RECOGNIZING THE VALUE OF STORAGE TANK BOTTOM MFL INSPECTION DATA

Victor J. Escobar
NDTIC 2017
Quebec City, Quebec
June 6 - 8 2017
CONTENT EXAMPLE

1. ROSEN Group
2. Tank Inspection
3. Tank Bottom Inspection Software (ROSOFT)
4. Case Studies
5. Conclusion
ROSEN GROUP

✓ Privately-held company for more than 35 years

✓ Continued reinvestment ensures stability and long-term growth opportunities

✓ Regional focus ensures commitment to needs of local customers and markets
ROSEN GROUP
STORAGE TANK INTEGRITY SERVICES

ROSEN has extensive experience in inspecting tanks and other structures in refineries, processing plants, power plants and terminals.

• Tank inspection services (over 15 years)
• North American group has inspected over 2,500 tanks
• Established processes and procedures for customers integrity programs
• Involved with two customers in creating / implementing a routine mechanical integrity piping plan
  o Probability / Consequence Assessment
  o Documentation / Records
  o Classification
  o Understanding of damage mechanisms (based on location, product, etc..)
  o Selection of applicable technologies, techniques and/or tools
TANK INSPECTION

API 653 Inspection
Inspection of ALL applicable structures/appurtenances:

• Settlement (with Laser Profile),
• Internal (MFL Floor Scan, etc.),
• External (UT, Visual, etc.),
• Shell (UT Crawler Inspection),
• Roof (UT, MFL Scan, etc.),

General Assessments:

• Corrosion rates,
• Remaining life,
• Liquid load conditions,
• Next inspection interval

Repair & Change of service options

FAILURE MODE: CORROSION

- Atmospheric Corrosion
- Vapor Space Corrosion
- Interface Corrosion
- Product Side Corrosion
- Aqueous phase Corrosion
- External bottom corrosion
TANK BOTTOM INSPECTION

IMPORTANT PARAMETERS

- Isolated versus clustered pitting versus general
- Pit-on a-pit is very unlikely
- Pitting is in most cases govern
- Corrosion process differs between internal and external
  - Internal Corrosion: more or less predictable, \( f(\text{product}) \)
  - External Corrosion: unpredictable, case-to-case assessment
- CP installed, however external corrosion present
- Linearity of CR – no models available
TYPICAL BOTTOM SCAN RESULT

- Plate number
- Indication code
- Location (datum, length, width)
- Remaining thickness & Depth
- Etc..

<table>
<thead>
<tr>
<th>PLATE</th>
<th>PNT</th>
<th>REMAINING</th>
<th>X LOCATION</th>
<th>Y LOCATION</th>
<th>INT</th>
<th>US (# INS)</th>
<th>RE</th>
<th>CO</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>0.155</td>
<td>0.205</td>
<td>29.53</td>
<td>13.26</td>
<td>3</td>
<td>1</td>
<td>14 x 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>0.245</td>
<td>38</td>
<td>30</td>
<td>1</td>
<td>12 x 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>0.220</td>
<td>31</td>
<td>48</td>
<td>28 - 29</td>
<td>2</td>
<td>1</td>
<td>16 x 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>0.140</td>
<td>24</td>
<td>47</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>12 x 12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to take an integrity approach to tank inspection, operators need excellent inspection data in order to assess the root cause and manage data:

- Visualization of corrosion (or pattern)
- Integration into a database
- Corrosion Histogram
- Utilization of data for RBI assessments
- Repair strategies (i.e. 10 vs 20 year or coating)
ROSOFT FOR TANKS

- Inspection results reported on-site
- Classify features dependent on repair thresholds
- Utilize ROSOFT for repairs
- Repair strategy will summarize repairs;
- Repair Patch List (Patch dimension, location, shape)
- Repair Patch Summary (total no., weld length, patch area/volume)
ROSOFT FOR TANKS
CASE STUDY - 1

Tank Details
- Crude Oil Storage Tank
- Diameter – 245 ft (75 m)
- Region – Gulf Coast
- Age – 8 years
- Coating – Thin film epoxy
- CP system - Yes

Damage Mechanism
- External severe corrosion
- Centralized corrosion pattern
CASE STUDY - 2

Tank Details
• Crude Oil Storage Tank
• Diameter – 279 ft (85 m)
• Region – Central
• Age – 15 years
• Coating – Film epoxy (30 mils)
• CP system - Yes

Damage Mechanism
• Internal severe corrosion
• Corrosion pattern
CONCLUSION

RBI Utilization Model

Utilizing all of the inspection “data” gathered during an inspection and running an RBI calculation after the Post Repair Inspection allows Operators to extend the service life of a tank.
CONCLUSION

- UT grid measurements should not be used for RL assessment;
- No alternative tools or software available to quantify the ‘problem’;
- The need for high-resolution inspection data collection is warranted and required;
- Defect depth sizing accuracy of ±10% is feasible;
- Relative “cheap” way to justify extending the next inspection period (in comparison with the cost for cleaning/gas-freeing);
- Define your repair scope more efficiently;
- Strategize your repair strategy based on cost or operations;

“Finding the actual origin of tank bottom deterioration enables operators to treat not only the symptom, but also the cause – and thereby to take far more effective mitigation measures”…this is our approach.
THANK YOU FOR JOINING THIS PRESENTATION.
TANK BOTTOM LAYOUT