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Hanford Tank Integrity

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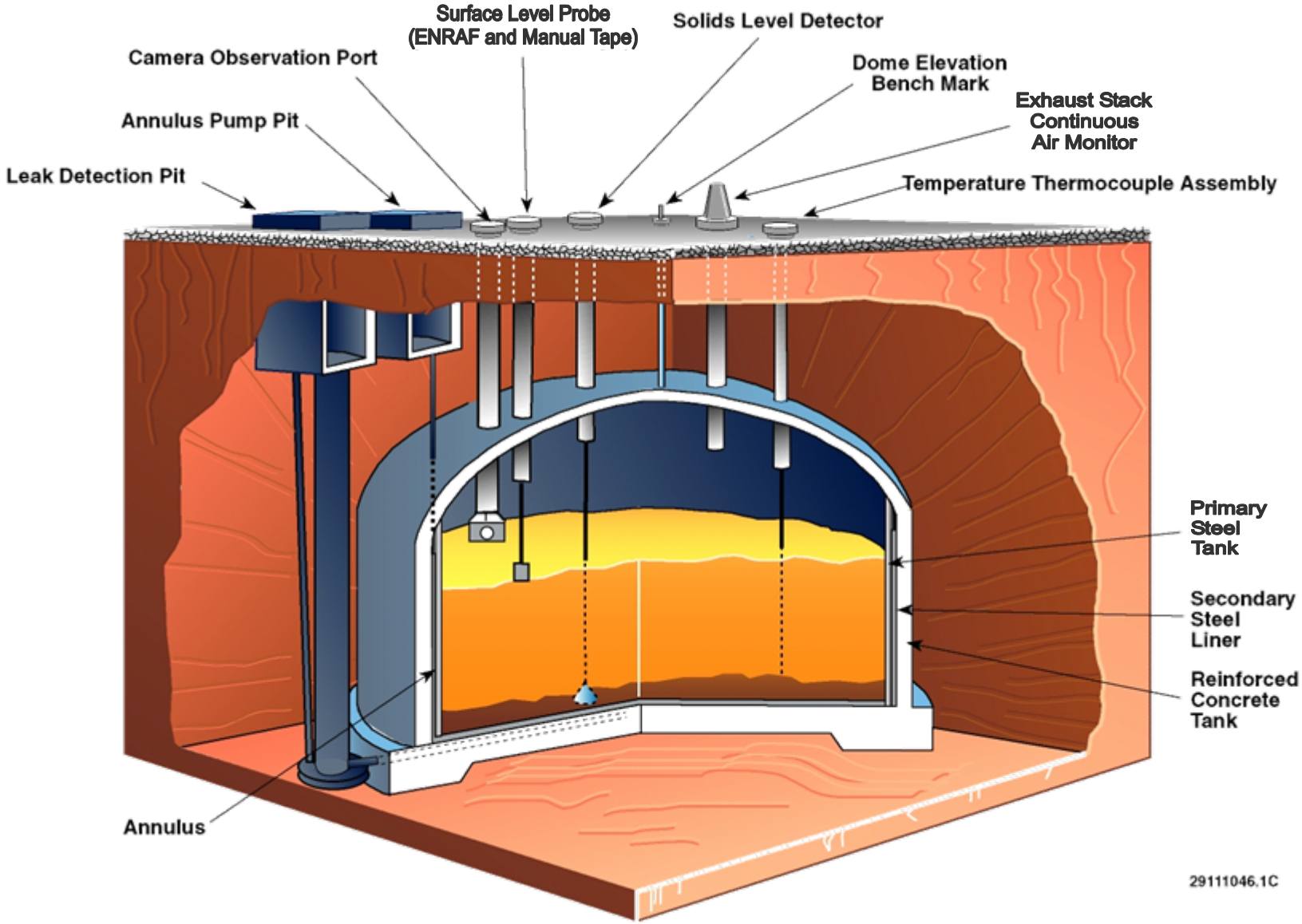
Overview of Tank Integrity

