 503 Regs present opportunities to obtain a EQS designation.

- Monitor Pathogens to confirm Fecal Reduction.
- Petition regulators to allow experimentation
- Develop Public demonstration plots
- EQS Production Trials
- Seek Funding
Timeline of Journey to the GIWA's LCLT Project

- **Awareness of Need**
  - N-VIRO
  - Sludge Management Plan, MCM

- **Research of Management Options**
  - TPAD Study

- **Continuous Improvement**
  - Master Plan
  - MTU Partnership
  - Saw Start
  - Saw End
  - CHP
  - MTU Senior Design
  - MTU Senior Design
Summary of
Sludge Management Plan
for the
Gogebic Iron Wastewater Authority

By:
McMahon Associates, Inc.
ENGINEERS ARCHITECTS SCIENTISTS SURVEYORS
Menasha, Wisconsin - Valparaiso, Indiana

May 17, 1995
Summary of Sludge Management Plan
for the Gogebic Iron Wastewater Authority

Existing Sludge Management System

- WAS to Primary Clarifiers
- Co-thickened Sludge (3.5% solids) to Primary Digester
- Feed Belt Press from Secondary Digester
- Dewatered Sludge from Press to Storage or Land Application
- Land Application by Plant Staff with Plant Owned Equipment
Biosolids freeze solid over winter and may not thaw until mid-June.

Land applications compete with farmers and weather.
Recommendations

- Digester Mixing Improvements  $181,250
  Implement ASAP in 1995

- Trial / Test Fly Ash Addition / Accelerated Drying
  Get USEPA Input into Test Protocol

- Fly Ash or Lime Addition Improvements
  estimated to cost $168,750
  Implement by Fall 1996
1995 Sludge Management Plan
Fly Ash/Alkaline Addition/Accelerated Drying
1995 Sludge Management Plan
Fly Ash/Alkaline Addition/Accelerated Drying

Technology Rejected:
• Emerging in 1995
• High Odors
• Material Handling
• Annual License Fees
• High O&M
• History of Project Failures
Timeline of Journey to the GIWA's LCLT Project

AWARNESS OF NEED

N-VIRO

SLUDGE MANAGEMENT PLAN, MCM

TPAD STUDY

MASTER PLAN

MTU PARTNERSHIP

MTU SENIOR DESIGN

SAW START

CONTINUOUS IMPROVEMENT

CHP

MTU SENIOR DESIGN

SAW END

Research of Management Options
TEMPERATURE-PHASED ANAEROBIC DIGESTION PILOT TEST FINAL REPORT

For The
Gogebic-Iron Wastewater Authority
Ironwood, Michigan

Prepared By:
McMahon Associates, Inc.
Neenah, Wisconsin

November 21, 1997
McM. No. 712-96330
Do nothing option, most cost effective but does not address:

- Freezing of sludge in Winter
- Limited time to apply
- Site distance
- Availability of suitable acreage
- Administrative overhead
Fly Ash Option

• Did not solve freezing issue
• Did not solve availability of agricultural sites for land application.
• Odors issued difficult and expensive.
1995 Sludge Management Plan
McMahon and Associates

ATAD Option
• Arose since 1995 Plan.
• Innovative Class A
• 18% increase in VSD and gas production.
• Odors comparable to mesophilic.
• Fits within GIWA’s configuration.
Footnote to this chapter;

Shortly after the GIWA gave up on TPAD, the method went on to become a successful treatment process.
Timeline of Journey to the GIWA's LCLT Project

AWARNESS OF NEED

N-VIRO

SLUDGE MANAGEMENT PLAN, MCM

TPAD STUDY

MCM

CONTINUOUS IMPROVEMENT

MTU PARTNERSHIP

SLUDGE MANAGEMENT PLAN

MTU SENIOR DESIGN

SAW START

SAW END


Research of Management Options
Partnership with MTU

• March 2011 District Heating
• December 2011 Contacted Dr. Hand
• Introduction to Dr. Seagren
• Winter 2011 - Student Design Project, Freeze/Thaw Experiments
• 2012 Learned of Two Summer Method
• May MTU/GIWA Presentation at MWEA Section 21 U.P. Wastewater Operator Conference
Partnership with MTU Cont.

• 2013 Intensified research into Low-Cost, Low-Tech SPTs (Sludge Processing Trains).
• 2012/13 The GIWA subscribes to WE&RF
• October 2013 Funding Applications:
  • NSF by MTU
  • SAW-IT Grant by GIWA
Development of a Sustainable Process for Class A Biosolids Production at Gogebic-Iron Wastewater Authority

Christa Meingast, Mark Bowman, Jennifer G. Becker, and Eric A. Seagren
Outline

• Introduction
• Motivation
• Wastewater Treatment Facilities
• Reviewed PFRP’s
• Composting Trials
• Freeze/Thaw Lab Testing
• Conclusions
Tour of Lakeland Sanitary District No. 1
Minocqua, WI
Time and Temperature Recorder Validates PFRP
Rotary Screw Press for Dewatering
16%-18% Cake
Cake Discharge
Cake Storage Building
Covered Accelerated Drying Building
Drying Piles Showing Evidence of Composting

Light and dark colors show transition from anaerobic to aerobic microbial activity.

