OFFICE OF
RIVER PROTECTION
United States Department of Energy

Hanford Tank Integrity Program

Hanford Advisory Board
Tank Waste Committee

Presented by: **Jeremy Johnson, DOE Office of River Protection**

June 19, 2018

Agenda

- **Integrity Program Purpose and Overview**
- **Areas of Interest from Recent Inspections and Reviews**
  - AY-102 waste chemistry analysis
  - Liquid-Air Interface (LAI) of tanks that receive condensate from AY and AZ ventilation
  - Floor of secondary liner in some DSTs
- **Tank Integrity Expert Panel Engagement**
- **Path Forward**

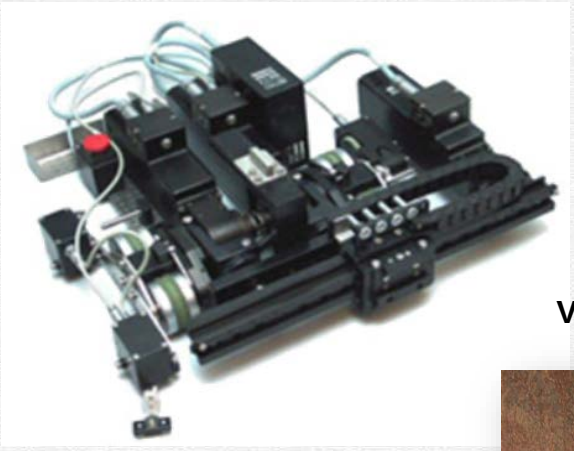
Integrity Program Mission

- **Primary objectives of the DST Integrity Program include:**
  - Maintain DSTs to safely store and transfer mixed radioactive waste for treatment
  - Monitor tank integrity to inform management decisions
  - Monitor tank corrosion

Integrity Program Scope

- Primary tank wall and annulus floor inspected (video every ~3 years, ultrasonic every ~10 years)
- Waste chemistry corrosion control laboratory testing
- 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 support facilities such as the 242-A Evaporator

