Sanitary Sewer Overflow Prevention

Presented to NCTCOG SSO Workshop

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Overview

- What is a SSO?
- Wet Weather Induced SSOs
- Dry Weather SSOs
- Industry Practices for Collection System Maintenance
- Municipal Perspective
- Conclusions
An SSO is a type of unauthorized discharge of untreated or partially treated wastewater from a collection system or its components (e.g., a manhole, lift station, or cleanout) before it reaches a wastewater treatment facility.

SSOs can occur if there is significant inflow/infiltration, the collection system is poorly operated and maintained, or the system lacks adequate capacity to collect or store flows for treatment, or to treat them.
SSO Prevention

The impossible objective…

1. The 1972 Clean Water Act also set as a lofty goal the "zero discharge" of pollutants into the nation's waters by 1985.
2. Today, EPA and TCEQ acknowledge SSOs can occur but the goal should be for elimination (still impossible)
3. In reality, actions can be taken to reduce SSOs but there are no actions that will ensure no SSOs
### Why do SSOs Occur?

<table>
<thead>
<tr>
<th>Cause of SSOs</th>
<th>Intuitive Solutions</th>
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<tbody>
<tr>
<td>Capacity restriction downstream</td>
<td>Install larger pipe or reduce groundwater leakage into pipe</td>
</tr>
<tr>
<td>Blockages in conveyance</td>
<td>Eliminate blockage or source of blockage (FOG, roots)</td>
</tr>
<tr>
<td>Unforeseen or unanticipated collection system failures</td>
<td>Establish redundancy, remote system monitoring, and improve foresight by defining asset condition and expected failures</td>
</tr>
<tr>
<td>Extraordinary events</td>
<td>Power redundancy, emergency response plan, on call contractors</td>
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Types of SSOs

1. Wet weather SSO - A SSO that is triggered through I/I impacts following wet weather events

2. Dry weather SSO - A SSO that is triggered by a reduction in existing pipeline capacity due to either fats, oils, and grease (FOG) or other obstructions to flow or a system failure
Types of SSO Sources

- Inflow Sources
- Infiltration Sources

- Roof Drain Connection
- Uncapped Cleanout
- Connected Foundation Drain
- Broken House Lateral
- Faulty Lateral Connection
- Faulty Manhole Cover or Frame
- Cracked or Broken Pipe
- Deteriorated Manhole
- Storm Sewer Cross-Connection
- Storm Sewer
Approach to Wet Weather Induced SSO

Meter No. 10 - Hourly Flow (MGD)

Classical Inflow Source from direct rainfall connections to sewer (rainspouts, manhole leaks, open cleanouts)
Approach to Wet Weather Induced SSO

Meter No. 20 - Hourly Flow (MGD)

Classical Infiltration
Extended Flow
## Approach to Wet Weather Induced SSO

<table>
<thead>
<tr>
<th>Diagnostic Toolbox</th>
<th>Relative Cost ($-Low/Medium/High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke testing</td>
<td>Low, essential toolbox in municipalities</td>
</tr>
<tr>
<td>Flow measurement</td>
<td>Medium, common in larger city toolboxes</td>
</tr>
<tr>
<td>Pipeline inspection</td>
<td>Medium, common in larger city toolboxes</td>
</tr>
<tr>
<td>Hydraulic capacity analysis</td>
<td>High, typically outside services</td>
</tr>
</tbody>
</table>
### Approach to Wet Weather Induced SSO

<table>
<thead>
<tr>
<th>Diagnostic Toolbox</th>
<th>Findings and Degree of Actionable Solution</th>
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<tr>
<td>Smoke testing</td>
<td>Locations of inflow, allows for enforcement of city ordinances on removal of roof drains and cleanout openings</td>
</tr>
<tr>
<td>Flow measurement</td>
<td>Flow characterization for relative understanding of source and possible understanding of capacity utilization of pipelines</td>
</tr>
<tr>
<td>Pipeline inspection</td>
<td>Identification of specific defects and may allow for root removal, FOG programs, line repair</td>
</tr>
<tr>
<td>Hydraulic capacity analysis</td>
<td>Holistic understanding of what capacity is needed to prevent capacity exceedance and identification of pipeline improvement to reduce SSO potential</td>
</tr>
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Approach to Wet Weather SSOs

Operating a Successful Business Model

Step 1- Create system in model

Step 2- Load predicted flows

Step 3- Change downstream pipe size

Step 4- Confirm HGL is below surface
Approach to Wet Weather Induced SSOs

Solutions for Wet Weather SSOs

- More capacity
  - New pipeline or pipe burst existing pipeline

- Elimination of capacity losses
  - Remove I/I component
  - Remove sand/silt buildup with cleaning
  - Remove obstructions