Aerobic outer layer

Anaerobic inner layer
Test Compost Pile
<table>
<thead>
<tr>
<th>Date</th>
<th>Process Day</th>
<th>ID (initials)</th>
<th>Outside Temp.</th>
<th>Time</th>
<th>Depth of Temp.</th>
<th>Pile Temperature</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper 1/3rd</td>
<td>Lower 1/3rd</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>8-7</td>
<td>0</td>
<td></td>
<td></td>
<td>6AM</td>
<td>6</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>8-8</td>
<td>1</td>
<td></td>
<td></td>
<td>6AM</td>
<td>6</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>8-9</td>
<td>2</td>
<td></td>
<td></td>
<td>6AM</td>
<td>6</td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>8-10</td>
<td>3</td>
<td></td>
<td></td>
<td>5AM</td>
<td>12</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>8-11</td>
<td>4</td>
<td></td>
<td></td>
<td>8AM</td>
<td>6</td>
<td>47</td>
<td>44</td>
</tr>
<tr>
<td>8-12</td>
<td>5</td>
<td></td>
<td></td>
<td>8AM</td>
<td>6</td>
<td>44</td>
<td>49</td>
</tr>
<tr>
<td>8-13</td>
<td>6</td>
<td></td>
<td></td>
<td>6AM</td>
<td>6</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>8-14</td>
<td>7</td>
<td></td>
<td></td>
<td>6AM</td>
<td>12</td>
<td>48</td>
<td>45</td>
</tr>
</tbody>
</table>

**NOTES:**
(Location, turning events, moisture conditions/adjustments or odors)

Christa Visit, Consolidated pile into Higher shorter pile 3x6.5x10
Field Composting Experiments

Figure 1: Maximum Daily Temperature in Compost Pile for Trial 1
Field Composting Experiments

• Solutions to Composting Trial 1 problems
  – Higher windrow and less turning
    • Keep in moisture and heat
  – Volatile solids between 45% to 50%
  – Total Solids between 45% and 55%
  – Composted Sludge Mixed with Cake Sludge
  – Location of Storage Building
Field Composting Experiments

Figure 2: Maximum Daily Temperature in Compost Pile for Trial 2
Timeline of Journey to the GIWA's LCLT Project

AWARNESS OF NEED

1990 - N-VIRO

SLUDGE MANAGEMENT PLAN, MCM

1995 - TPAD STUDY

1997 - MASTER PLAN

MTU SENIOR DESIGN

MTU SENIOR DESIGN

SAW START

CONTINUOUS IMPROVEMENT

Research of Management Options

SAW END
Purpose: Evaluate alternatives to provide the GIWA with a pathway that develops Low-cost, Low Tech sustainable sludge treatment and management options.
2014 Senior Design Projects Teams

• ABCK Consulting
• DESM Engineering
• PACS
• Sustainable Biosolids Solution
Evaluation of Sludge Process Train Alternatives for Class A Biosolids Production at the Gobegic-Iron Wastewater Authority (GIWA)

Anna VanderKooi PM, Brogan Beyette, Collin DePrekel, Kaitlin Hannum

Background
The Gobegic-Iron Wastewater Authority (GIWA), located in Ishpeming, MI serves a population of 12,000. Currently the facility is producing Class B biosolids (residual organic byproduct of wastewater treatment) that are land applied but due to a decline in agriculture in the area, a short growing season, and restrictive phosphorus limits this system is not sustainable. The facility would like to produce biosolids which would meet Class A Exceptional Quality biosolids regulations in the USDA 40 Code of Federal Regulations Part 503 and could be distributed with less regulatory guidance.

Objectives
The objective of this project is to design a sustainable biosolids process train for producing Class A biosolids that can be implemented at the GIWA while utilizing existing resources. Both high technology and low technology process alternatives are considered and a final recommended process is selected.

Composting Final Design – Recommended Process

1. Composting Mix Characteristics
   Composting is the process of decomposing organic material via biological means in which pathogens are inactivated by elevated temperatures. Windrow composting was chosen by ABEC Consulting over in-vessel and static aerated piles via a ranking system.

Final Mix Characteristics –
- 5 Months Bio Solids - 1.5 Fish Solution - 7.5 Fish Blood Chips
- CHN Ratio – 35:12
- Moisture Content - 67%

2. Process Flow Diagram/Site Layout

3. Operation Layout

4. Auxiliary Equipment & Site Modifications

Existing Facilities –
- Sludge Storage Building – Active Composting Area
- Front End Sifter/Air Screener

New Equipment/Construction –
- Window Turner – Backs up 16:30
- Wood Chip Screening Device – 5’ x 5’
- Testing Equipment – Pathogen & Temperature
- Curing/Storage Cover Building

5. Cost Estimation

<table>
<thead>
<tr>
<th>Table 1. Annual Costs</th>
<th>Table 2. Capital Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation &amp; Maintenance</td>
<td>$44,000</td>
</tr>
<tr>
<td>Capital Goods</td>
<td>$36,430</td>
</tr>
<tr>
<td>End User Application</td>
<td>$14,090</td>
</tr>
<tr>
<td>Total Capital Cost</td>
<td>$373,420</td>
</tr>
</tbody>
</table>

Final Recommendations
The final recommended process is window composting. Composting will allow for the production of an easily marketable, Class A biosolids product with favorable characteristics.

Although composting maintained a higher capital investment, it sustained a comparable annual cost to combined lagernoping/air drying. ABEC Consulting is confident that once window composting is established it will be a more sustainable option to meet the current needs of the GIWA.

Acknowledgements
ABEC Consulting would like to extend a special thank you to both our client and our faculty advisors for their assistance throughout the course of this analysis.

Client:
Mr. Mark Bowman, GIWA Manager

Advisors:
Dr. Eric Seiger & Dr. Jennifer Becker
Production of Class A Biosolids

Dominic Davis, Wesley Ellenwood, Mitchell Murphy (PM), Courtney Sian
Advisors: Dr. Jennifer Becker, PhD, and Dr. Eric Seagren, PhD
Michigan Technological University
Civil and Environmental Department, 2014

Site Background

The Gogebic-Ironwood Wastewater Authority (GIWA) turned in 1995 about 3.4 MGD of municipal wastewater. The plant utilizes an anaerobic digestion process to treat and stabilize the sludge. The plant currently produces 233 wet tons of sludge per year. An average solids content of 24%. The biosolids produced from the sludge currently meet the standards for Class B biosolids. There has been a decrease in demand for the GIWA biosolids due to land application restrictions and a shrinking farming community. According to the “Standards for the Use and Disposal of Sewage Sludge” (Part 503, 30 CFR 503), GIWA biosolids have more restrictions on land applications due to higher levels of pathogenic microorganisms.

