Biosolids Land Application and Regulatory Compliance

Des Moines Metro WRF Land Application Program
Presentation Outline

• Plant Details
  • Pre-Treatment
  • Solids Processing and Handling
  • Solids Sampling
  • Solids Application
  • Post Application Reporting
Des Moines Metropolitan Wastewater Reclamation Facility
City of Des Moines Operating Agency
Average Flow – 57 MGD
Peak Flow - 200+ MGD
17 Separate Entities – 500,000 Residents
81,000 Wet Tons of Biosolids Produced
Aerobic Digestion
Belt Filter Presses Dewater solids to 18% Cake
• Plant Details
• Pre-Treatment
  • Solids Processing and Handling
  • Solids Sampling
  • Solids Application
  • Post Application Reporting
Pre-Treatment Industrial Monitoring

- 43 Business
- Food Processors
- Tire Manufacturing
- Agriculture Processors
- Equipment Manufacturing
- Metal Plating
- In addition, samples are taken at the influent and discharge of the plant to monitor pollutants and removal efficiency

**PRETREATMENT PROGRAM SUMMARY**
Calendar Year 2020

<table>
<thead>
<tr>
<th>Significant Industrial User Compliance</th>
<th>Categorical</th>
<th>Noncategorical</th>
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<tr>
<td>No. of SIU’s submitting BMR’s</td>
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<td>No. of SIU’s submitting 90-day compliance reports</td>
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<td>No. of SIU’s submitting periodic compliance reports</td>
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<td>No. of SIU’s on compliance schedules</td>
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<td>No. of SIU’s meeting compliance schedules</td>
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<td>No. of SIU’s in significant noncompliance</td>
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</table>
Hauled Waste Receiving

- 21,000 Loads Per Year
- 90 Individual Costumers
- High Strength Waste
- Feed straight to the Digesters
- Loads are Screened Before Loading and Sampled at the Plant
INDUSTRIAL HAULED WASTE PROFILE FORM

GENERATOR INFORMATION
Company Name: [Redacted]
Mailing Address: [Redacted]
City: [Redacted]  State: [Redacted]  Zip: [Redacted]
Waste Generation Address: [Redacted]
City: [Redacted]  State: [Redacted]  Zip: [Redacted]
Authorized Official representing Waste Generator:
Name: [Redacted]  Title: [Redacted]
Telephone: [Redacted]  email: [Redacted]

WASTE DESCRIPTION & PRODUCTION INFORMATION
Common Name of Waste: Waste 1: [Redacted]  Waste 2: [Redacted]
Are the wastes in a flowable state?  YES  NO
Is the process by which this waste is generated subject to Federal Categorical Pretreatment Standards?  YES  NO
If yes, please identify process:
SIC Code(s) of Processes Generating the Waste(s):

Waste Type:
- Industrial Process Waste—Organic
- Industrial Process Waste—Inorganic
- Food Production/Processing Waste
- Pet/Livestock Food or Manufacturing Waste
- Biofuels Production Waste

Other (please describe):
Anticipated Volume (gal): [Redacted]
One-Time Disposal or On-Going/Continuous?
- One-Time
- On-Going/Continuous

DESCRIPTORS & CERTIFICATIONS
Check all those which are likely to be present in your hauled waste stream(s).
- Acids and Alkalis
- Biological Wastes
- Chemicals
- Corrosive Substances
- Explosives
- Flammable Solvents
- Gasoline
- Halogenated Solvents
- Heavy Metal Shoots
- Hot Water (50°F)
- Hericides
- Ink
- Mercury
- Nonhazardous Solvents
- Nonhazardous Substances
- Oil, Grease, or Fat
- Paints and Varnishes
- Paper

I hereby certify the following: The wastes identified in this Hauled Waste Profile Form for consideration for disposal at the Des Moines Metropolitan WRF do not contain any pesticides or herbicides including Endrin, Methylichlor, 2,4-D Lindane, Tawophene, 2,4,5-T PIP (Silvex), Chlordane, or Heptachlor (and its Epichlor) does not contain PCBs and does not contain any material or a concentration which would render it hazardous as defined in 40 CFR 261.3.

Authorized Official’s Initials: [Redacted]

SIGNATURE OF AUTHORIZED OFFICIAL
I have personally examined and am familiar with the information submitted in this document and attachments. To the best of my knowledge, the submitted information is true, accurate, and complete. I acknowledge that any changes from the stated pollutants, general pollutant concentrations, volumes, or other measures require immediate notification to and approval from the Des Moines Metropolitan WRF, and waste acceptance by the WRF is strictly limited to the wastes identified in this Hauled Waste Profile Form.

