CSI Winston-Salem: SSO Forensics Edition
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01 Background
Background

**What?** Collection System Improvement Program

**Why?** Reduce SSO’s and Increase Operational Efficiency

**Where?** City of Winston-Salem, Forsyth County, North Carolina

- **Who?** City/County Utilities (CCU) serving
  - 100k sewer connections
  - 225 FTEs working in collection and treatment
  - 1750 miles of gravity sewer lines
  - 50 Pump stations

**When?** 5-year “CSIP” kicked off in July 2016 (assessment and fast start activities Mar-Jul 2016)
Historical SSOs

SSO Count

Year       State Reportable | EPA Reportable
2012       117            | 63
2013       110            | 57
2014       79             | 40
2015       80             | 58
2016       72             | 42

Legend:
- Red: State Reportable
- Blue: EPA Reportable
Historical SSOs
SSOs by Cause

- High percentage of O&M caused SSOs
02 SSO Initiatives
CSIP: First Response Initiatives

- An initiative dedicated to characterizing wastewater releases, spills, and sanitary sewer overflows was chartered to help meet the City’s goal of 2 SSOs per 100 miles of pipe.

- Year 1 Focus:
  - SSO Definition
  - **SSO/Back-up Review Meeting Design**
    - The old “SSO” meeting was not dedicated to analyzing trends among SSOs in the system.

- Year 2 Focus:
  - Standard operating procedure for SSO events
  - SSO Tracking in a centralized database

- Year 3 Planned Focus:
  - First Response for False Positives SSOs
  - SSO Response Policies

- Year 1 and the beginning of Year 2 forensic breakdowns will be discussed in the following slides, first with an understanding of the “old” SSO meetings and the new design to help curb SSO trends.
03 Meeting Design
OLD SSO Meetings
State of the System Meeting

- Before FY 17, CCU did not have a specific meeting dedicated to SSO event review.

- Held quarterly and typically run by the Utilities Director or the Collection System Supervisor.

- Focused on the System as a whole.
  - Treatment
  - Collection
  - Distribution

- Presented Production and System Statistics.
  - 3 months of SSOs plus other system issues discussed during one meeting.
NEW SSO Meetings

- In order to fully understand the system's need a dedicated SSO Meeting was established.

- Meetings occur bi-weekly.

- Each SSO is forensically dissected and the course of actions during the first response are discussed and documented.

- Some actions are resolved during the meeting, while others require follow-up.
Old “SSO” Meeting Roster

- Director of Utilities
- Utilities Supervisor
- Collection System Supervisor
- Treatment Plant Supervisor
- Pre-Treatment Supervisor
- Pump Station Supervisor
- GIS Coordinator

New SSO Forensic Team

- CCU Attendees include:
  - Collection System Supervisor
  - Utilities Supervisor
  - Fields Operations Manager
  - Assistant Field Operations Manager
  - GIS Coordinator
  - Grease Compliance Officer
  - Planner/Dispatcher
  - Crew Members:
    - CCTV Operator
    - Crew Leads (2)

- HDR Attendees:
  - Initiative Lead
  - Project Engineer (Planner/Scheduler)
  - Water Resources EIT
Meeting Attendance

- In order to fully address the cause of SSOs, meetings needed to have the correct people in attendance.

- Inviting crew leaders to the meeting allows them to see how their actions in the field and their documentation make a difference.

- These actions play a large role in learned trends.

- For example:
  - If a crew lead marks a main with root ball blocking flow as a clear main in their inspection findings, the cleaning optimization tool cannot accurately recommend a new cleaning frequency for the pipe.
Improved Documentation

- A checklist was developed by CCU initiative leads and HDR initiatives leads.

- This checklist not only covers the fields required by the State if the SSO is reportable, but helps to analyze the cause and the course of actions taken during the event.

- During the SSO Meeting, this checklist is reviewed and “Lessons Learned” are modified and added.

- Site photos are added to reports to show the site during and after the event.
Potential Root Cause Review

- Determining the root cause of SSOs helps to analyze trends.

- Crew leaders track cleaning findings after unstopping the main.

- Depending on the root cause of the SSO, the course of action will vary.

- SSOs caused by heavy roots may be added to a chemical root control plan while those caused by grease might require FOG outreach.
04 Action Items
Meeting Follow-Up

- The new SSO checklist also helps to document lessons learned after each SSO event.
- Database entries
- Data documentation errors
- Course of Action infractions
- Planner/Dispatcher will create action items.
- Action items are assigned during meeting discussion and addressed prior to the next SSO meeting.
- Allow for constant work to be in progress.