Ultrasonic Testing Crawler



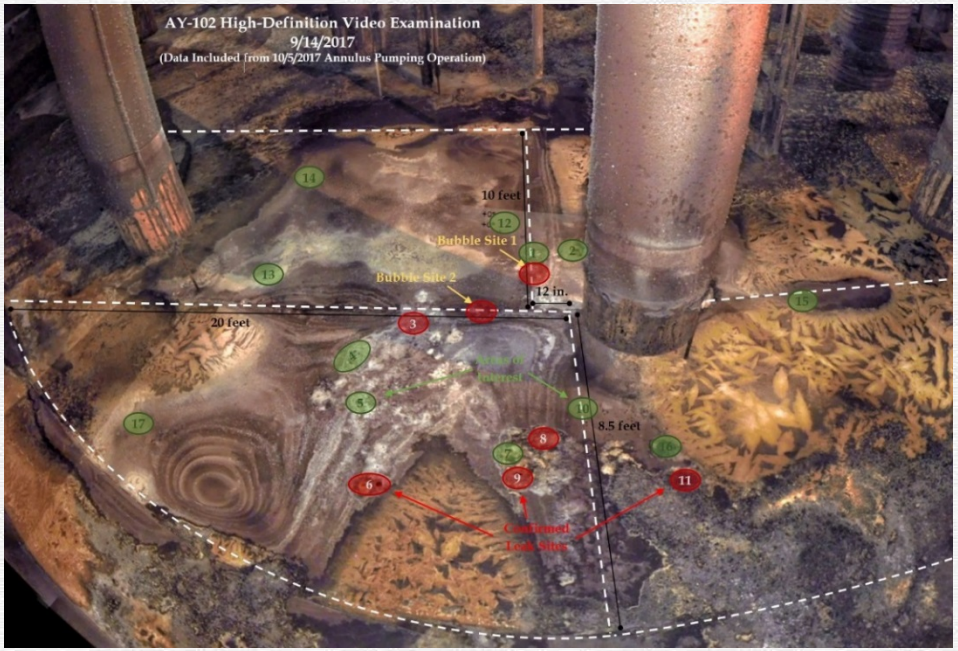
Visual Inspection Crawler

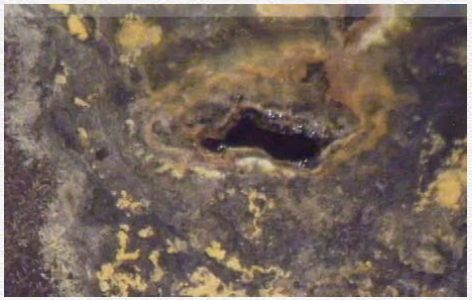
PTZ Camera Systems

Findings & Areas of Interest

Chemistry Analysis

- AY-101, AZ-101, and AZ-102 may have held waste with chemistry similar to AY-102
- The results of this study should not be interpreted as indicating that any of the DST's are currently leaking, or will leak, from the primary liner to the secondary liner, or from the tank to the environment
- **Current actions:**
  - Evaluating available information to assess possible implications for other tanks
  - Performing core sampling of tank bottom layers to evaluate local conditions
  - Revising chemistry control testing and program to improve protection against pitting corrosion
  - Developing tank bottom inspection tool to provide visual and volumetric examination capability
  - Identify additional characterization needs and to develop strategies to minimize the risk of leakage

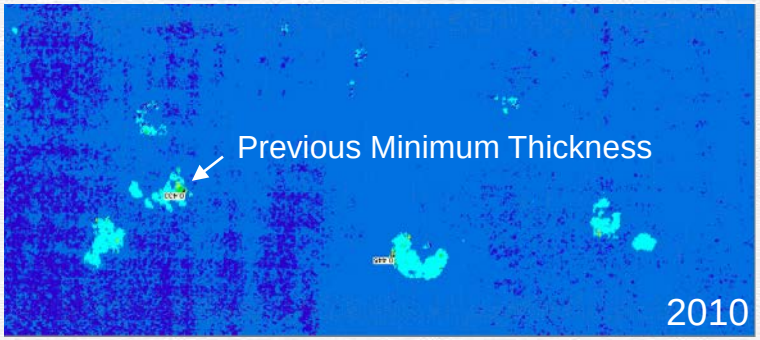


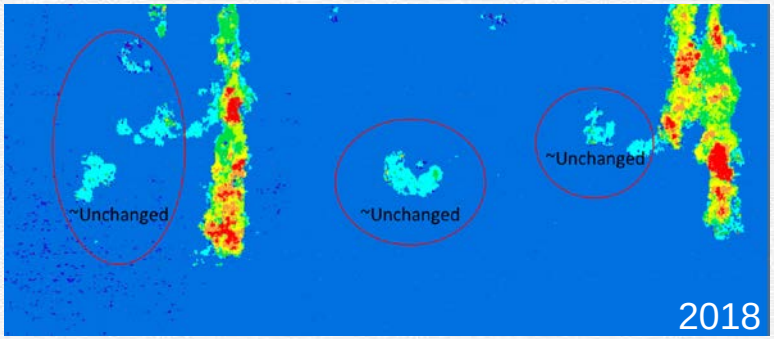


High definition visual of bottom of AY-102 indicated severe pitting – at least seven failure points have been identified

Liquid to Air Interface (LAI)

- AY-101 and AZ-102 receive condensate from AY and AZ ventilation systems, which may form potentially corrosive layer
- Amount of condensate addition is unique to AY-101 and AZ-102 due to high waste temperatures in AY and AZ Tank Farms
- Ultrasonic testing has been conducted on Tank AY-101 many times with liquid-to-air interface scans as a primary focus and is now complete for 2018
- 2018 inspection identified additional degradation that was not present in prior inspections (~26-33% max loss from 0.500” nominal)