Name: [Redacted]  Title: [Redacted]
• Plant Details
• Pre-Treatment
• **Solids Processing and Handling**
  • Solids Sampling
  • Solids Application
  • Post Application Reporting
Biosolids Processing and Handling

- 6 Anerobic Digesters – 5 Primary and One Secondary/Gas Holder
- Digester Feed – High Strength Waste, Primary and Waste Activated Sludge
- Solids are Dewatered on Belt Filter Presses to ~18% Solids
- Presses run 6 Days/24 hrs. per Week
Class B Land Application Requirements

- Vector Attraction Reduction
  - Volatile Solids Reduction – (>38%) 67%
  - Incorporation of Solids into Soils
    - Process to Significantly Reduce Pathogens
      - Time and Temperature
        - Typically 100 degrees for 30 days in our Anerobic Digesters
        - Fecal Coliform (2,000,000 mpn) 1310 mpn
Solids Storage

• After Dewatering the Solids are stored in a Covered Facility
• Solids are trucked though the plant to Storage
• Enough Storage for 30,000+ Wet Tons
Presentation Outline

- Plant Details
- Pre-Treatment
- Solids Processing and Handling
- **Solids Sampling**
- Solids Application
- Post Application Reporting
Solids Sampling

• Solids are tested after dewatering to insure they meet the standards for Land Application of Class B Biosolids
• The first analysis is for nutrients and pollutants
• The second analysis is the Fecal Coliform test
• We test for Fecal Re-Groth a minimum of 12 time a year due to the amount of solids produces
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>MRL</th>
<th>Batch</th>
<th>Method</th>
<th>Analyst</th>
<th>Analyzed</th>
<th>Qualifier</th>
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<td><strong>pH, Soils</strong></td>
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<td>&lt;6.3</td>
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</table>
Presentation Outline

• Plant Details
• Pre-Treatment
• Solids Processing and Handling
• Solids Sampling

• **Solids Application**
• Post Application Reporting
Site Selection

• Both land owner and farm operator need to give permission
• Application sites are selected on several criteria
  • Location
  • Soil suitability
  • Slopes

• NRCS Web Soil Survey is a useful tool
<table>
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<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
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</thead>
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<td>5B</td>
<td>Ackmore-Colo complex, 2 to 5 percent slopes</td>
<td>2.1</td>
<td>0.9%</td>
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<td>8B</td>
<td>Judson silty clay loam, 2 to 5 percent slopes</td>
<td>26.7</td>
<td>11.6%</td>
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<tr>
<td>63C</td>
<td>Chelsea loamy fine sand, 5 to 9 percent slopes</td>
<td>3.0</td>
<td>1.3%</td>
</tr>
<tr>
<td>63D</td>
<td>Chelsea loamy fine sand, 9 to 14 percent slopes</td>
<td>2.3</td>
<td>1.0%</td>
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<td>65E</td>
<td>Lindley loam, 14 to 18 percent slopes</td>
<td>0.5</td>
<td>0.2%</td>
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<td>120B</td>
<td>Tama silty clay loam, 2 to 5 percent slopes</td>
<td>26.6</td>
<td>11.5%</td>
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<tr>
<td>120C2</td>
<td>Tama silty clay loam, 5 to 9 percent slopes, eroded</td>
<td>43.5</td>
<td>18.0%</td>
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<td>120D2</td>
<td>Tama silty clay loam, 9 to 14 percent slopes, eroded</td>
<td>28.2</td>
<td>12.2%</td>
</tr>
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<td>133+</td>
<td>Colo silt loam, 0 to 2 percent slopes, occasionally flooded, overwash</td>
<td>63.4</td>
<td>27.5%</td>
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<td>175B</td>
<td>Dickinson fine sandy loam, 2 to 5 percent slopes</td>
<td>2.4</td>
<td>1.0%</td>
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<td>220</td>
<td>Nodaway silt loam, shallow loess, 0 to 2 percent slopes, occasionally flooded</td>
<td>4.4</td>
<td>1.9%</td>
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<td>620C2</td>
<td>Port Byron silt loam, 5 to 9 percent slopes, moderately eroded</td>
<td>6.8</td>
<td>2.9%</td>
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</table>
the map unit.