Course of Action

Check all that apply. Provide additional detail as applicable.

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
<th>Lead</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjust cleaning frequency</td>
<td>12 Months</td>
<td>Ting Chen</td>
<td></td>
</tr>
<tr>
<td>Pause cleaning frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-house point repair</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Refer to Capital Projects Group</td>
<td>&lt;Suggest: rehabilitation, replacement, etc.&gt;</td>
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<tr>
<td>Chemical root control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source control</td>
<td>&lt;List potential methods: inspection, outreach, enforcement, etc.&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Further inspection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity monitoring</td>
<td>&lt;List potential actions: flow metering, smart cover, etc.&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lift Station remediation</td>
<td>&lt;List actions: maintenance, repair/replacement, etc.&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>&lt;Describe&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporary action</td>
<td>&lt;List potential actions: bypass pumping, pits, etc.&gt;</td>
<td></td>
<td></td>
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</tbody>
</table>

Lessons Learned

- Database has WO not WO 913880 as SR, instead of 1124036.
- COTools has already processed a cleaning frequency of 12 months.
QA/QC

- Checklists are finished 2-3 days prior to the meeting so they can be reviewed by HDR and CCU.

- Prior to the meeting both CCU and HDR will investigate questionable work orders and find explanations for missing information.

- By reviewing the SSO Checklists in the meeting, the attendees are able to identify gaps in documentation.

- One issue faced currently is accurately documenting response time.
Sewer Overflow Follow-up

- State reportable SSOs require a state-mandated follow up to the SSO site within five days of the spill.

- Supervisors check the site for post-spill clean up, the flow of the manholes of the confirmed problem asset, and the manholes upstream and downstream.

- Sewer Overflow Follow-ups for non-reportable SSOs have been put into place to ensure proper protocol is followed during clean up and the problem assets have good flow.
Crew Follow-ups

- After SSO meetings, the Collection System Supervisor will meet with the crew leaders that handled the SSOs discussed at the meeting.

- This is an opportunity to discuss any issues with documentation and to identify what the crew leaders are doing well.

- By identifying strong parts of the crew leaders actions, we can identify training opportunities.
05 Data Analysis
Data Analysis

- A GIS SSO database is moderated and maintained by the Collection System Supervisor and the GIS Coordinator for CCU.

- This database is updated after each SSO event and a polygon is generated on the city CMMS, CityWorks and on GIS around the confirmed problem asset.
Historical Analysis and Database Updates

- Prior to the development of the new SSO meetings and SSO Event Review Checklist, documentation of SSOs was inconsistent.

- In order to accurately trend SSO events, updates to historical data must be done to match future data collection practices.

- CCU and HDR used state regulations to modify the SSO database to accurately demonstrate the type of SSO that occurred.
Applying SSO Knowledge

- With current data and historical updates made to the existing database, we are able to look at historical issues for pipes.

- With this information, we can adjust pipe cleaning schedule to prevent future SSO’s using historical and current data.

- This is done through the Cleaning Frequency Optimization Tool (COTools) which processes cleaning findings and allows cleaning frequencies to be manually changed after SSO event reviews.
SSO by aggregated cause

Month (March, April, May, June, July, August, September, October, November, December, January, February)

- O&M
- Pipe Failure
- Other
- LS
- Severe Natural Condition
- I&I

SSO Count (0 to 14)

Legend:
- O&M
- Pipe Failure
- Other
- LS
- Severe Natural Condition
- I&I
Next Steps
Next Steps

- After discussion and meeting follow-ups are completed, the SSO checklists and databases are updated and distributed.

- Adding information and editing information in the checklist is in the process of being done directly into a geodatabase.

- These edits will provide a geospatial point for each SSO as well as tie all the information about the SSO to that location.
# Survey123 for Automating SSO Checklists

<table>
<thead>
<tr>
<th>SSO ID:</th>
<th>Confirmed Problem Asset ID #:</th>
<th>Discharge Asset ID #:</th>
<th>Date Of Event:</th>
<th>First Responders:</th>
<th>Response Time:</th>
<th>Duration:</th>
<th>Volume:</th>
<th>Date Of Review Meeting:</th>
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<td>25</td>
<td>20</td>
<td>Mar 8, 2018</td>
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Conclusions
Conclusion

- Since the implementation of the new SSO Event Review Meetings, SSO discussions and frequency have been on the downward trend.

- Improved documentation helps determine the issues and allows for an overall increase in productivity.

- Data collected before, during, and after the meeting are used to adjust pipe cleaning frequency to prevent future SSOs.
Questions?

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