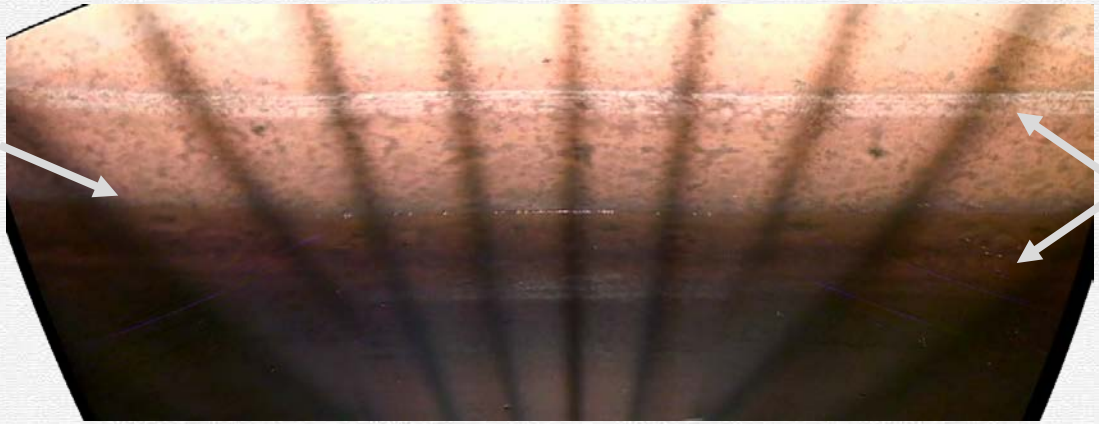




Liquid to Air Interface

- Ultrasonic testing in AY-101 found similar degradation results around the tank circumference
- Primary tank interior visual inspection was performed alongside waste sampling operations for AY-101 and AZ-102
- Tank AY-101 & AZ-102 recirculation performed
- Tank AZ-102 ultrasonic testing has been accelerated into the 2018 fiscal year
- Changes to Operations
  - Use tanker truck to transfer condensate to Effluent Treatment Facility
  - Implement additional controls to recirculate AY-101 and AZ-102 more frequently if condensate is added

Waste Surface (~345”)



Historic LAI

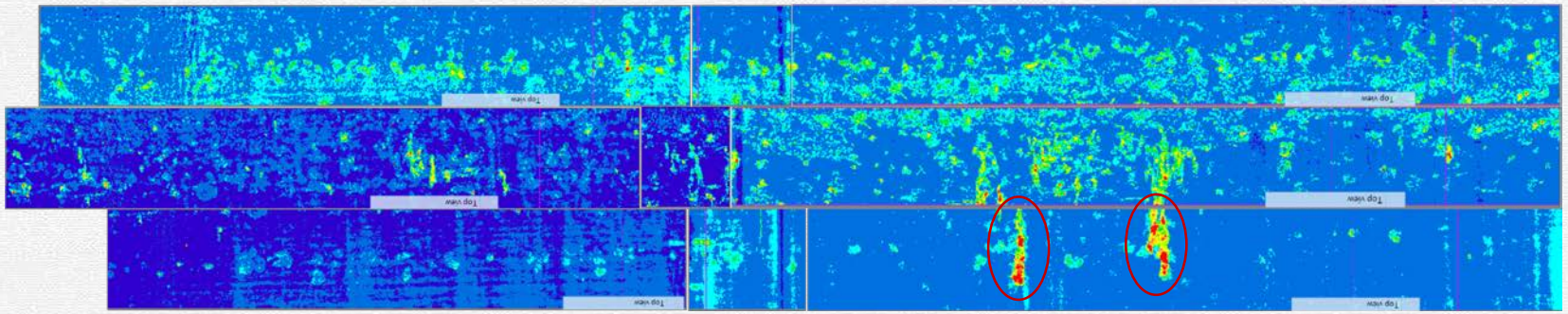
AY-101 looking straight at interior wall