Description of Tama, Eroded

Setting

Landform: Interfluvies
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Fine-silty loess

Typical profile

Ap - 0 to 6 inches: silty clay loam
BA - 6 to 12 inches: silty clay loam
Bt1 - 12 to 20 inches: silty clay loam
Bt2 - 20 to 33 inches: silty clay loam
BC - 33 to 60 inches: silty clay loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat):
  Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No
The WRF Land Application Program

• The solids are applied to agricultural ground as fertilizer
• The solids are staged at the application site
• The application rate is determined by the agronomic needs of the particular crop
• All solids are applied the same day as they are hauled
Application Rate

• Lab analysis is used to determine the application rate
• Rates are based on the Nitrogen requirements for the crop
• We use the Iowa State University Recommendations
• The things that have to be considered are-
  • Crop rotation
  • Previous Application
  • Are the solids going to be incorporated – rates are lower if incorporated with in 48 hours as more Nitrogen is captured
  • Information is compiled to help with this planning
<table>
<thead>
<tr>
<th>Lab Results / PPM</th>
<th>NUTRIENT</th>
<th>ANALYSIS</th>
<th>LBS/DYR TON AVAIL</th>
<th>RATE</th>
<th>TOTAL PLANT AVAILABLE</th>
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<tr>
<td></td>
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<td></td>
<td>DRY NITROGEN (PAN) LBS/ACRE</td>
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<tr>
<td>TKN</td>
<td>56975</td>
<td>ORGANIC</td>
<td>97.9% 90%</td>
<td>16.6</td>
<td>9.8</td>
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<td>NH3</td>
<td>8038</td>
<td>AMMONIA</td>
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<td>Organic</td>
<td>48950</td>
<td>NITRATE</td>
<td>0.0% 100%</td>
<td>0.0 0.0</td>
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<tr>
<td>% Solids</td>
<td>17</td>
<td>If Incorporated in 48 Hrs.</td>
<td>TOTAL</td>
<td>35.7</td>
<td>9.8 4.9</td>
</tr>
<tr>
<td>P2O5</td>
<td>70575</td>
<td>P AS P2O5</td>
<td>141.2% 50%</td>
<td>70.6</td>
<td></td>
</tr>
<tr>
<td>K2O</td>
<td>4145</td>
<td>K AS K2O</td>
<td>6.3% 100%</td>
<td>6.3 8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Zinc</td>
<td>615</td>
<td>ZINC</td>
<td>1.2</td>
<td>VARIES</td>
<td>1.2</td>
</tr>
</tbody>
</table>

To convert Dry Tons/Acre to Wet Tons/Acre – Devide Dry Ton Amount by %Solids (as a decimal)

Example: \( \frac{6 \text{ (DT)}}{0.17 \text{ (17%)}} = 35.29 \text{ Wet Tons/Acre} \)

To Calculate Wet Tons/Acre – Target Nitrogen Rate (Divided by) Lbs. Nitrogen per DT (Divided by) Percent Solids (as Decimal)

Example: Bean to Corn 140 Lbs. Nitrogen  \( \frac{140 \text{ (Lbs. N Desired)}}{23.7 \text{ (Lbs. N per DT - if not Inc.)}} / 0.19 \text{ (19% Solids)}} = 31 \text{ (Wet Tons per Acre)} \)

<table>
<thead>
<tr>
<th>To Find Tons Needed Per Pass</th>
<th>Length x Width + 43560 x Rate Tons/Pass ÷ 2</th>
<th>Tons/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>1200 x 25 + 43560 x 33 22.72727273 ÷ 2 11.36363636</td>
<td></td>
</tr>
</tbody>
</table>

This is the number of Spreaders Working in the field - Could be 1, 2, or 3

To Find Width of a Pass

Example: 13 x 2 26 ÷ 1200 x 43560 ÷ 33 x 28.6 Width
PRE-APPLICATION
SITE INFORMATION

Land Owner: 

Farm Operator: Kevin Van Winkle Ph# 515 971-0552

Site/Legal Description: T77N R21W Sec 35, NW ¼ SW ½
Jasper, Des Moines, 35
41.5168, -93.2532

Work Order #: 

Field Name: W 109th St S .5 Mi. S. of F70 Eastside

Acres: 28

Previous Applications: N/A

Target Rate: 23

Crop Rotation: Bean to Corn

Soil PH/Test date: N/A

Setbacks (wells, waterways, tiles, occupied residences etc.):

Lots of D slopes
Nutrient Value

• The solids are analyzed for nutrient value
• They are tested for the three macro nutrients needed by the crops
  • Nitrogen (N)
  • Phosphorous (P)
  • Potassium (K)
• Micro Nutrients used by the crops are also detected in the testing
  • Zinc (Z)
  • Molybdenum (Mo)
  • Copper (Cu)
Application Timing

• The WRF Land Application Program has operated in every month of the year

• Each season has it’s own challenges

• Winter
  • Frozen ground has special regulations
  • Equipment problems in cold weather
  • Transportation during winter weather
  • Fewer hours of daylight
  • Benefit is low ground compaction
Application Timing

• Fall
  • Longest application season
  • Starts in late August
  • Continues until ground freezes
  • Normally a dryer time of year
  • Higher application rates on Corn Crop ground
  • Fair amount of daylight
The WRF Land Application Program

