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Structural Integrity Program Integration

Karthik Subramanian

URS-WD High Level Waste Integration

Background

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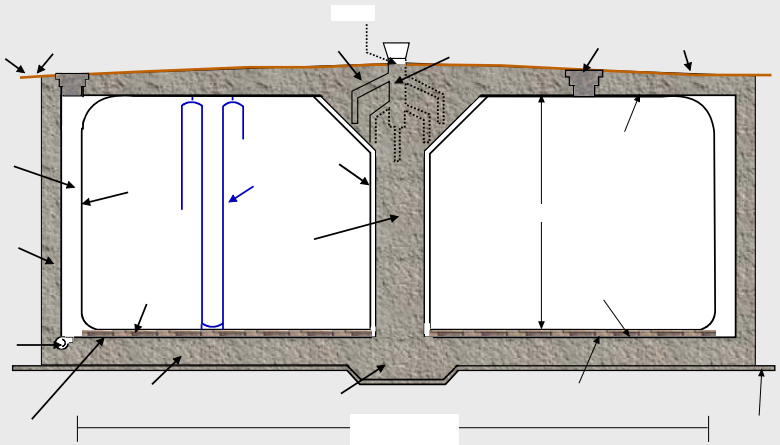
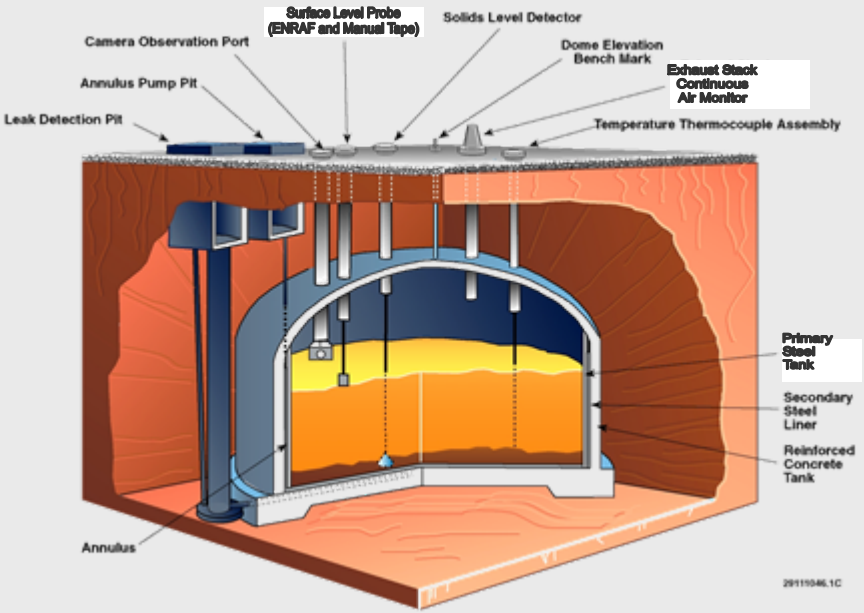
- High level radioactive waste (HLW) tanks provides interim confinement for waste prior to processing and permanent disposal
- Maintaining structural integrity (SI) of the tanks is a critical component of operations
- “Structural Integrity” and “Leak Integrity”





Structural Integrity Programs

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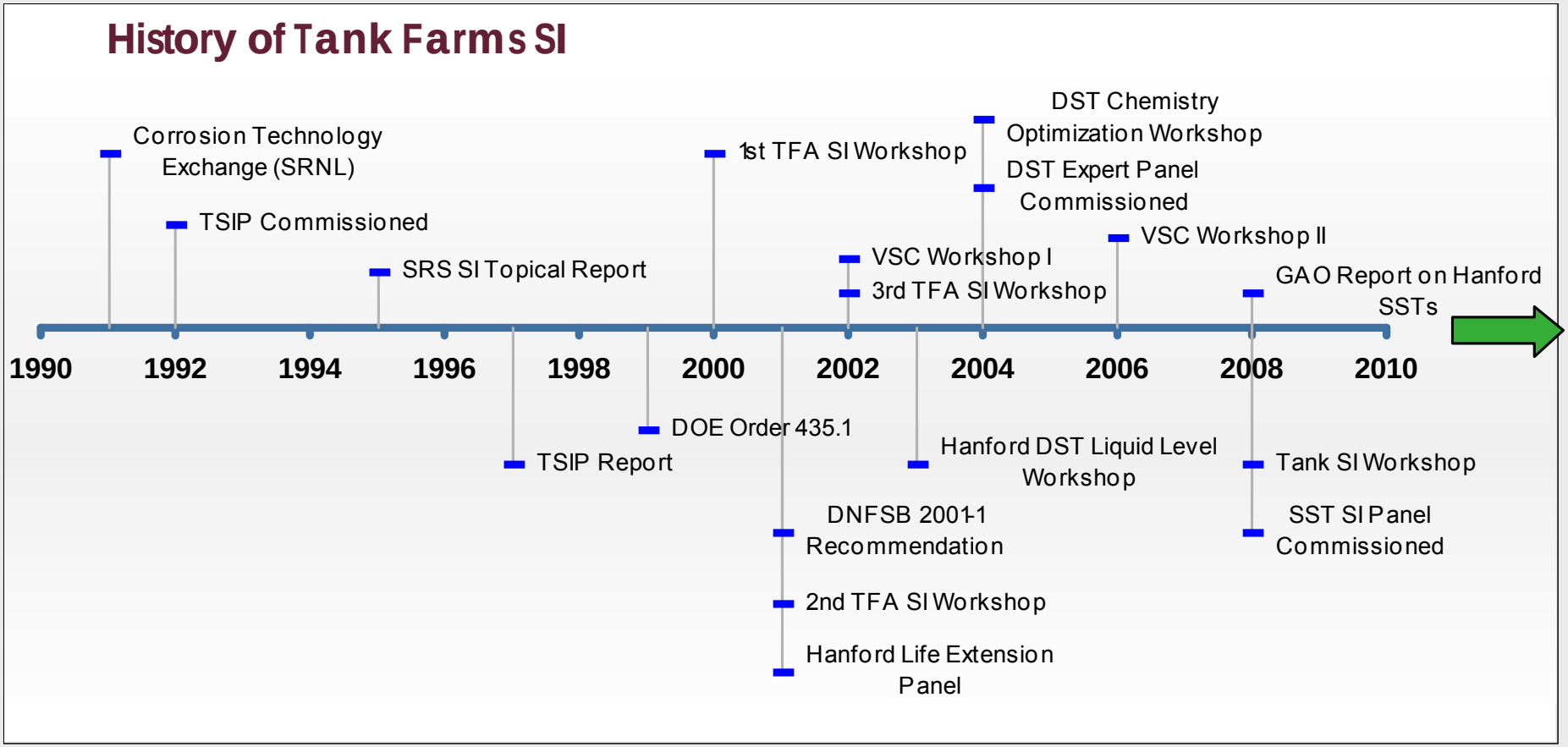