Project Scope

- Unsuitable Class B biosolids due to air transportation costs, land application constraints, and a long winter season.
- Obtain Class A biosolids utilizing pathogen reduction techniques.
- Design a low-cost alternative for GIWA to use in the production of Class A biosolids.
- Achieve a 3-5 year return on investment.

Screening

- Processes to further reduce pathogens (VFA/Fa) ranked based on a scale of 5 being the highest and 1 being the lowest.
- Computing decision is: score.

Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Acre (Acres)</td>
<td>3.320</td>
<td>1.39925</td>
<td>5,574,246</td>
</tr>
<tr>
<td>Storage Mulch Line (L)</td>
<td>1.395</td>
<td>246.57</td>
<td>58,317,200</td>
</tr>
<tr>
<td>Storage Line Delivery (L)</td>
<td>0.2450</td>
<td>1</td>
<td>3,610,983</td>
</tr>
<tr>
<td>Storage Line Return (L)</td>
<td>0.5450</td>
<td>6</td>
<td>3,056,599</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$58,913,60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Cost based on 2014 FISMAN, Heavy Construction Cost Data.

Conclusion

DDEM Engineering also analyzed the proposed process of composting. However, this system would require 1.6 weeks, a bulking agent to be added to the biosolids, and an air supply system. The process of in-waste composting involves the purchase of additional storage buildings, control systems, a screening device, and a belt. A cost for in-waste composting was found to be $6,065,000. Due to the high capital cost of such a system, DESM recommends implementing the process of thickening storage into the existing facility. The system would be profitable in one year and is a fast because of the extended storage period. By selling the Class A biosolids produced from thick storage, GIWA will experience profits within 3-5 years.

DES M would like to thank Dr. Jennifer Becker, Dr. Eric Seagren, Mark Bickman (the Plant Manager at GIWA), Kristin Peterson, and Paul Affleck from the Lakeview Area Joint Wastewater Treatment Plant, and Dr. Kris Mattila for their assistance throughout this project.
Evaluation of Sludge Process Train Alternatives For Class A Biosolids Production

Gogebic-Iron Wastewater Authority (GIWA) Treatment Facility

William Ashbaugh  Shawn Conard  Michael Polkinghorn  Kyle Slavik

Department of Civil and Environmental Engineering  Michigan Technological University

Advisors: Dr. Jennifer Becker and Dr. Eric Seagren  GIWA Plant Manager: Mark Bowman

Project Background
- GIWA plant located in Ironwood, MI
- 850 tons of Class A biosolids produced yearly
- Biosolids are treated wastewater solids collected through the process
- Biosolids regulated by U.S. EPA Title 40, Part 503 Rule
- Federal regulation defines an alternative to achieve Class A biosolids
- Focuses on Alternative 5, Processes to Further Reduce Pathogens (FRP) and Alternative 6, an untreated process that can be determined equivalent to a FRP by the EPA and granted Alternative 5 status
- Class A biosolids have below detectable pathogen levels (total coliform, E. coli, Salmonella, sp. lactis)
- Pathogen levels of GIWA biosolids are below Class A limits
- Design one process to further reduce pathogens in FRP and one low-cost, low-tech solution for GIWA Treatment Facility
- Recommended most feasible design to GIWA Treatment Facility

PFPR and Low-Cost Low-Tech Screening
- Processes evaluated based on capital cost, operation cost, ease of existing facilities, waste, color and public perception
- Composting selected as FRP using aerated static piles due to low costs, ease of operation, and utilization of existing facility
- Combined lagooning and air drying selected as low-cost low-tech process due to low operation costs, ease of operation, and combination of pathogens killing mechanisms from lagooning and air drying

Location of GIWA Treatment Facility
- Location of lagoon and drying pad
- Selected low-cost low-tech process (Alternative 4)
- Biosolids fed to lagoons for 1 year and stored for 2 years
- Co-asphaltic Clay Liner (CCL) selected as lagoon base and high density Polyethylene (HDPE) selected as lagoon liner with a layer of double layered geosynthetic clay liner (GCL) for physical protection and UV ray protection
- Biosolids removed from lagoons at the end of storage time with front end loader
- Formed into 14 windrows on 220’ x 220’ asphalt drying pad for air dry
- Biosolids turned with skid steer composting aerator 3 times per week
- Slipped drying pad to allow water to drain into a ditch and be pumped to head of plant
- Very low operation and maintenance (OM) costs

Cost Analysis
- Aerated Static Pile
- Lagoon and Air Drying

Conclusions
- Combined lagooning and air drying is the most feasible process for achieving Class A biosolids at the GIWA Treatment Facility. This process requires higher capital costs than aerated static pile composting, but low operation costs maintain the more economical option. Thus, PACS recommends continued lagooning and air drying to the GIWA Treatment Facility.
Analysis, Design, and Recommendations for Achieving Class A Biosolids For the Gogebic-Iron Wastewater Authority Treatment Plant

Keith Anderson, Justen Kosmowski, Ryan Leveille, Jonathan Witham

Spring 2014

CE 4905

**Chosen Process Designs**

**PFRP: Autothermal Thermophilic Aerobic Digestion (ATAD)**

How ATAD Works:
Influent sewage sludge is thickened and pumped into a cylindrical tank reactor. Thermophilic (40 to 70°C) microbial digestion produces heat and promotes biodegradation of organic material as the sewage sludge is mixed. This treatment process produces Class A biosolids and meets VWR requirements.

Design for GIWA:
The unused primary anaerobic digester will be modified to adding four insulated concrete dividing walls and 4 Turborator® aerators. A sludge spraying foam control mechanism will be employed.