• The Solids are loaded out of storage with Rubber Tired Front-end Loader

• They are transported to the application site in trucks with end dump boxes

• We use both Semi Tractor-Trailers and Straight Trucks
Getting it Right

• GPS Mapping and Guidance
• Easy to get proper width every pass
• Can use on straight passes and contours
• A high level of precision is possible with GPS guidance
• Map help us accurately report application area
• Maps are given to the farmers and regulators
Verifying the Rate

- Loader is equipped with scale
- Load Spreader box to consistent level
- Check scale for appropriate amount
- GPS tracks acres covered
- Could vary if passes get longer or shorter
- Material changes can affect consistency
- Spreader operation is manually controlled
- We normally maintain >95% accuracy
- Our rates have a 6-9% buffer
Improving Technology

• New unit will have scales on the applicator
• Allows for real time application rate monitor
• Interface with GPS mapping for rate specific maps
• Could do variable rate application
• Rate controllers are still not in the plan
Satellite Maps
Presentation Outline

• Plant Details
• Pre-Treatment
• Solids Processing and Handling
• Solids Sampling
• Solids Application

• Post Application Reporting
<table>
<thead>
<tr>
<th>Field Location</th>
<th>F70 E of Runnels - Machine Shed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Description</td>
<td>Jasper, Des Moines, Section 31</td>
</tr>
<tr>
<td>Township &amp; Range</td>
<td>Lat: 41°31'20.216, Long: 93°19'27.743</td>
</tr>
<tr>
<td>Application Start Date</td>
<td>9/6/2016</td>
</tr>
<tr>
<td>Application End Date</td>
<td>9/12/2016</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Total Acres Applied</th>
<th>35.7</th>
</tr>
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<tbody>
<tr>
<td>Nutrients Lbs/Acre</td>
<td>N</td>
</tr>
<tr>
<td>P2O5</td>
<td>1211</td>
</tr>
<tr>
<td>K2O</td>
<td>353</td>
</tr>
<tr>
<td>Application C/Year</td>
<td>2017</td>
</tr>
<tr>
<td>Careover</td>
<td>56</td>
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</table>

<table>
<thead>
<tr>
<th>Wet Tons Applied</th>
<th>1211</th>
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</thead>
<tbody>
<tr>
<td>Tons/Acre - Wet</td>
<td>33.9</td>
</tr>
<tr>
<td>Tons/Acre - Dry</td>
<td>6.4</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Future N Availability</th>
<th>2018</th>
<th>37</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>2019</td>
<td>19</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Metals (mg/kg)</th>
<th>ppm</th>
<th>Lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Applied</td>
<td>Limits</td>
</tr>
<tr>
<td>As</td>
<td>12.0</td>
<td>75</td>
</tr>
<tr>
<td>Cd</td>
<td>3.7</td>
<td>85</td>
</tr>
<tr>
<td>Cr</td>
<td>43.6</td>
<td>3000</td>
</tr>
<tr>
<td>Cu</td>
<td>302.1</td>
<td>4300</td>
</tr>
<tr>
<td>Hg</td>
<td>0.6</td>
<td>57</td>
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<tr>
<td>Mo</td>
<td>15.7</td>
<td>75</td>
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<tr>
<td>Ni</td>
<td>27.9</td>
<td>420</td>
</tr>
<tr>
<td>Pb</td>
<td>26.5</td>
<td>840</td>
</tr>
<tr>
<td>Se</td>
<td>22.0</td>
<td>100</td>
</tr>
<tr>
<td>Zn</td>
<td>659.9</td>
<td>7500</td>
</tr>
</tbody>
</table>

| Fecal Coliform (MPN/dry gram) | | |
|-------------------------------|--|
| Applied | Limits |
| 19716 | 2,000,000 |
The Iowa DNR tracks Biosolids application sites

The blue dots are DMMWRA sites

In 2020 we applied to 53 individual fields, for 19 different farmers, in 4 counties
Reports

- Reports are given to farmers
- Farmers are also given GPS map data
- We reference reports before future applications
- Nutrients carry over for up to 2 years
- Carry over credit must be accounted for in rate calculation
- Data from reports are compiled for DNR and EPA reports
Questions?

