Double-Shell Tank Integrity Program Overview

Oregon Hanford Cleanup Board

Presented by: Jeremy Johnson, Deputy Federal Project Director, Tank Farms

September 26, 2016
Tank Integrity Program History

Activities

**DST**
- Ultrasonic Testing
- Visual Inspection
- Chemistry Optimization
- Structural Integrity

**SST**
- Stabilization & Isolation
- Single-Shell Tank Integrity Project

**Expert Panel**
- BNL-52361 Structural Analysis Guideline Panel
- PNNL-13571 DST Life Extension
- BNL-52527 Tank Structural Integrity Panel
- RPP-RPT-22162 Waste Chemistry Optimization
- RPP-19438 Waste Level Rise
- RPP-31129 Vapor Space Corrosion
- RPP-10435 SST Integrity Assessment Report (IQRPE)
- RPP-28538 DST Integrity Assessment, HFFACO Milestone M-48-14
- Update RPP-28538

**Integrity Assessment**
- Completed Saltwell Pumping of 29 Tanks
- DST Analysis of Record / Dome Deflection Surveys / and Dome Load Controls
- Structural Analysis / Forensic Testing
## Double-Shell Tank Overview

<table>
<thead>
<tr>
<th>Tank Farm</th>
<th>241-AY</th>
<th>241-AZ</th>
<th>241-SY</th>
<th>241-AW</th>
<th>241-AN</th>
<th>241-AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Tanks</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Design Life (years)</td>
<td>25</td>
<td>20</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Years in Service as of 2012</td>
<td>41</td>
<td>36</td>
<td>35</td>
<td>32</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Type of Steel</td>
<td>A515</td>
<td>A515</td>
<td>A516</td>
<td>A537</td>
<td>A537</td>
<td>A537</td>
</tr>
<tr>
<td>Capacity (Mgal.)</td>
<td>1</td>
<td>1</td>
<td>1.16</td>
<td>1.16</td>
<td>1.16</td>
<td>1.25</td>
</tr>
<tr>
<td>Maximum Waste Depth (feet)</td>
<td>30.3</td>
<td>30.3</td>
<td>35.2</td>
<td>35.2</td>
<td>35.2</td>
<td>38.3</td>
</tr>
<tr>
<td>Maximum Specific Gravity</td>
<td>1.77</td>
<td>1.77</td>
<td>1.77</td>
<td>1.77</td>
<td>1.77</td>
<td>1.84</td>
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</tbody>
</table>
Primary objectives of the DST Integrity Program include:
• Maintain DSTs to safely store and transfer 56 million gallons of high-level waste for treatment
• Extend life of DSTs to support WTP operation
• Monitor tank integrity to inform decisions for repair or replacement
• Monitor tank corrosion
• Meet RCRA requirements
DST Integrity Program Scope

- Primary tank wall and annulus floor inspected every ~10 years (video and ultrasonic inspections)
- Waste chemistry corrosion control studies
- Waste chemistry sampling and adjustments for corrosion mitigation
- Periodic testing, evaluation, certification of ancillary equipment (e.g., valve pits, piping)
- Structural analysis and studies for thermal, operating, and seismic loads
- Periodic testing and integrity assessment of 242-A Evaporator
**Tank AY-102 Leak**

- Visual inspection every 2 weeks
- Corrosion testing shows leaked waste poses no realistic threat to liner integrity

**2016 IQRPE Assessment**

- Released report (RPP-RPT-58441); 24 recommendations, no findings of greater significance
- Report concluded DST system is fit for use; reassessment required in 10 years (2026)

The annulus of AY-102 continues to be inspected every two weeks.
Panel is comprised of experts from a variety of private and government organizations including SRNL and PNNL. Panel meets twice a year to provide independent advice and recommendations to DOE and WRPS on existing and emerging tank integrity issues with focus on safety.

The Tank Integrity Expert Panel last met May 16-17 in Richland.

Expert Panel members:
- Andy Duncan, SRNL
- Brenda Garcia-Diaz, SRNL
- Russ Jones, GT Engineering
- Leon Stock
- Glenn Light, Southwest Research Institute
- Mike Rinker, PNNL
- Bob Sindelar, SRNL, Vice Chair
- Todd Martin, Chair/Facilitator
Summary of Current Expert Panel Recommendations:

- Continue existing corrosion and refractory testing
- Obtain a sample of the waste in the AY-102 annulus to determine corrosion threats to the secondary liner
- Utilize remote inspection techniques
- Confirm AY-102 secondary liner integrity
DST Secondary Liner Analyses

- Ultrasonic scans on bottom of secondary liner (outer shell) performed in 7 DSTs
  - Liner thinning >10% observed in all but one tank (localized areas)
  - One tank (AP-102) found to have small area with up to 70% thinning
  - Thinning observed in tanks with no prior leak detection pit accumulation
- No indication primary DST containment is affected
Riser 31

- Two areas of secondary shell floor thinning discovered above foundation drain slots
  - Average thickness of these areas was 0.380”, or 24% loss vs nominal 0.500”
  - Thinnest location was 0.156”, or 70% loss in small area

