Resource Recovery & Electrical Energy (R2E2)

WWOA
Lake Michigan Region Meeting

May 23, 2019
Bruce Bartel
Jake Becken
Who or What is NEW Water?

- Brand of the Green Bay Metropolitan Sewerage District (GBMSD)
- Two treatment facilities serving NE Wisconsin 24/7/365
- Governed by five member Commission
Protecting our most valuable resource, water.
About NEW Water

- Wholesale provider of wastewater conveyance and treatment services
- 15 municipal customers (232,000 people) and two direct industrial customers
- Service area of 285 square miles
- Third largest wastewater treatment plant in Wisconsin
- Treats 38 million gallons of wastewater per day on average
30 million gallons per day
De Pere Facility
8 million gallons per day
De Pere Solids Handling

- Sent to the Green Bay Facility
- 7 mile force main
- Processed and disposed at the GBF
Solids Handling Upgrade

Three main drivers:
- Aging infrastructure
- Environmental regulations
- Increased capacity needs
R2E2

- Most cost-effective solution to replace solids handling at the Green Bay Facility
- Tools to treat wastewater as a resource
R2E2

• R2E2: Solids & Digestion Facilities
  • Includes:
    • Anaerobic Digestion
    • New Solids Building (Including Office Areas and Control Room)
    • Centrifuge Dewatering
    • Dryer
    • Biogas Storage
    • Electrical Energy Generation
    • Nutrient Recovery
    • Fluid Bed Incineration
    • State of the Art Air Pollution Control
    • Power Distribution
    • Aeration Basin Reconfiguration
R2E2

- Basin Modifications
  - Adapt to changes in nitrogen load post digester startup
  - Enhance bio P removal
  - Replace outdated air diffusers
  - Improve DO control
R2E2

• Dewatering
  • Three – 21” Centrisys Dewatering Centrifuges
  • One – 26” Centrisys Thickening Centrifuge

• Solids Drying
  • One – Haarslev Scalping Dryer
  • Thermal Oil for Heat Recovery
R2E2

• Fluid Bed Incineration
  • One – SUEZ (IDI)
  • 51 Dry Tons per Day
  • Heat Recovery

• State of the art air pollution control equipment to reduce air pollutants and meet new standards
Operational Challenges

• Finding the "Sweet Spot"
  – VS reduction to 60 to 65%
  – Optimize biogas production
  – Optimize electrical energy production
  – How far to dry solids
  – Autogenous incinerator operation

Energy Managers
Air Pollution Control Equipment

- Meets new, stricter limitations
- State-of-the-art equipment
R2E2

- R2E2 Components
  - Anaerobic Digestion (mesophilic) for biogas production and solids reduction
    - Two Silo Shaped Digesters
    - 110 Feet Tall
    - 2.2 MGD Capacity Each
    - High Strength Waste Receiving
R2E2

• R2E2: Solids & Digestion Facilities
  • Energy Recovery:
    • Biogas to run two – 2.0 MGW I.C. Engines
    • Heat from the I.C. engines to heat the anaerobic digesters
    • Heat recovery from the fluid bed incinerator to run dryer
    • Autogenous incinerator operation
    • Nutrient harvesting to produce fertilizer product
Energy Summary for 2035 - Annual Average Flows (Revised: May 12 2014)

Engine Generator 2 @ 1.95 MW
EH RU1, EH RU2

Digester Feed Sludge Feed to Incineration
20.2 kW
0 Mbtu/hr

Notes:
1 24/7 Operation
2 24/5 Operation
3 LHV basis
4 Full Load Output with 2 Engine Generator units operating
Nutrient Recovery

• Reduces phosphorus and nitrogen from solids processing recycle stream
• Reduces maintenance to manually remove struvite from equipment and piping
• Produces a beneficial re-use product

Picture above: Struvite (Magnesium Ammonium Phosphate) in pipes
Nutrient Recovery System

- Reduces struvite maintenance issues
- Beneficial reuse
- Generates revenue stream
Operational Challenges

- Finding the “Sweet Spot”
  - VS reduction to 60 to 65%
  - Optimize biogas production
  - Optimize electrical energy production
  - How far to dry solids
  - Autogenous incinerator operation
  - R2E2 Side Streams

- Energy Managers
Project Challenges

- Staff Training
- Process Tie In’s
- Project Schedule (Very Compressed)
- Potential for Scope Creep
- Staffing Challenges
R2E2 Benefits

• Addresses the original project drivers:
  • Aging infrastructure
  • Environmental regulations
  • Increased capacity needs
• Lowest cost plan over a 20-year planning period
• Generate about 50% of NEW Water’s energy needs
Energy Data

- **November 2018**
  - Electricity Used – 3,088 MWH
    - Purchased – 2,863 MWH (93%)
    - Generated – 225 MWH (7%)

- **March 2019**
  - Electricity Used – 3,452 MWH
    - Purchased – 2,151 MWH (62%)
    - Generated – 1,301 MWH (38%)

- **April 2019**
  - Electricity Used – 3,337 MWH
    - Purchased – 2,066 MWH (62%)
    - Generated – 1,272 MWH (38%)
Biogas Production

• **November 2018**
  - Biogas Generated – 108,924 CCF
    - Generators – 22,635 CCF (21%)
    - Flare – 86,289 CCF (79%)

• **March 2019**
  - Biogas Generated – 170,110 CCF
    - Generators – 169,817 CCF (99.8%)
    - Flare – 293 CCF (0.2%)

• **April 2019**
  - Biogas Generated – 185,616 CCF
    - Generators – 182,596 CCF (98.4%)
    - Flare – 3,020 CCF (1.6%)
Back to the Future: Resource Recovery & Electrical Energy (R2E2)

1935: GBMSD Plant

- Sludge Drying Beds
- Chlorinated Effluent
- I/C Engines/Gen
- Wastewater Wetwell
- Methane Storage
- Digesters
- Primary Clarifiers
- Laboratory
Thank You!

Questions / Comments?

Contact Information:
Bruce Bartel, Treatment Manager
bbartel@newwater.us
(920) 438-1006

Jake Becken, Treatment Leader
jbecken@newwater.us
(920) 438-1004

For more information please visit:
www.newwater.us

Stay connected with us:

Facebook
Twitter
YouTube
LinkedIn