Brad Tingley
Plant Field Worker
Des Moines Metropolitan Wastewater Reclamation Facility
bwtingley@dmgov.org
FACULTATIVE SLUDGE LAGOON AND DEDICATED LAND DISPOSAL OPERATIONS

Presentation to the EPA - May 27, 2021
DUBLIN SAN RAMON SERVICES DISTRICT
Founded in 1953, DSRSD serves more than 188,000 people

121 Full-Time Employees

WATER DISTRIBUTION SYSTEM
- City of Dublin ~ 9 MGD
- Serving ~ 89,000

WASTEWATER TREATMENT
- Designed capacity 17.0 MGD
- ADWF 10.6 MGD
- Serving ~ 163,400
- 23 acre main wastewater plant
- 27 acres facultative sludge lagoons
- 55 acres dedicated land disposal unit

SAN RAMON VALLEY RECYCLED WATER PROGRAM
- CBWSF 16.2 MGD
- Microfiltration 2.5 MGD
- ~ 633 irrigation customers
- Annually recycle ~ 40% of wastewater effluent (landscape irrigation)
REGIONAL WASTEWATER TREATMENT FACILITY

1. COLLECTION SYSTEM
   - Bar screen
   - Grit removal
   - Grit
   - Compactor and Dewatering
   - Grit Washer and Dewatering
   - Odor Reduction

2. PRETREATMENT
   - Bar screen
   - Grit

3. PRIMARY TREATMENT
   - Sedimentation
   - Primary Sludge

4. SECONDARY TREATMENT
   - Microbial Aeration
   - Clarifier

5. DISINFECTION
   - Hypochlorite
   - Chlorine contact tank

6. S.F. BAY
   - LAVWMA
   - EAST BAY DISCHARGERS AUTHORITY
   - Dechlorinated before it enters the Bay

7. TERTIARY TREATMENT for RECYCLED WATER
   - Ballasted flocculation system
   - Sand filtration OR Microfiltration
   - UV disinfection

8. REUSE & LANDSCAPE IRRIGATION
   - Storage

9. SOLIDS HANDLING
   - Landfill
   - Dedicated Land Disposal Site

10. LIQUIDS HANDLING
    - Digester
    - Facultative Sludge Lagoon
    - Sludge Thickener
1. Biosolids Treatment
2. Conveyance of runoff by surface grading
3. Containment of surface water accumulation
4. Placement of biosolids
5. Removal of surface water by treatment prior to discharge under an NPDES permit
6. Diversion of surface water runoff from surrounding areas
7. Facility liner
8. Groundwater monitoring
9. Annual compliance reporting
10. Cover crop
11. Future challenges and concerns
BIOSOLIDS TREATMENT

Facultative Lagoons

Dedicated Land Disposal Area

STONERIDGE DRIVE

Digesters

Thickener
DEDICATED LAND DISPOSAL UNIT (DLD)
55 acres

SIX FACULTATIVE SLUDGE LAGOONS (FSL),
EACH ~ 4 ACRES SURFACE
Each ~15 ft deep
ANAEROBIC DIGESTERS

• Adequate digestion is important in order to maintain effective treatment and minimize odors.
• Regulations require a minimum of 15 days of treatment (34 days at DSRSD)
• 503 requires minimum 38% volatile reduction, DSRSD achieves 55 to 65%

• Adequate treatment capacity
  — Proper size and number of digesters
  — Regular cleaning is important in order to maintain designed treatment capacity (every 5 to 7 years)
  — Effective sludge digestion results in less volatile load on facultative lagoons and dedicated land treatment unit.
VOLATILE REDUCTION

ANAEROBIC DIGESTERS –
55% to 65% (20* to 34 Days)
*with largest Digester out of service

FACULTATIVE SLUDGE LAGOONS
32 to 36 % (3 to 5 years)

Dedicated Land Disposal Area
POLLING QUESTION 1

If your facility has lagoons as part of your biosolids treatment processes are they:

1. Aerobic
2. Anaerobic
3. Facultative
DSRSD FACULTATIVE SLUDGE LAGOONS

- 15 feet deep, average four acre surface area
- Sludge lays on the bottom and continues to undergo anaerobic bacteria decomposition for two to five years
- Water on the surface where algae and aerobic bacteria neutralizes odors from the anaerobic layer
In-service lagoons are continually fed from the sludge digesters
If odor control is a major concern for your biosolids management process what method(s) do you use to minimize odors and determine how effective you are at odor control?

1. Metrics of odor complaints from utility phone or website.
2. Regular air monitoring of odors constituents at places surrounding your facility such as at the property line.
3. Reodorant sprays into the air at your facility
4. Air odor scrubbing equipment
5. Two or more of the above
ODOR CONTROL

- Volatile loading rate (for odor control)
  - 20 lbs. volatile solids/1000 ft² surface area industry guideline
  - 15 lbs. volatile solids/1000 ft² surface area DSRSD guideline
  - Currently 11 lbs. volatile solids/1000 ft² surface area DSRSD

- Algae generates oxygen for aerobic microbes during the day
- Mechanical surface aeration at night
- Target a minimum 4 ft cap water (aerobic zone)
- Odor control
- March 2000 “Stockyard Smell” – Up to 87 odor calls/day
- Last 18 years averaged four to eight odor calls/year
FACULTATIVE SLUDGE LAGOONS - ODOR CONTROL

