In-Service Inspection Program for the SRS Waste Tanks: Update

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SRR, Office of the Chief Engineer
• SRR: Savannah River Remediation
• SI: Structural Integrity
• ISI: In-Service Inspection
• Kgal: Thousands of gallons
• Mgal: Millions of gallons
• SRNL: Savannah River National Laboratory
• SST: Single Shell Tank
• DST: Double Shell Tank
• VSC: Vapor Space Corrosion
• GAO: Government Accountability Office
• DNFSB: Defense Nuclear Facilities Safety Board
• TSIP: Tank Structural Integrity Panel
• SCC: Stress Corrosion Cracking
• AUT: Automated Ultrasonic Inspection
• SRR Committed to Safety and Security Excellence

• Still THE priority

• SRR will continue the SRS safety tradition

• Security is like safety: SRR will keep it front and center
Outline

• Calendar Year 2008 Inspection Results
• Waste Tank Design
• Structural Integrity (SI) Program
• Corrosion Control Program
• In-Service Inspection (ISI) Program
• SRR Program Status
• 6782 photographs
• 1633 visual/video inspections

• Two new leaksites identified
  – Tank 5 (during final cleaning) and Tank 12 (during waste removal)
  – Consistent with known degradation mechanisms in non-compliant, old-style Type I/II tanks with partial secondary containment
  – Specific response/communication plans during waste removal and cleaning activities
Waste Tanks

- **(24) Old Style Tanks**
  - Type I/II: partial secondary containment
    - Routine visual inspections of annulus
    - Monitor and visually inspect during waste removal activities
  - Type IV: single shell tanks (SST)
    - Routine internal visual inspections
  - Up to 50 years old
  - Do not have full secondary containment
  - (2) have been closed
  - No active leaksites today

- **(27) New-Style Tanks**
  - Full secondary containment
  - No leakage history
  - Receive all new waste
  - Used for all processing activities
  - Comprehensive inspection program
    - Visual inspections
    - Volumetric inspection
• Waste tanks provide critical interim containment for waste prior to processing and permanent disposal
• Comprehensive integrated approach to maintaining structural integrity of tanks, a critical component of operations
• Evolving program to successfully address emerging issues and preclude consequential degradation
History of Tank Farms SI

- Corrosion Technology Exchange (SRNL)
- TSIP Commissioned
- SRS SI Topical Report
- 1st TFA SI Workshop
- DST Chemistry Optimization Workshop
- DST Expert Panel Commissioned
- VSC Workshop I
- 3rd TFA SI Workshop
- VSC Workshop II
- GAO Report on Hanford SSTs
- DOE Order 435.1
- Hanford DST Liquid Level Workshop
- DNFSB 2001-1 Recommendation
- 2nd TFA SI Workshop
- Hanford Life Extension Panel
- Tank SI Workshop
- SST SI Panel Commissioned

Timeline:
- 1990
- 1992
- 1994
- 1996
- 1998
- 2000
- 2002
- 2004
- 2006
- 2008
- 2010
Degradation Mechanisms

- Primary mode of degradation is nitrate-induced stress corrosion cracking (SCC) near fabrication welds or repair welds.
- Occurred early in service in non-stress relieved Type I/II Tanks.
- Type III Tanks have no known leaksites:
  - Better materials of construction
  - Post-weld heat treatment to relieve weld residual stresses.
- Corrosion control program to preclude further degradation.
Corrosion Control Program

- Maintain corrosion inhibitors
  - Envelope of nitrite, hydroxide, nitrate concentrations
- Maintain temperatures
  - Concentration dependent temperature limits
Comprehensive Inspection Program

• Visual Surveillance
  – Still photography – (~5000 photos/year)
  – Wide Angle
  – Direct
  – Video Camera Inspections (over ~1000 video/visual exams/year)

• In-Service Inspection Program
  – NDE inspections included remote automated ultrasonic (AUT) inspection supplemented by remote visual inspection.
Comprehensive Inspection Program