**Low Cost, Low Technology:** Long Term Lagooning and Air Drying

How Long Term Lagooning and Air Drying Works:
Influent sewage sludge is pumped into a lagoon and sits for 1 to 3 years. Then, the solids are dewatered and placed on an air drying pad, where they can be formed into long piles, called windrows. The combination of lagooning and air drying kills weakened pathogens to achieve Class A standards.

Design for GIWA:
Influent sewage sludge from the primary anaerobic digester will be pumped into one of four lagoons and sit for two years. The lagoons will be lined with a high density polyethylene geomembrane in-between two six-inch clay layers. A draw-off well will decant excess water to achieve 8% solids. The solids will be dewatered using the belt press and dry outside, formed into windrows, and mechanically turned until 60-80% solids are achieved.

**Process Design Screening**

**PFRP Criteria:**
- Capital Costs
- Operation and Maintenance Costs
- Use of existing facilities
- Reliability of Treatment
- Life Expectancy
- Marketability

**Technological Criteria:**
- Time to implement

**Final Recommendation**

Based on the screening results, we recommend the ATAD design for GIWA.

**Final Design Cost Analysis**

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Dividing Walls</td>
<td>$23,845</td>
</tr>
<tr>
<td>Water-stop</td>
<td>$1,485</td>
</tr>
<tr>
<td>Anchoring Bolts</td>
<td>$167</td>
</tr>
<tr>
<td>Turborator® (4 with floats)</td>
<td>$500,000</td>
</tr>
<tr>
<td>Odor Control</td>
<td>$100,000</td>
</tr>
<tr>
<td>Foam Control</td>
<td>$55,000</td>
</tr>
<tr>
<td>Operation &amp; Maintenance Costs</td>
<td>$15,248/yr</td>
</tr>
<tr>
<td>Assumed Lifetime</td>
<td>20 yr</td>
</tr>
<tr>
<td>Lifetime O&amp;M costs</td>
<td>$25,220</td>
</tr>
<tr>
<td>Approximate Total Cost</td>
<td>$287,000</td>
</tr>
</tbody>
</table>

**Modifications to Primary Anaerobic Digester**

**Modified solids process train incorporating ATAD.**

**ATAD Key Components**

- Bar Screens
- Primary Clarifiers
- Digesters
- Turborator® Maintenance
- Foam Control
- Odor Control

**Acknowledgements:** The authors would like to thank Dr. Eric Seagren and Dr. Jennifer Becker of the Department of Civil and Environmental Engineering at Michigan Tech for their insight and patience during the course of this project.

**References:**
- PFRP: Autothermal Thermophilic Aerobic Digestion (ATAD). How ATAD Works: Influent sewage sludge is thickened and pumped into a cylindrical tank reactor. Thermophilic (40 to 70°C) microbial digestion produces heat and promotes biodegradation of organic material as the sewage sludge is mixed. This treatment process produces Class A biosolids and meets VWR requirements. Design for GIWA: The unused primary anaerobic digester will be modified to adding four insulated concrete dividing walls and 4 Turborator® aerators. A sludge spraying foam control mechanism will be employed.
ATAD Design

Design for GIWA
- Placed in location of Anaerobic Digesters
- High Temperatures
- Retrofit Concrete Walls
- Feed Cycle
  HRT: 6 days
  Two Stages
  Batch-fed
- Mixing/Aeration:
  4 MGD Turborators®
- Foam and Odor Control
ATAD Design

Design for GIWA
- Placed in location of Anaerobic Digesters
- High Temperatures
- Retrofit Concrete Walls
- Feed Cycle
  HRT: 6 days
  Two Stages
  Batch-fed
- Mixing/Aeration: 4 MGD Turborators®
- Foam and Odor Control
Many Influential Documents:
This WERF Report is a good one

Example LCLT Programs

- Downer Grove, IL
- Lakeland Sanitary District No. 1
- MWRA of Greater Chicago
- Pinery
- Wenatchee, WA
- Others
Anaerobic Digestion 3-5% TS

Centrifugation 20-30% TS

Lagoon Dewatering 15% TS

Air Drying 60% TS

Final Class A Biosolids

Final Class A Biosolids

Lagoon Aging

Air Drying 60% TS

Metropolitan Sanitary District of Greater Chicago
PINERY WASTEWATER PLANT PRODUCES CLASS A COMPOST FOR COMMERCIAL APPLICATIONS

Unique (But Simple) Procedure Produces High-Quality Compost

Using a very simple, very economical procedure of their own design, Pinery Water/Wastewater District, Parker, Colorado, is producing sludge compost which ever since its introduction in 1996 has continued to be in full compliance with all State and Federal regulations—including the new EPA 533 standards.

Thanks to the turning and aeration provided by the District’s Brown Bear sugar tractor, liquid sludge changes through natural drying and natural decomposition from a pressed cake averaging 12 to 15% by dry weight to a rich black soil additive averaging 70 to 80% by dry weight.

No bulking agent is added at any stage.
Update on the District’s Biosolids Management Program

Albert Cox: Soil Scientist
Dan Collins: Biosolids Manager
Biosolids Mechanically Agitated (Paddle Aerator) During Air-Drying On Paved Drying Cells
Biosolids Spread as Fertilizer Topdressing
Blue Island Park District, 2008
Controlled Solids Marketing & PR
Field Day – June 2008
Recent Accomplishments
Farmland Application Program

Oak Forest High School football field just after biosolids applied, May 2008

Oak Forest High School football field – Greener in July 2008

Stan’s Park, Blue Island - Just before biosolids applied, August 2008

Stan’s Park, Blue Island after biosolids topdressing – Greener in September 2008
The Road to National PRFP Equivalency is filled with Potholes

Long Term Storage:
Time, digestion, thermal effects, suppression by non-pathogenic bacteria, competition for food and chemical actions individually or in concert all have a positive effect on the reduction of pathogens.
Allison,