- Tank History
- Double-Shell Tank Integrity Project
  - Objectives
  - Inspections
  - Chemistry Control
  - Recovery Plans
- Single-Shell Tank Integrity Project
  - Objectives
  - Structural Integrity and Leak Monitoring
  - SST Integrity Panel
  - Future work

Double-Shell Tank Design and Construction



DST Integrity System Objectives

- Assure continued tank integrity
  - Maintain 28 Double-Shell Tanks to safely store and transfer 53 Million gallons of highly radioactive chemical waste for treatment
  - Extend DSTs lives from 20 to 50 years to 100 years
  - Provide sufficient assurance of tank integrity to allow for repair and replacement
  - Prevent the need for additional tanks (up to $100 M per tank).
- Status tank corrosion
  - Monitor with ultrasonic testing, visual inspections, and corrosion monitoring to project tank corrosion to facilitate corrosion minimization and safe operations
  - Provide advanced notice of repair or replacement requirements
- Meet RCRA monitoring legal requirements as a result of proactive project activities.
- DST System Infrastructure
  - Piping and pits to support transfer system
  - Piping cathodic protection system
  - 242-A Evaporator, AZ-301, and 204 AR

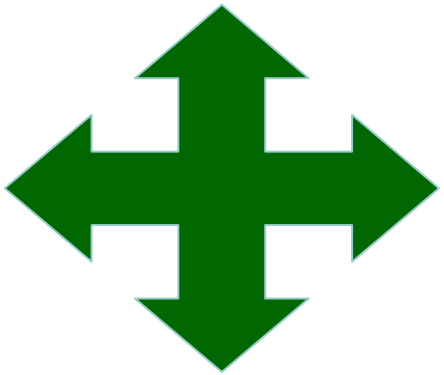
Double-shell Tank Integrity Program (DSTIP)

LIFE CYCLE MANAGEMENT

- Regulatory Certification of DST System
- Expert Panel Recommendations
- Structural Analysis using Finite Element Analysis

CHEMISTRY CONTROL

- Chemistry Additions
- Chemistry Sampling
- Corrosion Testing
- Corrosion Probe Data Collection and Analysis



INTEGRITY ASSESSMENTS

- DST UT/Visual
- DST System Videos
- DST System Line Tests
- DST Pit Inspections
- DST Facility Integrity Assessments

CORROSION MITIGATION

- Technical Safety Requirements for Chemistry Control
- Annulus Ventilation System Operation
- Corrosion Probe Development
- Laboratory Testing

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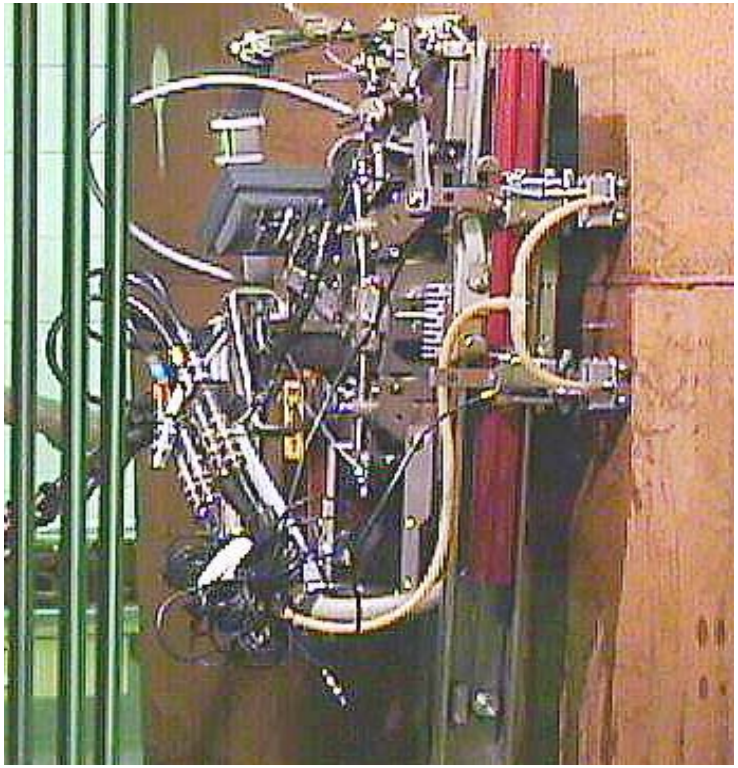
Ultrasonic Testing with Force Institute P Scan