Liquid to Air Interface

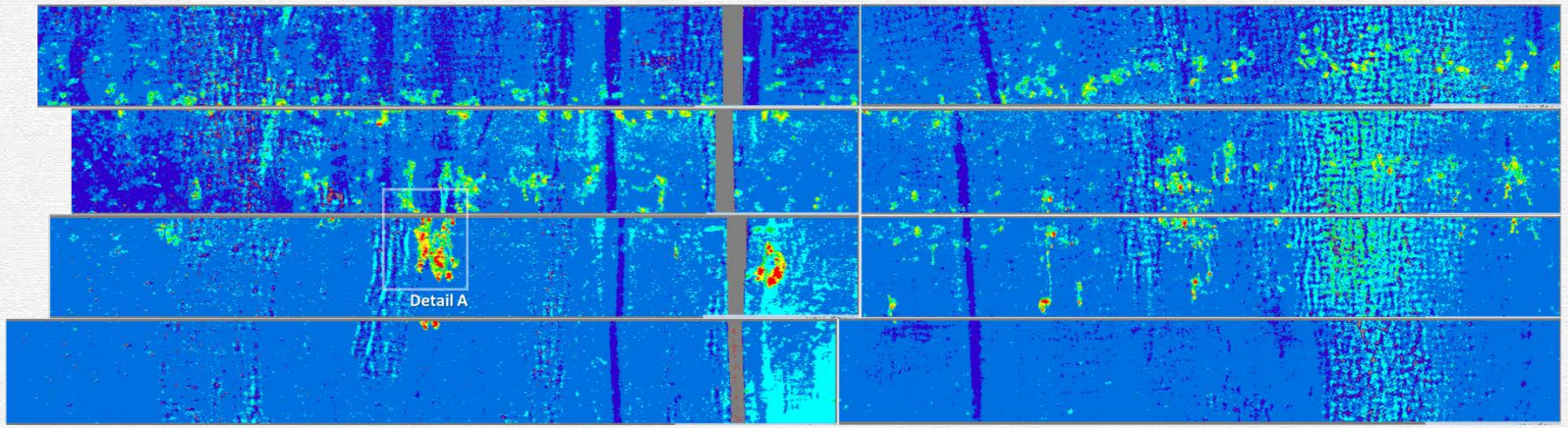
- Pictures show scan results from tank AY-101 LAI region
- Each scan is ~20 feet x 15 inches
- Material thickness is represented by the color scale below
- Red regions represent highest areas of loss due to localized corrosion