As we discussed, I ran the project proposal by the Pathogen Equivalency Committee (PEC) managers noting that it aims to quantify the impacts of environmental factors and biosolids properties on pathogen and indicator organism inactivation for low-cost, low tech methods of producing Class A biosolids (i.e., lagoon storage, air drying, and cake storage) and indicated that to me it looked like an ideal opportunity to come up with a way to include documenting the performance of such passive methods in a manner that could help lead to having them listed as approved PFRP methods if it is done in coordination with the PEC …
Understanding Class A and Pathogen Equivalency

Mark C. Meckes
U.S. EPA
Office of Research and Development
Senior Research Microbiologist
Chair: Pathogen Equivalency Committee

Northwest Biosolids Management Association
Annual Conference
Chelan, WA
September 19-21, 2010
Website Resources

The Equivalency Recommendation Process

Initiation Phase:
- Contact Permitting Authority
- Contact PEC

QAPP Phase:
- Prepare QAPP
- PEC Review (checklist)
- Implement QAPP (i.e., perform sampling & analysis)
- Fix Deficiencies

Application Phase:
- Prepare Application
- PEC Review (checklist)
- Prepare O&M Manual
- Fix Deficiencies

Notification Phase:
- PEC Issues Recommendation to OST
- OST Review
- OST Forwards Recommendation to Permitting Authority
- Fix Deficiencies

Legend:
OST: Office of Science and Technology
O&M: Operation and Maintenance
PEC: Pathogen Equivalency Committee
PA: Permitting Authority
QAPP: Quality Assurance Project Plan

How to Apply page

www.epa.gov/nrmrl/pec
Website Resources

How to Apply page

Pathogen Reduction Equivalency Application Package for Biosolids Treatment Processes

INSTRUCTIONS

Help With This Form

U.S. Pathogen Equivalency Committee Website
You can access the PEC website 7 days a week, 24 hours a day at
http://www.epa.gov/nrmrl/pec

Many basic questions can be answered and guidance documents to assist in the successful completion of an equivalency application can be accessed by visiting the U.S. Pathogen Equivalency’s website. This should be your first source of information for help in completing this form.

Contacting the U.S. Pathogen Equivalency Committee
You can communicate with the PEC at your convenience through the PEC’s e-mail address:
pec@epa.gov

If you are unable to find the information you are seeking, the U.S. Pathogen Equivalency Committee can be contacted by e-mail. If preferred, you may request to speak to a committee member by telephone. Simply indicate your preference in your e-mail and be sure to leave your phone number, days and time of availability and a brief description of your problem or question. A committee member would be happy to return your e-mail or set up a telephone call in a timely manner.

- Application Guidelines
- New Equivalency Application Package Form
  - Ready-made fill-in form
  - summary information & attachment list
  - Detailed line-by-line instructions
- Application Guidelines
- New Equivalency Application Package Form
  - Ready-made fill-in form
  - summary information & attachment list
  - Detailed line-by-line instructions
Alternative 6 ~ Equivalent processes

- Created in 1985 to provide technical expertise to permitting authorities on PFRP/PSRP Equivalencies
- 11 members with direct or related expertise and diverse points of view

- **Pathogen Equivalency Committee**
  - **U.S. EPA**
    - **Office of Research & Development**
      - National Exposure Research Laboratory
    - National Homeland Security Research Center
    - National Risk Management Research Laboratory (chair)
  - **Office of Water**
  - **Regional Offices**
    - Region VIII
  - **Center for Disease Control & Prevention (CDC)**
    - National Institute of Occupational Safety & Health
    - National Center for Environmental Health

- Microbiology
- Virology
- Parasitology
- Medicine
- Environmental engineering
- Wastewater treatment
- Industrial hygiene
- Federal regulations
PEC Decision Matrix

Are you seeking a site-specific or national equivalency?

Our Challenge:
Goals

1. Pilot demonstration

2. Obtain approval for Class A biosolids;
   1. Site-specific, or
   2. Nationally-declared equivalency.
3. Provide the fundamental mechanisms leading to pathogen kill and survival
LCLT Funding

- $635,652 SAW Grant
- $37,000 WERF
- $27,000 Lystek International Inc.
The $37,000 award from WERF, the research arm of the Water Environment Federation, supports one part of a three-part research project that hopes to demonstrate how low-tech, low-cost biosolids treatment processes can be used to achieve Class A quality. Ultimately, the goal is to equip small-town water treatment superintendents and regulatory personnel across the nation with a mathematical formula that predicts pathogen die-off in the process. 'We want to know how much time it takes to create Class A biosolids whose pathogens are virtually undetectable," Becker says.
MTU News Cont.

- **Sustainability**

- For the more than 80 percent of WRRFs in the US that serve a population of fewer than 10,000, according to the EPA's 2008 Clean Watersheds Needs Survey Report to Congress, cost-effectiveness, efficiency and sustainability are growing concerns. This is particularly the case in an era of decreasing budgets and severe drought such as in the American Nest. In these times, forward-thinking WRRF superintendents are asking: Is there a way to improve the water treatment process to meet these challenges?

- "That's the really cool part about this project: It's driven by really smart superintendents who know how their plants work," Becker says. "And they are constantly looking for ways to improve things."
Water Environment Federation Scope

The Water Environment Federation through its research foundation (WERF) will be involved in the innovative technology pilot demonstration for peer review over the 3 year project period. There scope is outlined in their budget which is included in Attachment 3, Item No. 2. Generally, WERF will provide an oversight of the pilot work plan, input during data acquisition, a review of pilot results, and a review of conclusions. WERF involvement will help bring national attention to the study and its resulting conclusions.

- Have sufficient funding to complete the project: As a disadvantaged community, GIWA will be applying for full funding under the SAW Grant Program in the amount of $635,632. Of this, they will be budgeting $25,000 towards a WERF peer review.
LIFT/WERF Engagement

Assemble a Panel of Experts from:
- Industry Professionals
- EPA and Regional and Local Government.
- Engineering Firms
- Scientific Community and Academics
LIFT/WERF Engagement (Cont.)