- UT examinations on 8 to 10 year cycle
  - Scan four 15 inch wide swaths
  - Inspection 10 foot sections vertical and horizontal welds
- Inspection areas of liquid air interface



- Conduct additional scans based on tank use (e.g., Tank 241-AY-101)

Visual Examinations

- Types of Visual Examinations
  - Interior Inspection
    - Primary tank above the waste examined as part of the integrity visual examination in one riser located in the primary
  - Annulus Inspection
    - Integrity
      - Conducted on a five to seven year interval
      - Examine entire height of annulus in four risers with one located in each quadrant of the tank
      - Riser selection should consider re-examine previously examined area of interest
    - Water intrusion
      - Conducted in one tank in each farm every two years
      - Examine convergence of primary tank and secondary liner in four risers in at least three quadrants
      - Conducted annually for tank farm under TSR recovery plans

Double-Shell Tank Chemistry Control

- Control the chemistry within the DSTs as defined in Administrative Control 5.16 “Corrosion Mitigation Controls”
- Optimizing chemistry to protect the DSTs
  - Maintain established pH and nitrite ranges
  - Implement refined pH and nitrite ranges as they are proven
  - Implement carbonate ranges for applicable environments
  - Define requirements for corrosion probe surveillance
- Reduce treatment costs of unnecessary sodium hydroxide additions
- Optimize use of tank space by eliminating unnecessary chemical additions

Double-Shell Tank Corrosion Monitoring

- Developed and installed multiple generations of corrosion monitoring probes
- Current probes:
  - Corrosion monitoring sensors transmit tank Corrosion Potential (E_{corr}) and Electrical Resistance (ER)
  - Metal coupons for destructive verification
- Provides critical support for Waste Chemistry Optimization

Probe contains three reference electrodes, three secondary reference electrodes, ER, and metal coupons.