Structural Integrity Program Integration

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- Evolve and maintain an integrated life management program for structural integrity of DOE high level waste tank systems

- *Identification of Aging Mechanisms*
- *Quantification of the Degree of Degradation*
- *Evaluation of the Effect of Degradation on Tank Integrity*
- *Verification of Leak Tightness (for non-leaking tanks)*
- *Verification of Structural Adequacy*

Structural Integrity Programs

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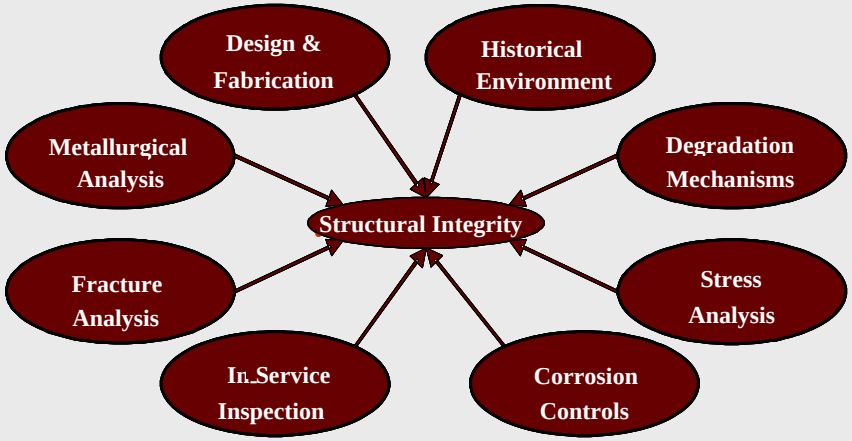

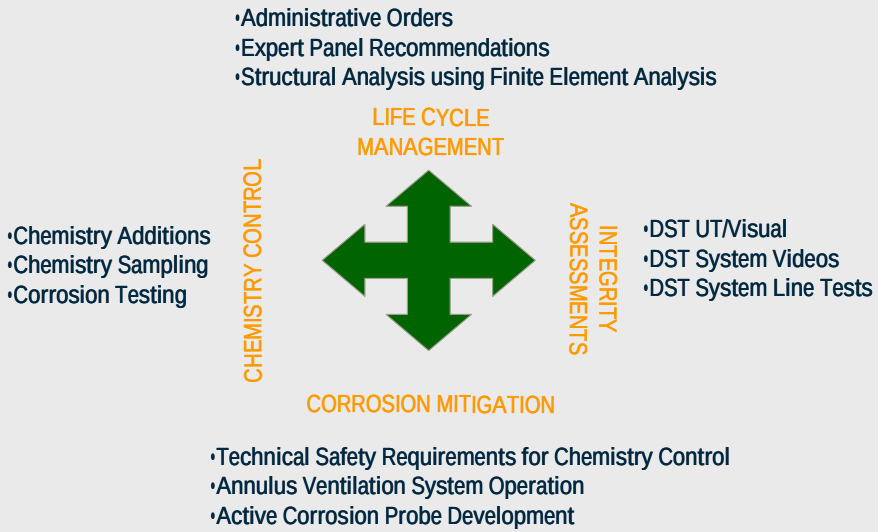

- SI program elements at SRS and Hanford are technically similar
  - Corrosion chemistry control
  - Structural Analyses
  - In-service inspection
- Site specific regulatory drivers dictate some differences in SI programs

Structural Integrity (SI) Program Integration

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- Chartered a Structural Integrity Working Group (SIWOG)
- Chartered issue-specific task teams that will address key facets of the SI program at each of the sites.
- Performing a detailed review of the SI programs at each of the sites
- Publish a “living” reference document that will provide the technical bases for an integrated SI program.