• Weekly cap water measurements
  – Ph (6 – 9)
  – Dissolved Oxygen (> 0.8 mg/l)
  – Conductivity (2700 – 4000) μS/cm
  – Color (Some shade of green)

• Lagoon aerators
  – Along with wind action discourages scum formation
  – Along with photosynthesis and wind action adds dissolved oxygen
BIOSOLIDS AT DSRSD

• In the spring and fall operators measure lagoon blanket
• Fall measurement targets FSL to be harvested in summer
• Stop feeding targeted FSL for 4 to 6 months
• For at least 15 years all bio-solids met Class “A” standards – Class “B” in what is required by regulations
BIO-SOLIDS HARVESTING

SEPT  FSL Depth Measurements
MARCH  FSL Depths, 503 and class “A” sampling
MAY    DISC FIELD, prepare dredge, hire temp staff
JUNE 1  Start sludge harvesting

Place biosolids in the summer to provide greatest potential net evaporation and to minimize potential infiltration

SEPT 30  Complete sludge harvesting
OCT     PLANT COVER CROP (if desired)
• DSRSD’s solids operations produce Class A biosolids containing undetectable or extremely levels of pathogens prior to land application.

• Class A is not required for land application

• Drying, sunlight, and other natural processes cause pathogens to die rapidly when applied to soils.
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Operator Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredge</td>
<td>Yes</td>
</tr>
<tr>
<td>Booster Pump</td>
<td>Yes</td>
</tr>
<tr>
<td>Fueling Vehicle</td>
<td>Yes</td>
</tr>
<tr>
<td>Discing Tractor</td>
<td>Yes</td>
</tr>
<tr>
<td>Injecting Tractor</td>
<td>Yes</td>
</tr>
<tr>
<td>Hose Reel Tractor</td>
<td>Yes</td>
</tr>
</tbody>
</table>
DREDGE OPERATIONS

- Daily operations sheet
- Daily sampling
- Density meter
- Flow meter
- The dredge operator, operates a boom, auger, and pump located on the dredge.
- Sludge is pumped from the dredge to an on-shore booster pump which conveys sludge to DLD hydrants
- Flow GPM: 300 - 375
- Sludge Density: 3% (+ or – 0.5 %)
DEDICATED LAND DISPOSAL AREA PREPARATION

- Start disking as soon as field dries out (spring)
- Disking breaks down large chunks of compacted soil and promotes moisture evaporation
DLD OPERATION

• DLD is divided into 14 quadrants for sludge injection

• Eight sludge hydrants each serving one or two injection quadrants

• Quadrants are injected in series. Then...
  - Two weeks of natural evaporation
  - Disk to promote additional evaporation

• Typically, injection covers the field twice during harvesting season
DLD OPERATION
SLUDGE INJECTION TRACTOR

- Tractor injector is lowered into the soil about 8” to 12”
- Injector tractor is set to a speed of 0.07mph. This allows for maximum dispersion of biosolids into the soil.
- Very dependent on soil type. DSRSD has clay soils. Sandy, silt, or loam will have greater evaporation and moisture depth penetration.
- On a normal season two complete injections passes are made across the DLD.
- Annually ~ 37,000 cubic yards are injected
- Each year biosolids harvesting requires ~ 80 - 10-hour workdays to complete
## CURRENT STATUS: 2020 SEASON

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting FSL #</td>
<td>3</td>
</tr>
<tr>
<td>Total sludge (including seed)</td>
<td>54,475</td>
</tr>
<tr>
<td>Total cubic yards to harvest</td>
<td>40,856</td>
</tr>
<tr>
<td>Cubic yards harvested to date</td>
<td>37,846</td>
</tr>
<tr>
<td>Total US dry tons to harvest</td>
<td>1,087.29</td>
</tr>
<tr>
<td>US dry tons harvested to date</td>
<td>1,007</td>
</tr>
<tr>
<td>US dry tons remaining to harvest</td>
<td>80.11</td>
</tr>
<tr>
<td>Total gallons of water applied to the DLD</td>
<td>9,343,324</td>
</tr>
<tr>
<td>Percent complete</td>
<td>93%</td>
</tr>
<tr>
<td>Days of harvesting completed to date</td>
<td>78</td>
</tr>
<tr>
<td>Average dry LBS harvested per day</td>
<td>26,821</td>
</tr>
<tr>
<td>Average US dry tons harvested per day</td>
<td>13.99</td>
</tr>
<tr>
<td>Average sludge density harvested to date</td>
<td>2.60%</td>
</tr>
<tr>
<td>Average gallons per day applied to the field</td>
<td>126,856</td>
</tr>
<tr>
<td>Estimated days remaining to finish harvesting</td>
<td>0</td>
</tr>
</tbody>
</table>
BIOSOLIDS HARVESTING AND LAND APPLICATION

1. Placement of biosolids
2. **Conveyance of runoff by surface grading**
3. Containment of surface water accumulation
4. Removal of surface water by treatment prior to discharge under an NPDES permit
5. Diversion of surface water runoff from surrounding areas
6. Facility liner
7. Groundwater monitoring
8. Annual compliance reporting
9. Cover crop
10. Future challenges and concerns
DIRECTED CONVEYANCE OF RUNOFF BY SURFACE GRADING
POLLING QUESTION 3

How often is your land treatment unit graded to improve site drainage?