Riser 30

- No areas of floor thinning observed
<table>
<thead>
<tr>
<th>Tank, Year, Report #</th>
<th>% Thinning from Nominal</th>
<th>Additional Detail from Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN-105</td>
<td>0.2% 3.6% 29.8%</td>
<td>Small areas inspected from one riser in 1999 and 2006 (~10 ft²). No thinning, pitting, or crack-like indications detected. Scan area in 2016 as large as possible from two risers. Several areas of localized thinning detected under both risers. Note – these are 3 different areas at 3 different times.</td>
</tr>
<tr>
<td>1999, HNF-4816</td>
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<td>2006, RPP-RPT-27467</td>
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<td>2016, Report in preparation</td>
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<td></td>
</tr>
<tr>
<td>AN-107</td>
<td>10.0%</td>
<td>Scan area ~1 ft x 8 ft in length. Minimal thickness of 0.450 in. indicates floor thinning. No pitting or crack-like indications detected.</td>
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<tr>
<td>1999, HNF-3353</td>
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<tr>
<td>AP-106</td>
<td>2.20%</td>
<td>14” x 8.4’ of scanning revealed no areas of reportable wall thinning, no non-reportable pits, no reportable indications of pitting, and no reportable linear indications.</td>
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<tr>
<td>2014, RPP-RPT-57127</td>
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<tr>
<td>AP-102</td>
<td>70.2%</td>
<td>Inspected 13” x 25’ at Riser 30 and 15” x 20.4’ at Riser 31. Two localized areas of reportable thinning (&gt;10% loss), and reportable pits (&gt;25% loss) were found through Riser 31.</td>
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<td>2014, RPP-RPT-58276</td>
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<td></td>
</tr>
<tr>
<td>AN-103</td>
<td>23.8%</td>
<td>23’ x 17’ each at Riser 25 and Riser 26. Two localized areas of reportable thinning, no pitting (reportable or non-reportable).</td>
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<td>2015, RPP-RPT-58776</td>
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</tr>
<tr>
<td>AN-104</td>
<td>39.6%</td>
<td>A total area of 49’ x 17” was scanned through Riser 25 (25’ x 17”) and Riser 26 (24’ x 17”). Several areas of thinning were detected.</td>
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<td>2015, RPP-RPT-58924</td>
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<tr>
<td>AW-103</td>
<td>19.4%</td>
<td>Floor scans complete and reportable thinning &gt;10% detected. Scan area as large as possible with existing equipment.</td>
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<tr>
<td>2016, Scanning in Progress</td>
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</tbody>
</table>
Path Forward

- Add secondary floor scans to inspection program – complete
- Share info/baseline with Savannah River Site – complete
- Develop investigation/mitigation strategy – complete
- HQ EM-led programmatic risk evaluation in August – complete
- Accelerate UT floor scans (minimum 3 scheduled for FY17)
- Prioritize DSTs based on intrusion history
- Develop capability for increased floor scan area and implement new technologies
- Eliminate/reduce/reverse annulus vacuum
- Inspect additional leak detection pit drain lines and obtain samples
- Perform additional corrosion coupon testing
Questions?
Backup slides on SSTs
149 single-shell tanks were built between 1944 and 1965.

Various capacities
- Type I 55 kgal
- Type II 530 kgal
- Type III 760 kgal
- Type IV 1 million gal

<table>
<thead>
<tr>
<th>Tank Series</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IVA</th>
<th>IVB</th>
<th>IVC</th>
</tr>
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<tbody>
<tr>
<td>Farms</td>
<td>241-B</td>
<td>241-B</td>
<td>241-BY</td>
<td>241-SX</td>
<td>241-A</td>
<td>241-AX</td>
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<td></td>
<td>241-C</td>
<td>241-BX</td>
<td>241-S</td>
<td>241-BY</td>
<td>241-AX</td>
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<td></td>
<td>241-T</td>
<td>241-C</td>
<td>241-TX</td>
<td></td>
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<td></td>
<td>241-U</td>
<td>241-T</td>
<td>241-TY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Tanks</td>
<td>16 Tanks</td>
<td>60 Tanks</td>
<td>48 Tanks</td>
<td>15 Tanks</td>
<td>6 Tanks</td>
<td>4 Tanks</td>
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</tbody>
</table>
Why do we have an SST Integrity Program?

- SSTs are well beyond design life (removed from service in 1980)
- Many tanks have leaked in past; 1 currently (T-111)
- SSTs contain about half (25M gal) of total volume of tank waste, including ~2.5M gal drainable liquid
- Maintenance of SST structural integrity will remain an important issue for decades until retrieval and closure of tanks is completed
Primary functions of the SST Integrity Program include:

- Periodic dome deflection surveys
- Waste liquid level evaluations
- Visual inspections
- Intrusion mitigation
- Evaporation of liquids with exhausters
- Corrosion testing
- Evaluate new monitoring technology
TPA Milestones and Targets

• 17 TPA milestones and targets completed (M-045-91)

Analysis of Record (AOR) complete

• Modern structural analysis of all four SST types, tanks are sound

C-107 dome plug (2011)

• Cores taken from dome

• Concrete material properties shown to be higher than design specifications

A-106 core sample (2014)

• Concrete material properties again shown to be higher than design specifications
SST Integrity Program Scope

Leak Assessment Process
• Utilize formalized process, supports cost effective retrieval

In-Tank Visual Inspections
• ~12 tanks per year, priorities given to level trends, no signs of structural distress

Level Change and Intrusion Evaluations
• Evaluated 20 tanks for level increase and 20 tanks for level decrease between 2011 and 2014, continue to evaluate level change trends

Exhausting Tank Free Liquid
• Exhauster operating on T-111