• Type I/II tanks
  – No active leaksites
  – Use of conductivity probes in annulus
  – Routine visual inspections of annulus
  – Monitor and visually inspect during waste removal activities

• Type III/IIIA tanks
  – Comprehensive visual inspection program
  – Comprehensive volumetric inspection program
Visual Inspections

- Visual evidence of changes in tank component appearance
  - Leak sites
  - Corrosion
  - Abnormal conditions
Ultrasonic Inspections

- Historical Volumetric Wall Measurements
  - Data collection initiated in 1967
  - Collected over 24,000 spot measurements thru 1985

- NEW PROGRAM 1st CYCLE COMPLETED

- All 27 Type III tanks inspected with new program
- Examinations look for wall thinning, pitting, and Stress Corrosion Cracking
- Type II Tank 15 inspected twice
- Inspect primary and secondary walls
- Formal methodology for disposition of results

- Access thru small-diameter riser
- On-board cameras
Ultrasonic Inspection of a Tank

Probe travels over 1 mile during a tank inspection.
• Consistent with understanding of waste chemistry and known mechanisms
• One-riser inspections as likely to find pitting as four-riser inspections
• No reportable, service induced indications (i.e., wall thinning, pitting, or cracking) on the primary tank wall.
• Revealed incipient pitting and non-reportable indications on the interior of the few primary tank walls.
  – Most are pre-service
• Revealed reportable wall thickness and locally thin areas on the secondary wall and floor.

<table>
<thead>
<tr>
<th>Tank #</th>
<th>Inspection Year (FY) / Inspection Type</th>
<th>Incipient Pitting Indications</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>2004 / A</td>
<td>One 0.35” diameter pit 0.036” deep.</td>
<td>Isolated, broad shallow pitting</td>
</tr>
<tr>
<td>29</td>
<td>2006 / FS</td>
<td>Four 0.5” diameter pits 0.019 – 0.065” deep</td>
<td>Isolated, broad shallow pitting</td>
</tr>
<tr>
<td>31</td>
<td>2003 / A</td>
<td>One ~0.37” diameter pit 0.046” deep</td>
<td>Isolated, broad shallow pitting</td>
</tr>
<tr>
<td>32</td>
<td>2003 / FS</td>
<td>Three pits, max 0.75” diameter and 0.055” deep</td>
<td>Isolated, broad shallow pitting</td>
</tr>
<tr>
<td>49</td>
<td>2005 / A</td>
<td>A band of pitting ~85 to 114 inches tank elevation. Up to 0.75” diameter and 0.040” deep.</td>
<td>Broad shallow pitting</td>
</tr>
</tbody>
</table>

* FS = Full Scope  A= Augmented
Baseline Data: Incipient Pitting
Definition

- Incipient pitting is a term used to describe small pit-like indications prior to them becoming reportable or actionable
- The term describes a shallow indication
- The term does not necessarily imply that the pit has recently developed or that it is still growing
- Many incipient pits may have developed pre-service
• Revised SRS ISI Program for waste tanks inspects all 27 Type III/IIIA tanks
  – Incipient interior tank wall indications
  – Wall thickness of secondary
  – Knuckle region in select tanks
  – High stress region: Tank 50

• Frequency
  – All 27 type III/IIIA tanks shall be inspected every 6-10 years
  – Tank 15 shall be inspected seven years after the most recent inspection
  – A formal review of the ISI program shall be performed every three years

• Acceptance Criteria outlines actions in response to indications consistent with national “Tank Structural Integrity Panel” recommendations
• Special inspection performed on Tank 29 to confirm assumption of circumferential uniformity of service-induced pitting

• One-strip inspection covers all historical interfaces (e.g., liquid-air) known to be the highest risk areas for corrosion

• Tank 29 inspected through all accessible risers (16) to provide the rigorous technical bases prior to launching of the next cycle of inspections
• The structural integrity program for the SRS tanks has over 50 years of successful operation
• Program aggressively addresses emerging issues
• Program proactively evolves in support of mission goals
• Technology-based evolution of programs
• POISED TO SUPPORT THE FUTURE
• Questions?