1. Annually (or more often than annually)
2. Every 2 years
3. Every 5 years
4. Every 10 years
5. Not an issue
BIOSOLIDS HARVESTING AND LAND APPLICATION

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10. Future challenges and concerns
GRADING OF DEDICATED LAND DISPOSAL AREA
CONTAINMENT OF SURFACE WATER ACCUMULATION DURING THE WINTER WITHIN PERIPHERAL BERMS
BIOSOLIDS HARVESTING AND LAND APPLICATION

1. Placement of biosolids
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10. Future challenges and concerns
Precipitation that falls on the DLD is drained back into the WWTP for full treatment.
INSPECTION OF DLD FACILITY BERMS

• Inspect for:
  – Water leaving or entering the site
  – Erosion or animal burrowing of containment levees
  – Evidence of ground movement
  – Road access and stability
  – Sludge or biosolids on the surface
  – Condition of DLD surface water drainage
  – Foul odors
  – Observe water foul and other animals

• Photo of facility and berms are taken annually
• Inspection forms and facility photos are part on annual biosolids report
BIOSOLIDS HARVESTING AND LAND APPLICATION

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LINER
ANCIENT LAKEBED WITH CLAY SOILS

• DSRSD has native underlying soils with low permeability, ranging from $1 \times 10^{-7}$ to $1 \times 10^{-8}$ cm/sec (hydrogeologic study for Dublin San Ramon Services District Facultative Sludge Lagoon and Dedicated Land Disposal Area. Better than engineered liners.

• Sites with sandy, silt or loam soils may require an engineered liner to protect groundwater.
BIOSOLIDS HARVESTING AND LAND APPLICATION

1. Placement of biosolids
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ANNUAL BIOSOLIDS REPORT

• Ground water sampling and analysis is contracted out to hydrogeologists.

• Hydrogeologist look for trends of constituents of concern in the groundwater that might indicate that facility operation is negatively impacting groundwater.

• Groundwater monitoring data, routine facility observations and maintenance work carried out by DSRSD staff are included in the annual report.

• Hydrogeologist’s report on ground water sampling analysis is reviewed by District Staff (Operations, Laboratory and Engineering).
• DSRSD maintains a network of 14 dedicated monitoring wells at the site
• The site is underlain by an aquiclude composed of silts and clays to a depth of approximately 42 feet (Upper Aquiclude)
• Underlying the Upper Aquiclude is a shallow aquifer, approximately 25 to 30 feet thick (Upper Aquifer)
• The monitoring well network targets these two distinct water bearing zones
GROUNDWATER MONITORING

SEMI-ANNUAL SAMPLING SCHEDULE

• Depth-to-groundwater measurements are obtained semiannually from the network of wells

• Groundwater quality samples are also collected semiannually from each monitoring well and analyzed for general water quality parameters and dissolved metals per the Order General. Water quality parameters consist of field parameters (temperature, specific conductance, pH, and turbidity) and laboratory analyses (total dissolved solids (TDS), chloride, nitrate as nitrogen, unionized ammonia, and total ammonia)

• The semi-annual dissolved metals suite comprises arsenic, barium, cadmium, copper, chromium, lead, mercury, nickel, vanadium, and zinc

• In addition to the required parameters listed above, dissolved oxygen, color, color intensity, odor, and odor intensity, have also been monitored and documented during purging activities

5-YEAR SAMPLING SCHEDULE

• The 5-year sampling schedule comprises of seven additional metals (antimony, beryllium, cobalt, selenium, silver, thallium, and tin), pesticides and PCBs, and chlorophenoxy herbicides
BIOSOLIDS HARVESTING AND LAND APPLICATION

1. Placement of biosolids
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COVER CROP IMPROVES DLD SITE AESTHETICS
COVER CROP

• Conducted a pilot test on cover crops
• Submitted data to EPA and received approval to use as cattle feed
• Demonstrated no phytotoxicity in plant tissue (brown mustard and winter oats)
• Soil ph (7.0 – 8.5)
• All pollutants below the limit levels noted in 503 regulations
• Biosolids applied to DLD meet “class A” – This is not a requirement
• Tissue samples collected and analyzed in each year cover crop is grown and results are submitted as part of Annual Biosolids report.
BIOSOLIDS HARVESTING AND LAND APPLICATION

1. Placement of biosolids
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10. Future challenges and concerns
Land application is the low-cost alternative.