Orders, Agreements, Permits and Guidelines

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DOE Order 435.1-1

SRS

- Federal Facility Agreement
- SCDHEC Industrial Waste Water Permit
- Tank Structural Integrity Panel Guidelines (TSIP), BNL-52527

Hanford

- Federal Facility Agreement
- Hanford Site Permit
- Tank Structural Integrity Panel Guidelines, BNL-52527

Aging Mechanisms

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- Analytical laboratory tests completed to assess key degradation mechanisms identified through the tanks inventory history and inspections
- Suspected impacts addressed through structural calculations and technical reports
- New mechanisms identified through inspections and laboratory analysis

Hanford

- Analytical laboratory tests completed to assess key degradation mechanisms identified through the tanks inventory history and inspections
- Expert Panel Recommendations for Hanford Double-Shell Tank Life Extension
- Suspected impacts addressed through structural calculations
- New mechanisms identified through inspections and laboratory analysis

Corrosion Mitigation Through Chemistry Control

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SRS

- A chemistry control program is developed to mitigate the effects of corrosive agents through the use of inhibitors
- The tanks are continuously monitored for compliance
- Controls revised to address changing missions

Hanford

- A chemistry control program is developed to mitigate the effects of corrosive agents through the use of inhibitors
- The tanks are continuously monitored for compliance
- Controls revised to address changing missions

Comparison of Programs: Chemistry Control

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Applicability	Parameter	SRS [Minimum Inhibitor M]		Hanford [M]
$5.5 \le [NO_3^-] \le 8.5$	$[OH^-]$	0.6		Not Allowed
	$[OH^-] + [NO_2^-]$	1.1		
2.75 (3.0 Hanford) $\le [NO_3^-] < 5.5$	$[OH^-]$	0.3		0.3 but not > 10 for Waste Temp < 100°C 0.3 but not > 4 for Waste Temp ≥ 100°C
	$[OH^-] + [NO_2^-]$	1.1		1.2
$1.0 \le [NO_3^-] \le 2.75$ (3.0 Hanford)	$[OH^-]$	$0.1*[NO_3^-]$		$0.1*[NO_3^-]$ but not >10 for Waste Temp < 100°C $0.1*[NO_3^-]$ but not >4 for Waste Temp > 100°C
	$[OH^-] + [NO_2^-]$	$0.4*[NO_3^-]$		$> 0.4*[NO_3^-]$
$[NO_3^-] < 1.0$ (Hanford) $0.02 \le [NO_3^-] < 1.0$ (SRS)	$[OH^-]$	1.0M	pH > 10.3	pH > 12 but not > 8M for Waste Temp < 75°C pH > 12 but not > 5M for Waste Temp < 100°C pH > 12 but not > 4M for Waste Temp > 100°C
		OR	AND	
	$[NO_2^-]$	n/a	1.66* $[NO_3^-]$ for Temp ≤ 40 °C plus limits based on chloride and sulfate	0.01 but not > 5.5
	$[OH^-] + [NO_2^-]$			$[NO_3^-] < 2.5 * ([OH^-] + [NO_2^-])$
$[NO_3^-] < 0.02$	$[OH^-]$	1.0M	pH > 10.3	None defined
		OR	AND	
	$[NO_2^-]$	n/a	0.033 Temp ≤ 40 °C plus limits based on chloride and sulfate	

Inspections

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- Visual inspections of the annuli looking at the primary tank and secondary liner
- Visual inspection of the interior of the Type IV primary tank
- Ultrasonic inspection of the primary tank and secondary liner
- Results compiled in the Tank Integrity Inspection Report for each tank

Hanford

- Visual inspections of the annuli looking at the primary tank and secondary liner
- Visual inspection of the interior of the primary tank
- Ultrasonic inspection of the primary tank and secondary liner
- Results compiled in the Tank Integrity Inspection Report for each tank

Program Integration Activities

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- Structural integrity workshop: Technology Development Roadmap
  - Corrosion chemistry
  - Inspection and Monitoring
  - Structural Analyses
- 2nd SI Workshop to focus on non-destructive evaluation techniques
- Double Shell Tank Expert Panel 2008-2009
- Single Shell Tank Expert Panel 2009

Benefits

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- Core structural integrity team has intimate knowledge of safe operations/processes including all key elements of SI
  - Recognized for multiple materials corrosion, life management, and structural integrity issues across high level waste complex
- Integrated between tank farm operations/engineering, national laboratories, DOE, DNFSB, and stakeholders
- Standardization of structural integrity approach
- Realize economic benefits for integrated approaches in technology development for multiple sites

Contact

URS
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Karthik Subramanian

Karthik.subramanian@srs.gov

803-208-8715