Services Provided:
• Peer Review
• Project Guidance

High Quality, Credible and Independent Assessment of:
• Research Assumptions
• Quality of Data
• Technical Conclusions
• Reports

Facilitate communication of research findings
Collaboration Opportunity: A New Paradigm for Class A Biosolids Production

Widespread adoption of sustainable biosolids treatment methods are currently held up by a lack of information on the impacts of environmental factors and biosolids properties on pathogen and indicator organism (PIO) inactivation in these systems. A new Targeted Collaborative Opportunity will explore the impact of these factors on PIO inactivation and developing mathematical models that can rationally predict PIO inactivation under a wide range of operating and environmental conditions for producing low-cost, low-tech, Class A biosolids. For more information, contact Allison Deines at adeines@werf.org.
Collaboration Opportunity: A New Paradigm for Class A Biosolids Production

Widespread adoption of sustainable biosolids treatment methods are currently held up by a lack of information on the impacts of environmental factors and biosolids properties on pathogen and indicator organism (PIO) inactivation in these systems. A new **Targeted Collaborative Opportunity** will explore the impact of these factors on PIO inactivation and developing mathematical models that can rationally **predict PIO inactivation** under a wide range of operating and environmental conditions for producing low-cost, low-tech, Class A biosolids.
High-tech analysis of low-tech methods for sustainable Class A biosolids production (WERF Project NTRY11T15)
Phase 1 - complete

- Provides a guide to design and construct a pilot-scale test bed
  - Methods are provided for monitoring pilot test environmental conditions (e.g. ambient temperature, solar radiation, precipitation), physical/chemical properties of biosolids over time (e.g. in situ temperature, TS, VS, pH, VFAs, NH3 content), and PIO densities (i.e. fecal coliforms, coliphage, enteric viruses, helminth ova)

- Starts the development of an experimental approach to provide data to verify adequate PIO reduction is achieved
COMPOST ANALYTICAL DATA SHEET

Product Description: Compost (100% Sample)  
Sample ID: B5085  
Sample Date: 5/23/2017

Test Results:
- Pathogens Zero
- Seed Germination 91% - 100%
- Seedling Vigor 94% - 100%
- Mature Very Stable
- Mg CO2-C/g 0.005

Definitions:
- Percent Emergence: the rate of emerged seedlings to the number of seeds planted
- Relative Seedling Vigor: indication of the health of seedlings by using seedling vigor, hypocotyl length (stunting), relative distention of cotyledons, and fresh weight of shoots

Reviewed By: Carmen Thiel  
Date Report Created: 7/13/17  
Date Report Sent/Email: 7/14/17

Principal Investigator: Janis MacK  
Date: 7/20/17  
Location: UW Oshkosh Center

Environmental Research and Innovation Center  
800 Algoma Blvd  
Oshkosh, WI 54904  
Tel: (920) 424-3148  
Fax: (920) 424-0832  
www.uwosh.org/arc

Client: Gogebic Iron Wastewater Authority
ATTN: Mark Bowman  
70000 Cloverland Drive  
Ironwood, MI 49938

Data Sampled: 5/23/2017  
Data Received: 5/24/2017
Batches of Biosolids produced by the GIWA using the LCLT methods are achieving the objectives of WERF’s High Quality Biosolids Project.

- Pathogens: Acceptable
- Mature: Very Stable
- Seed Germination: 91% - 100%
- Low Odors
- Seedling Vigor: 94% - 100%
We strive to look for innovative ways to deliver the (agriculture) program material, which include the latest technologies and best practices in the field of agriculture.
GOISD grows agriculture program
The Daily Globe

Ironwood - The Gogebic-Ontonagon Intermediate School District is bringing a bit of the great outdoors inside by building a new greenhouse near Luther L. Wright K-12 School.

The GOISD's Career Technical Education Department's new agriculture program will use the facility.

It is the first school year for the GOISD's ag program for Gogebic County students. The district began a similar program for Ontonagon County students last year in Ontonagon that included the building of a similar greenhouse.

CTE Director Shawn Klobis said the Gogebic County program began the school year with 11 students. There were 14 to start the year in Ontonagon.

bids for the Ironwood greenhouse came in a $136,000.

EVAN HUHTA, of Moyle Construction of Houghton, works on the Gogebic-Ontonagon Intermediate School District's future greenhouse north of Luther L. Wright K-12 School, near the football field, Monday afternoon. The facility will be used as part of the GOISD's Career Technical Education Department's agriculture program.
GIWA Plant and Gogebic Fairgrounds

Proposed Location of Public Demonstration
The Village of Midlothian

Applying compost for planting grass at a vacant lot in 2016.

A few weeks later...
Cinder Ridge Golf Course
Model of Public Distribution Program: Northwest Biosolids