357 inches

312 inches



357 inches

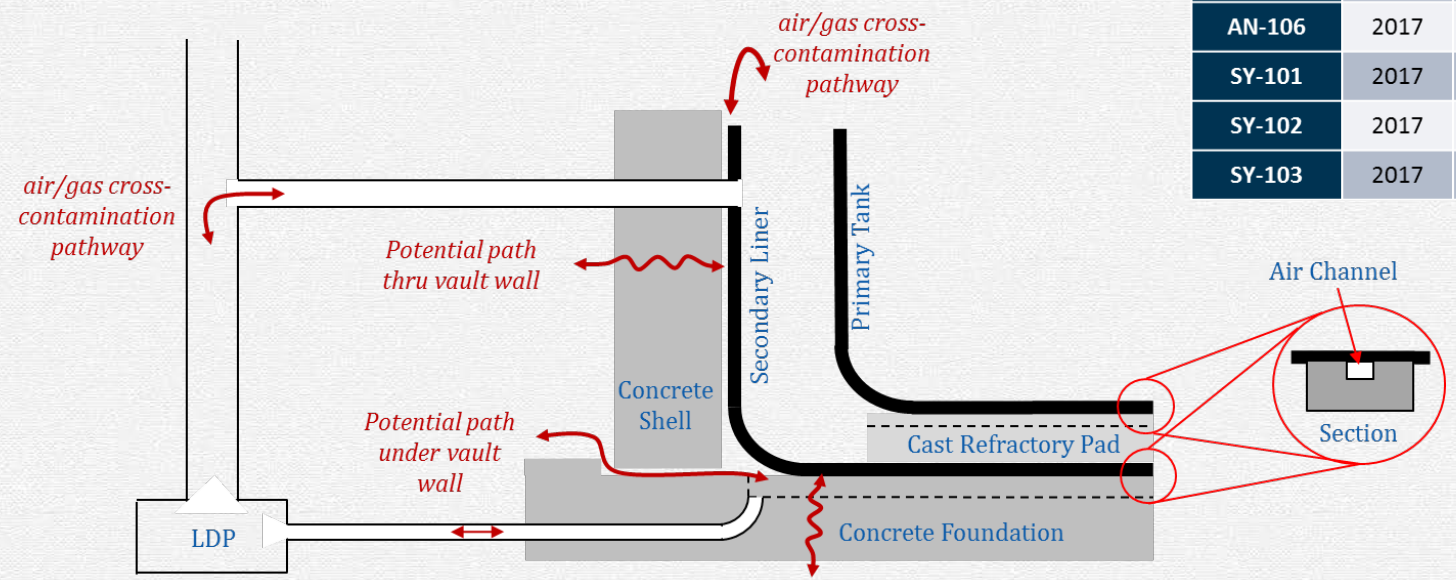


297 inches

Secondary Liner Analyses

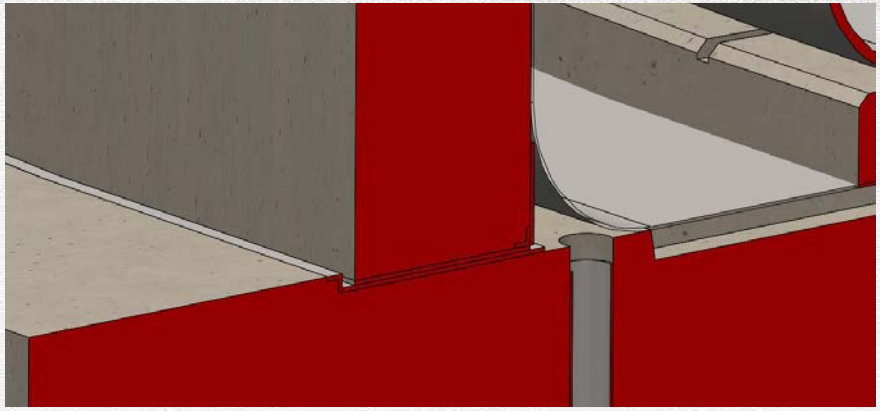
- Moisture can flow through and/or around the concrete shell and into the foundation of the DSTs
- No keyway or water stop between the shell and foundation
- Exposes secondary liner to moisture
- Annulus exhaust system helps draw moisture in

Tank	Year	Max % Thinning	Area Examined
AN-105	1999	0.2%	10 ft^2
AN-107	1999	10.0%	8 ft^2
AN-105	2006	3.6%	10 ft^2
AP-106	2014	2.20%	9.8 ft^2
AP-102	2014	70.2%	52 ft^2
AN-103	2015	23.8%	65 ft^2
AN-104	2015	39.6%	69 ft^2
AW-103	2016	19.4%	66 ft^2
AN-105	2016	29.8%	62 ft^2
AN-106	2017	9.6%	60 ft^2
SY-101	2017	23%	52 ft^2
SY-102	2017	13.6%	53 ft^2
SY-103	2017	17.6%	58 ft^2