- Improve reliability
  - Programmed cleaning
  - Programmed system review
Approach to Dry Weather SSOs

- Diagnostic Toolbox
  - Inspection
  - CCTV or internal inspection
## Approach to Dry Weather SSOs

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<th>Diagnostic Toolbox</th>
<th>Findings and Degree of Actionable Solution</th>
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<tr>
<td>Inspection</td>
<td>Identification of wax or grease buildup allows for execution of FOG or program for more frequent cleaning</td>
</tr>
<tr>
<td>Pipeline inspection</td>
<td>Identification of contributing effects from oil and grease, roots, or poor pipe condition as well as combination of multiple effects allowing for root removal programs, FOG programs, and/or pipeline repair</td>
</tr>
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</table>
Established SW US regional characteristics:

- 21 feet sewer/capita or

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<tr>
<th>Age Range</th>
<th>Percentage</th>
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<tr>
<td>0-10 YR</td>
<td>21.90%</td>
</tr>
<tr>
<td>11-20 YR</td>
<td>23.40%</td>
</tr>
<tr>
<td>21-50 YR</td>
<td>40.50%</td>
</tr>
<tr>
<td>51-100 YR</td>
<td>13.30%</td>
</tr>
<tr>
<td>&gt; 100 YR</td>
<td>0.90%</td>
</tr>
</tbody>
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- Peak to Average Ratio
  - 2.24 avg. peak flow to ADF
ASCE Collection System Optimization Of Maintenance Activities

- Sewer Cleaning- 0.38 Miles cleaned annually/Miles of System

<table>
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<tr>
<th>Inspection Frequencies as Per Cent of Total System</th>
<th>1YR</th>
<th>5 YR</th>
<th>10 YR</th>
<th>20 YR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Evaluation</td>
<td>32%</td>
<td>67%</td>
<td>106%</td>
<td>170%</td>
</tr>
<tr>
<td>Manhole Inspection</td>
<td>44%</td>
<td>186%</td>
<td>334%</td>
<td>598%</td>
</tr>
<tr>
<td>Smoke/Dye Testing</td>
<td>1%</td>
<td>17%</td>
<td>23%</td>
<td>34%</td>
</tr>
<tr>
<td>CCTV Inspection</td>
<td>10%</td>
<td>27%</td>
<td>35%</td>
<td>43%</td>
</tr>
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SSO Prevention Considerations

- Incentives- Public Impacts/Nuisance/Safety
  - Tale of three metroplex cities late November 2015
    - Anytown reports two major sewage spills caused by the weekend’s heavy rain
    - Several sewage spills over weekend did not harm Anytown’s public water supply, city says
    - Record rains resulted in five 100,000-gallon ‘domestic sewage’ overflows in Anytown
SSO Prevention Considerations

Cost incentive
- One SSO
  - $ Mobilization of city staffing
  - $ Barricade or monitoring
  - $ Repair if required
  - $ Diagnostic cost for cause
  - $ Cost for permanent correction
  - $ Increased wastewater treatment (power costs)
SSO Prevention Considerations

- Regulatory Incentive
  - TCEQ SSOIs
  - EPA prerogative to act when TCEQ is ineffective

- Fines if no action
SSO Prevention Considerations

Challenges

- Private sewer laterals (outside of control)
- Unusual weather events

**Climate**

*Monster El Nino expected to shape this winter's weather*
Municipal Perspective

1. City’s Have been successfully using capacity assurance for last twenty years to reduce wet weather SSOs, HOWEVER, SSOs have not stopped.

2. Exampleton is a city in DFW metroplex with population over 100,000. In Exampleton, approximately 85% of SSOs are dry weather SSOs.

3. City has undertaken three strategies:
   a. High frequency cleaning in problem areas prone to dry weather SSOs such as multi family high density, flat pipelines, tree root intrusion;
   b. City has aggressively marketed its program for FOG reduction; and
   c. City has begun remote monitoring flow levels inside manholes
1. Preventative maintenance at 30, 60, and 90 day cleaning cycles
2. 2008- added crew for preventative maintenance, cleaning lines throughout basins in advance of any problems
3. 2011- Smart Covers for use in dispatching crews in advance of SSOs
4. 2012- Root control and inhibition program
5. 2012- oxygen injection and fat emulsification system at lift stations
Municipal Perspective
New Developments in SSO Prevention

- Exampleton Tools Being Deployed
  - Increased vigilance during new construction
  - Improved Community FOG Awareness
  - Green Project funding for I/I
  - Smart Cover for mobilization
Conclusions

1. SSOs can be reduced but not eliminated
2. Once the causes are known, there are corrections that can be used specific to the problem
3. EPA continues to monitor Texas TCEQ progress in reducing SSOs with the potential to step in when it deems necessary

SSO Prevention Is a Journey, Not a Destination
Questions?

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