### Table: Treatment Results

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CO₂</th>
<th>EC₅₀</th>
<th>pH</th>
<th>Respiration (mg CO₂.gOM⁻¹.day⁻¹)</th>
<th>Mean Petunia Biomass (g)</th>
<th>Percent participants finding odor offensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond fines</td>
<td>9.1</td>
<td>1.6</td>
<td>6.5</td>
<td>8.6</td>
<td>2.2</td>
<td>71</td>
</tr>
<tr>
<td>Walnut char</td>
<td>15.5</td>
<td>13.6</td>
<td>10.1</td>
<td>1.8</td>
<td>3.0</td>
<td>91</td>
</tr>
<tr>
<td>SF Biosolids</td>
<td>6.6</td>
<td>7.2</td>
<td>6.2</td>
<td>1.3</td>
<td>6.2</td>
<td>36</td>
</tr>
<tr>
<td>Gypsum board fines</td>
<td>12.8</td>
<td>2.3</td>
<td>7.3</td>
<td>3.1</td>
<td>8.6</td>
<td>10</td>
</tr>
<tr>
<td>Tagro Mix</td>
<td>10.9</td>
<td>0.9</td>
<td>6.6</td>
<td>4.3</td>
<td>10.0</td>
<td>42</td>
</tr>
<tr>
<td>Compost</td>
<td>16.3</td>
<td>2.2</td>
<td>7.2</td>
<td>0.5</td>
<td>11.7</td>
<td>9</td>
</tr>
<tr>
<td>Yard waste fines</td>
<td>11.0</td>
<td>3.4</td>
<td>5.8</td>
<td>1.9</td>
<td>19.5</td>
<td>27</td>
</tr>
<tr>
<td>Biochar</td>
<td>11.3</td>
<td>5.6</td>
<td>6.9</td>
<td>1.3</td>
<td>20.2</td>
<td>15</td>
</tr>
<tr>
<td>Tagro Potting Soil</td>
<td>17.5</td>
<td>1.9</td>
<td>4.9</td>
<td>2.3</td>
<td>24.2</td>
<td>Not included in odor survey</td>
</tr>
</tbody>
</table>

### Ingredients Table

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond fines</td>
<td>40% Almond fines, 40% biosolids, 20% sand</td>
</tr>
<tr>
<td>Biochar</td>
<td>25% Biochar, 50% biosolids, 25% yard waste fines</td>
</tr>
<tr>
<td>Compost</td>
<td>100% Cedar Grove Compost</td>
</tr>
<tr>
<td>SF Biosolids</td>
<td>100% San Francisco cake</td>
</tr>
<tr>
<td>Tagro Mix</td>
<td>100% Tagro Mix</td>
</tr>
<tr>
<td>Yard waste fines</td>
<td>50% Yard waste fines, 50% biosolids</td>
</tr>
<tr>
<td>Walnut char</td>
<td>25% Walnut shell charcoal, 50% biosolids, 25% Yard waste fines</td>
</tr>
<tr>
<td>Gypsum board fines</td>
<td>40% Gypsum board fines, 40% biosolids, 20% sand</td>
</tr>
<tr>
<td>Tagro Potting Soil</td>
<td>100% Tagro Potting Soil</td>
</tr>
</tbody>
</table>
A MICHIGAN PLANT TEAM SEeks TO 
VALIDATE A PRODUCTION PROCESS 
FOR CLASS A BIOSOLIDS 
PAGE 19

HEARTS AND MINDS: 
Plant tour program in Concord, New Hampshire 
PAGE 16

PLANTSCAPES: 
Public art in Ames, Iowa 
PAGE 44

EXAM STUDY GUIDE: 
Help with preparations for license exams 
PAGE 41

THE Right 
Recipe

A PLANT TEAM IN MICHIGAN'S UPPER PENINSULA LOOKS TO WIN CLASS A BIOSOLIDS DESIGNATION BY VALIDATING A PRODUCTION PROCESS WITH SCIENTIFIC PROOF

STORY: Ted J. Rulik 
PHOTOGRAPHY: Gary Deifenbach

THERE ARE SEVERAL WAYS TO PRODUCE CLASS A biosolids. Mark Bowman wants to prove to the Environmental Protection Agency that his preferred method is both cost-effective and scientifically reliable. Bowman is the plant manager at the Cogqui-Iron Waterway Treatment Facility in Ironwood, Michigan, faces challenges with the Class B material that now applies to biosolids. One is dealing with regulation requirements that require application at agronomic rates. Another is the climate—long winters and short growing seasons mean a small window for application. There's also a shortage of farms in the area, many with soils already high in phosphorus so there's potential for being added. And then, some farmers who could use the material would rather not take it. Bowman reasons that creating a value-added Class A product desired by producers would remove administrative and financial barriers and help attract new customers for biosolids. The method he has in mind is used at the Metropolitan Water Reclamation District of Greater Chicago. The problem: The Cogqui-Iron Waterway Authority can't afford the extensive and costly pathogens testing Chicago performs as part of the method to win specific Class A approval from the EPA. 

The solution: Work with university scientists to document that the process, if followed, will reliably achieve the pathogens kill and vector attraction reduction that the EPA requires for Class A material. "We're working through a grant to prove scientifically that if we follow these steps we will produce Class A material—so we don't have to test it as we follow the process," says Bowman, who has been with the district since 1982.

PRESSURE ON RATES

The Cogqui-Iron Waterway Authority was founded in the early 1980s to serve the city and township of Ironwood and the city of Hurley, just across the border in Wisconsin. The treatment plant was completed in 1986 at a

101
"We're working through a grant to prove scientifically that if we follow these steps, we will produce Class A material — so we don't have to test it as long as we follow the protocol."

MARK BARON

OLD BUT EFFECTIVE

"The Triangle-Iron Waterstone Authority treatment plant was modelled on original designs, handling average flows of 25 to 28 mgd and discharging into the Detroit River at some point. It has now been expanded and improved to handle the new flow rates."

Pursuing innovation

After thirty years of operation, Mark Baron notes that the Gogebic-Iron Waterstone Authority (GWA) has made strides in improving its facility. One visible improvement is the installation of new equipment, such as the new sludge handling system, which allows for more efficient operation of the plant. The new system has reduced the amount of sludge produced and has made the overall operation more cost-effective.

The GWA has also made efforts to reduce energy consumption, which has led to significant cost savings. The plant’s energy use has been reduced by over 50%, resulting in a decrease of over 100,000 kilowatt-hours per year. This has not only reduced the plant’s carbon footprint but has also made the operation more sustainable.

The GWA is also looking at new technologies to enhance the performance of the plant. One such technology is the use of advanced oxidation processes (AOPs) to remove contaminants from the wastewater. This technology has the potential to reduce the plant’s operational costs by up to 30%.