Odors and aesthetics are a constant concern.

Annually ~ 2000 dry metric tons of biosolids are pumped from the WWTP to the FSLs.

Annually ~ 1000 dry metric tons of biosolids are harvested from the FSLs and injected into the DLD (3% Solids).

Future – Increase land applied solids from 3% to ~ 5 to 6%.

Eventually will have to off haul biosolids (if allowed) at increased cost. New Technology?

Landfill space in California is shrinking and getting more expensive.
QUESTIONS?

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Diane Griffin
Regulatory Compliance Manager
(925) 875-2324
griffin@dsrsd.com
Resource Recovery & Electrical Energy (R2E2)

EPA Webinar
Biosolids Disposal Methods
Incineration

May 27, 2021
Bruce Bartel
Outline

• NEW Water
• R2E2 Processes
• Incineration
• Anaerobic Digestion
• Energy Recovery
• Questions
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
33 million gallons per day
De Pere Facility
8 mgd
Outline

• NEW Water
• R2E2 Processes
• Incineration
• Anaerobic Digestion
• Energy Recovery
• Questions
R2E2

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

Three main drivers:

• Aging infrastructure
• Environmental regulations
• Increased capacity needs
R2E2

• R2E2: Solids & Digestion Facilities
  • Includes:
    • Anaerobic Digestion
    • New Solids Building
    • Centrifuge Dewatering
    • Dryer
    • Biogas Storage
    • Electrical Energy Generation
    • Nutrient Recovery
    • Fluid Bed Incineration
    • State of the Art Air Pollution Control
Poll Question 1
Outline

- NEW Water
- R2E2 Processes
- Incineration
- Anaerobic Digestion
- Energy Recovery
- Questions
Fluidized Bed Incinerator Overview

• High Temperature Fluid Bed System (HTFB)

• 51 DTPD Capacity

• Heat Recovery

• State of the art air pollution control equipment to reduce air pollutants and meet new standards
FBI System Overview

Condenser → Scalping Dryer → Cake Pump → Cold Windbox FBI → Thermal Oil Pump → Fluidizing Air Blower → Thermal Oil Economizer → Thermal Oil

Wet Electrostatic Precipitator → Multi-Venturi Wet Scrubber

Secondary Heat Exchanger → Stack

Mercury Adsorber → Mercury Preconditioner

Ash Collection Tank → Ash Pump

Purge Air – Reactor, Expansion Joints
Natural Gas – Preheat Burner
Fuel Oil – Bed Lances
Ammonia Injection – Freeboard & Exhaust Duct
Service Water – Wet Scrubber, Condenser, Roof
Caustic Injection – Wet Scrubber
Outline

• NEW Water
• R2E2 Processes
• Incineration
• Anaerobic Digestion
• Energy Recovery
• Questions
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
Poll Question 2
Outline

• NEW Water
• R2E2 Processes
• Incineration
• Anaerobic Digestion
• Energy Recovery
• Questions
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
Biogas Production

GBF Biogas Production

- Started The Second Digester – 100% Of Plant Loadings
- Started Testing HSW Feeding
- Incinerator Heat Exchanger Failure – Reduced Loadings to Digestion
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 Consumed – 3,088 MWH
    - Purchased – 2,863 MWH (93%)
    - Generated – 225 MWH (7%)
    - Biogas Utilized – 21%

• **June 2020**
  - Electricity Consumed – 3,359 MWH
    - Purchased – 1,893 MWH (56%)
    - Generated – 1,466 MWH (44%)
    - Biogas Utilized – 98%

• **April 2021**
  - Electricity Consumed – 3,306 MWH
    - Purchased – 729 MWH (22%)
    - Generated – 2,577 MWH (78%)
    - Biogas Utilized – 98%
Energy Data

R2E2 Energy Utilization

- **Purchased Electricity, MWH**
- **Generated Electricity, MWH**
- **Biogas Utilized %**
Back to the Future: Resource Recovery & Electrical Energy (R2E2)

1935: GBMSD Plant

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

NEW Water
The brand of the Green Bay Metropolitan Sewerage District
Thank You!

Questions / Comments?

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Stay connected with us:
Poll Question 1

What is the typical operating temperature for mesophilic anaerobic digesters?

- 35°C to 37°C (95°F to 98°F)
- 38°C to 40°C (100°F to 104°F)
- 28°C to 30°C (82°F to 86°F)
Poll Question 2

Which air pollution control device is primarily used for mercury emissions control?

- Multi-Venturi Wet Scrubber
- Adsorber (granulated activated carbon)
- Wet Electrostatic Precipitator (WESP)