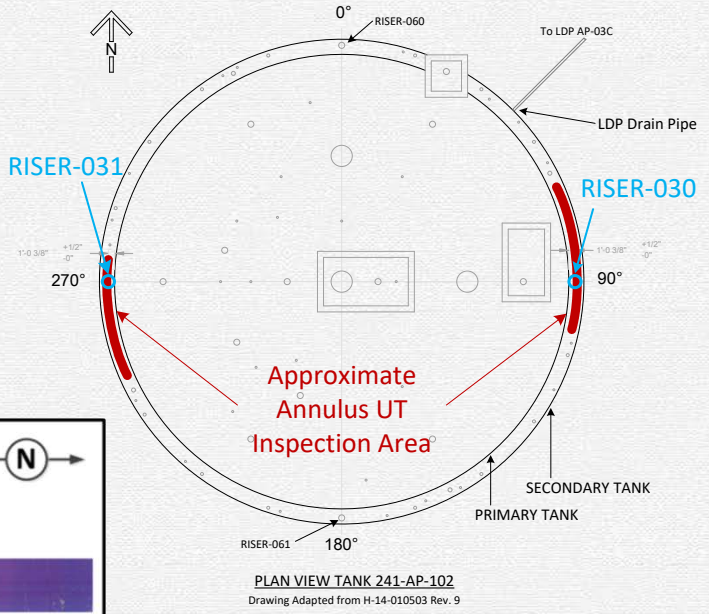


Secondary Liner Analyses

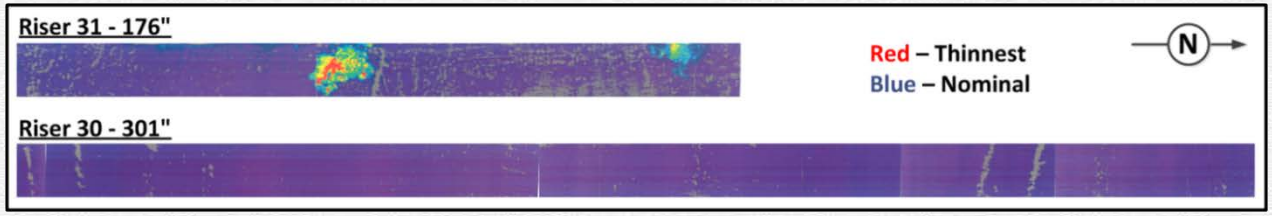
- UT scans of annulus floor began following AY-102 and as recommended by Tank Integrity Expert Panel (TIEP)
- 9 of 11 tanks tested show reduction from nominal
- Next steps include
  - Protecting DST secondary liner exteriors from water intrusion and humidity
  - Evaluating effectiveness of application of corrosion inhibitors
- Evaluation of potential tank repair techniques underway for localized areas of corrosion



Above: Close up of secondary liner



PLAN VIEW TANK 241-AP-102
Drawing Adapted from H-14-010503 Rev. 9



Tank Integrity Expert Panel & Independent Assessments

Tank Integrity Expert Panel

- Comprised of experts from a variety of private and government organizations, including national laboratories
- Meets at least once a year
- Provide independent advice and recommendations on existing and emerging tank integrity issues with focus on safety
- Next meeting June 27-28

Tank Integrity Expert Panel last met June in Richland.

Current Members

- Andy Duncan, SRNL
- Brenda Garcia-Diaz, SRNL
- Russ Jones, GT Engineering
- Glenn Light, Southwest Research Institute
- Leon Stock
- Mike Rinker, PNNL
- Bob Sindelar, SRNL, Vice Chair
- Todd Martin, Chair/Facilitator

Tank Integrity Expert Panel

- Engaged in all facets of Hanford Tank Integrity including emerging technical findings
- In recent years, the Panel has assisted with decisions regarding the following major areas as well as many others:
  - Forensic examination of tank AY-102 failure mechanisms and repair/reuse decision
  - Chemistry control and treatment of AY-102 annulus waste
  - Expansion of secondary liner examinations and evaluation of mitigation options
  - Waste chemistry control program corrosion testing to understand and mitigate pitting corrosion of the DSTs
  - Primary tank bottom technology development of visual and volumetric solutions

IQRPE Assessments

- **Independent, Qualified, Registered Professional Engineer (IQRPE)** Assessments are conducted on a periodic basis in addition to the ongoing integrity programs at Hanford
- Must be performed by IQRPE and "certified" that the "system will not collapse, rupture or fail"
- **DSTs**
  - 2016 final report issued - no findings, 24 recommendations
  - DST system is fit for use and reassessment recommended in 10 years (2026)
- **SSTs**
  - Structural assessment only
  - 2002 assessment found all SSTs structurally sound until ~~end of mission (then~~ 2018~~)~~ but with no guarantee of leak integrity
  - Reassessment of structural integrity is in process with report to be issued this fiscal year (TPA Interim Milestone M-045-91I, due 9/30/2018)

Path Forward

- Continued focus on Tank Integrity Program
- Continue support for the Tank Integrity Expert Panel
- Continue involvement with regulators and stakeholders