The GWA is also exploring the use of renewable energy sources, such as solar and wind power, to reduce its dependence on fossil fuels. This will not only reduce the plant’s carbon footprint but will also reduce its operating costs.

The GWA is committed to continuing its efforts to improve the efficiency and effectiveness of its operations. The plant’s management team is always looking for ways to improve the facility’s performance and reduce its environmental impact. With the use of new technologies and sustainable practices, the GWA is well on its way to becoming a model of efficiency and environmental responsibility.
The Gogebic-Iron Wastewater Treatment Facility, Unit Number 2, in Ironwood, Michigan, is one of the largest wastewater treatment facilities in the state, serving more than 40,000 people. The facility is designed to treat and discharge wastewater to the Chippewa River, which flows into Lake Superior. The facility has a capacity of 2.0 million gallons per day (MGD) and treats wastewater from residential, commercial, and industrial sources.

The treatment process at the Gogebic-Iron Wastewater Treatment Facility includes primary sedimentation, secondary treatment with an activated sludge process, and disinfection with ozone. The treated water is then discharged to the Chippewa River.

The Gogebic-Iron Wastewater Treatment Facility is operated by the Chippewa County Sanitary Authority (CCSA) and is funded through user charges and state and federal grants. The facility has been in operation since 1978 and has undergone several upgrades and expansions over the years to meet increasing demand and regulatory requirements.
Advancing Resource Recovery from Biosolids and Biosolids as a Resource

Christine H. Radke, PMP
Research Program Director
High Quality Biosolids From Wastewater
(WE&RF Project NTRYR15)

Lisa Boudeman
Material Matters, Inc.
Research to Encourage Use of HQB

- Define HBQ
- Expand use of HQB nationally
- Create new products
- Demonstrate efficacy of HQB products
- Use HQB in urban and suburban settings
- Market to customers
- Use of Social Media
Project Background

National Priorities are Shifting

Then

Wastewater Treatment Plants
- Wastewater treatment
- Inefficient
- Sewage disposal

Now

Water Resource Recovery Facilities
- Water reclamation
- Energy recovery
- Biosolids products
Project background

• National priorities shifting from treatment to resource recovery

• 40 CFR Part 503 Standards
  • What it **does** do:
    ✓ Protects public and human health
    ✓ Promotes distribution to areas with low public access
  • What it **does not** do:
    ✗ Define stability
    ✗ Define ability to store product
    ✗ Meet *customer* requirements
    ✗ Promote distribution in high public access areas
WRRF energy balance
BNR with AD-CHP


- 31% of influent chemical energy remains in dewatered biosolids
- 33% of influent chemical energy converted to digester gas
- Supplemental Carbon for BNR requires significant energy to produce (2.3 times energy in per COD energy out)
Renewable energy opportunity
High quality biosolids

- Define the standards and specifications needed for WRRFs to cost-effectively produce and more successfully market high quality, safe, and stable biosolids in areas across the country, with identified benefits for both the generator (WRRF) and the end user.

ONGOING:
- NTRY7R15 “High Quality Biosolids from Wastewater” (PI – Trudy Johnston, Material Matters)
Task 1 – Assessment of HQB derived products

- Utility partners will provide “customer ready” biosolids products to assess for quality characteristics
- Biosolids odor potential will be assessed using a human odor panel employing internationally accepted procedures
- Potential odor-related parameters to be evaluated include pH, TVS, VAR (SOUR, SRT, etc.); as well as proteins, and "new" respiratory techniques.
- Attractiveness to house flies will also be included in the assessment of biosolids
Interesting findings to date...

- Samples selected revealed a wide range of mean odor concentrations represented by range:
  - Low odor – 8%
  - Medium odor – 45%
  - High odor – 47%
- Lowest odor products were blended products
Descriptive Statistics: Important Product Characteristics

![Bar Chart showing Important Product Characteristics]

- **Nutrient Content**
- **Low Odor**
- **Consistent Moisture Content**
- **Specific Granule Size**
- **Low Dust**
- **Consistent Granule Size**
- **pH**
- **Specific Bulk Density**
- **Low Salt Content**
- **Seedability**

Legend:
- Yellow: Required by our customers
- Orange: Very important for our customers
- Light blue: Somewhat important for our customers
- Dark blue: Not at all important for our customers
### WE&RF Research Funding

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solicited Research</td>
<td>Specific RFPs; targeted areas</td>
</tr>
<tr>
<td>Unsolicited Research</td>
<td>Annual RFP; any area</td>
</tr>
<tr>
<td>Subscriber Priority</td>
<td>Annual RFP; any area; requires matching funds</td>
</tr>
<tr>
<td>Research Partnership</td>
<td>Board-advised fund for collaborations; rolling deadline</td>
</tr>
<tr>
<td>Tailored Collaborative</td>
<td>No dedicated budget; rolling deadline; WE&amp;RF provides fundraising support and management</td>
</tr>
</tbody>
</table>

See all opportunities: [http://www.werf.org/a/o/Funding.aspx](http://www.werf.org/a/o/Funding.aspx)
Technology Scans

Looking for innovative technologies that bring:

- Expert panel of consultants, operators, regulators, and academics provides feedback on these criteria
Introduction to the LIFT Program
What Is LIFT?

WEF/WE&RF initiative to accelerate innovation and help move new water technologies into practice.
National Test Bed Network: FAST Water

• Steering Committee

• Planning Partners

www.werf.org/fastwaternetwork
FAST Water Directory

70 Facilities

www.werf.org/testbeddirectory

- Level 1
- Level 2
- Level 3
- Level 4
University-Utility Partnerships

1. Develop Case Studies
2. Develop Guidance Manual
3. Develop Directory for University-Utility Partnerships
4. Develop Additional Program Activities and Elements
WERF is about to release this 68 page Guidance Document

Too bad I didn’t have this 20 years ago
Thank You