Leachate System Clogging - The Springfield Experience

Nathan Hamm
July 17, 2017
Presentation Overview

• Facility Background
• Challenges
• Technical Approach
• Findings
• Remedial Approach
• Design Recommendations
Facility Background

- **MSW Landfill**
  - 120 Acres Pre-Subtitle D
  - 22.2 Acres Subtitle D

- **Historically Trucked Leachate to WWTP**
  - Up to 15 MGY

- **Leachate Pumping System and Forcemain**
  - Constructed in 2010
  - Duplex Pump Station from Existing Storage Lagoon
  - 9 Mile, 4-Inch SDR 9 and SDR 17 HDPE Forcemain
  - Design Pump Flow 100 - 110 GPM (2.6 ft/sec)
  - >74M Gallons Pumped Since Commencement
Pump Station
Pumping System
Forcemain Construction
Challenges

• July 2016 Leachate System Stops Operating
  • Pumps Ramp Up and Shut Down (High Pressure Limits)

• City Attempts to Restore Service
  • Perform Pump Maintenance
  • Lagoon Intake Screen Dislodged
    • Turtles and Deer Bones
  • Attempts to Video / Camera Forcemain
  • Jetting Contractor Cleaned Select Section
    • Additional Clogs
Technical Approach

- Determine Extent of Problem
  - Forcemain Pressure Analysis
  - Camera / Video Select Forcemain Sections
- Assess Scale / Sludge Formation Mechanisms
  - Leachate Sampling and Analysis
  - Sludge Sampling and Analysis (Lagoons & Forcemain)
- Develop Remedial Alternatives/Recommendations
- Implement Selected Remedial Solutions
Findings - Forcemain Pressure Test

Forcemain Pressure Test Using Pump House Pumps

- Pump 'AR-2'
- Pump 'AR-4'
- Pump 'AR-5'
- Pump 'AR-6'
- Pump 'AR-8'
- Pump 'AR-10'

Pressure, PSI vs. Time, Minutes graph
Findings - Forcemain Camera
Findings - Leachate Analysis

• High TDS and Dissolved Metals
  • TDS 3,000 mg/L
  • Calcium, Iron, Magnesium, Sodium

• Moderate to High Organics Concentrations

• Scale Index Analysis and Precipitate Modeling
  • High Scaling Potential (Calcite-CaCO₃ and Siderite-FeCO₃)

![Chemical Oxygen Demand](chart1)

![Ammonia as N](chart2)
Leachate Lagoon Sludge
Pumping System Strainer Basket Sludge
Forcemain Sludge
Forcemain Sludge
# Findings - Sludge Sampling and Analysis – EMSL Analytical

<table>
<thead>
<tr>
<th>Sample ID:</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Lagoon Sludge</td>
<td>Forcemain Sludge</td>
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<tr>
<td><strong>Grouping</strong></td>
<td>Analyte</td>
<td>Contribution</td>
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<tr>
<td><strong>Liquid Phase:</strong></td>
<td>Water</td>
<td>45 - 55%</td>
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<td><strong>Solid Phase:</strong></td>
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<tr>
<td><strong>Plant Matter</strong></td>
<td>1 - 3%</td>
<td>1 - 2%</td>
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<td><strong>Decomposed Organic Matter</strong></td>
<td>1 - 3%</td>
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<td><strong>Quartz</strong></td>
<td>5 - 10%</td>
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<tr>
<td><strong>Calcium Carbonate</strong></td>
<td>30 - 40%</td>
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<td><strong>Mica</strong></td>
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<tr>
<td><strong>Iron Oxide</strong></td>
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<td><strong>Unidentified Inorganics</strong></td>
<td>1 – 2%</td>
<td>10 - 20%</td>
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<tr>
<td><strong>Biological Organisms:</strong></td>
<td>Bacteria</td>
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</table>
Findings - Summary

• Sludge / Sediment Buildup Throughout Forcemain
  • Loose Sludge with “Chips” vs. Hard Cementation
  • Heaviest Buildup in Middle Sections
  • Observed Scaling on Pipe Walls in Section Closest to Pumps

• Significant Sludge Buildup in Lagoon (>18-Inches)
  • Sucked into Pumping System

• Sludge Chemical Composition Different Between Lagoon and Forcemain

• Leachate Conducive to Precipitate Scale Formation
Remedial Approach

• Modify Lagoon Intake Structure
• Phased Cleaning Approach
  • High Rate Flushing and Suction
  • High Pressure Jetting
  • Chemical Cleaning (Acid Treatment)
• Camera the Pipes After Cleaning to Observe Effectiveness
• Develop a Long-Term Routine Maintenance Program
  • Pigging
  • Lagoon Aeration
  • Routine Flushing or Jetting
  • Chemical Scale Inhibitors
  • Biocides
# High Rate Flushing

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<th>Location</th>
<th>Station</th>
<th>Valve Adjustment</th>
<th>Dist to End, Feet</th>
<th>Max Pressure, psi</th>
<th>Flow Rate, gpm</th>
<th>Gallons for one flush</th>
<th># of Flushes</th>
<th>Flush Time (min)</th>
<th>Gallons Required</th>
<th>Set Up Break Down, Hrs</th>
<th>RT Haul, mi</th>
<th>Load Rate</th>
<th>Cycle Time, Hrs</th>
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## Subtotal
- **104 min**
- **16010 gal**
- **6 hr**
- **4 hr**
- **12 hr**

## Totals
- **10 hr**
- **107911 gal**
- **19 hr**
- **24 hr**
- **53 hr**
Forcemain Pigging

Foam Swabs and Scouring Pigs
Forcemain Pigging

Remote Tracking System
Pigging - Launcher
Pigging – Catcher System
Pigging – Before and After Swabs
Pigging – Before & After
Lesson Learned – HDPE Restrictions
Chemical Treatment

• Acid Blends
• Large Volume Requirements
• Safety Concerns
• Disposal
• Cost
Overall Conclusions

• Analyze Leachate for Scaling Potential During Design

• Design Forcemain Systems for Sediment Resuspension
  • > 3.5 ft/sec for loose scale removal and resuspension
  • < 8 ft/sec to avoid excess head and water hammer

• Forcemain Pipe ≥ 4-inch Diameter to Facilitate Maintenance

• Design for Maintenance
  • Cleanouts Spaced 400-500 ft Maximum
  • Pig Launchers and Catchers
  • Chemical Treatment Equipment

• Develop and Follow a Routine Maintenance Plan
Questions

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