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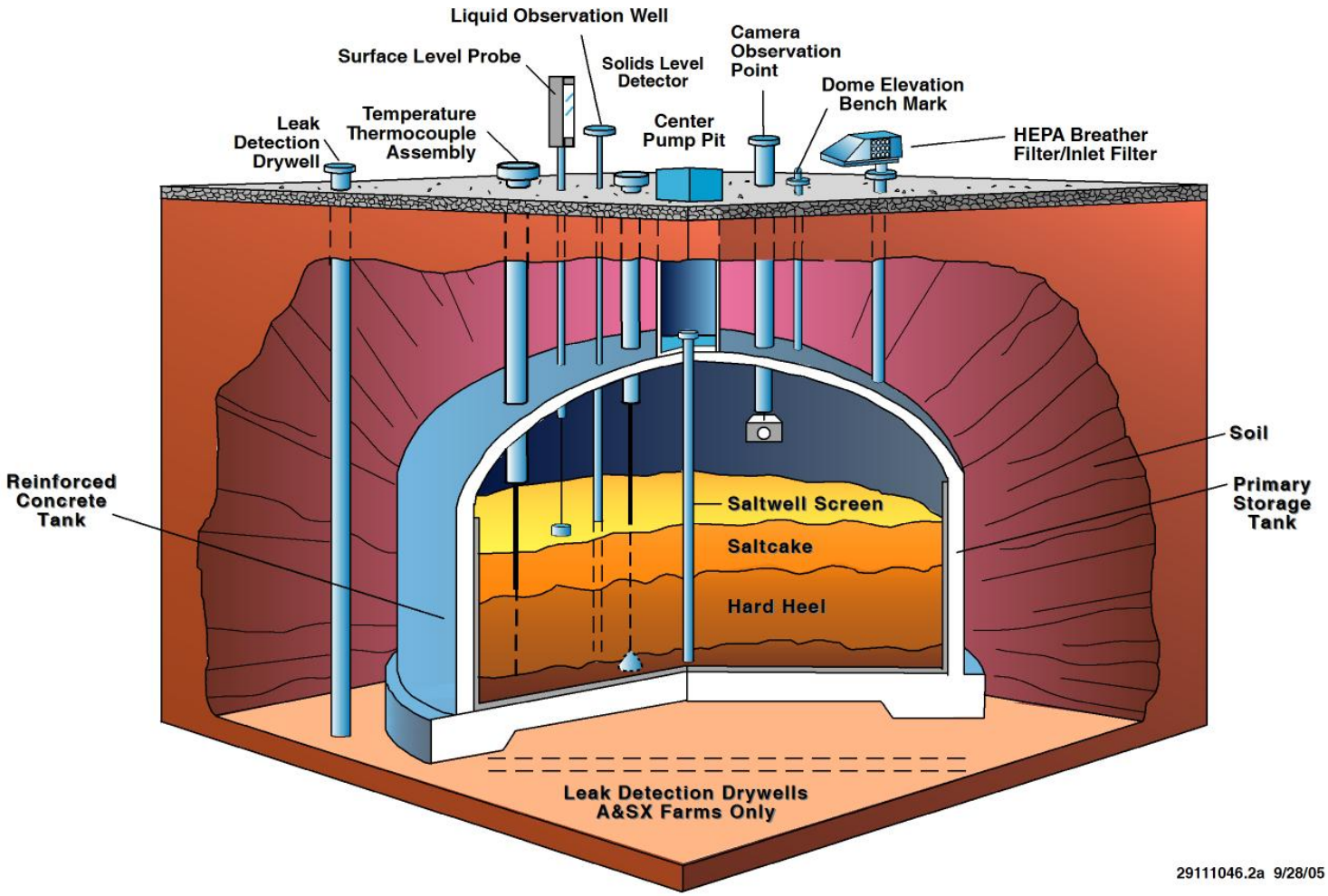
Single-Shell Tanks Design and Construction



Overview of Single-Shell Tank Integrity Project

- Current Activities to Ensure Single-Shell Tank (SST) Structural Integrity and Leak Integrity Monitoring

- Activities are underway to implement enhancements to the SST Integrity Project (SSTIP)

Assessments SST Structural Integrity and Leak Integrity

- Dome Deflection Surveys
- SST Structural Analysis of Record (2002)
  - RPP-10435 Single-Shell Tank Integrity Assessment Report
  - RPP-11802 Summary of the Single-Shell Analysis of Record
- Photo/Video Archives (Dome Interior)
- Leak History Archive
- Vadose Zone Inventory Estimate
- Surveillance
  - Liquid Observation Wells (LOWs), Drywell Monitoring, and ENRAFs
  - Material Balance during Retrieval and Waste Retrieval Waste Leakage Minimization
- High Resolution Resistivity (HRR) Leak Detection and Monitoring (LDM) System
- Subsurface Geophysical Exploration (SGE) Technology
- TFC-ENG-CHEM-D-42 Formal Tank Leak Assessment Process

Single-Shell Tanks Design and Construction

Mike Terry Chair
Todd Martin Co-Chair
Mike Rinker Analysis Lead

Bruce Thompson
Non-Destructive Evaluation

Bob Kennedy
Structural and
Seismic Analysis

Russ Jones
Materials

Karthik Subramanian
Corrosion

Steve Cullen
Soil and Vadose
Zone Analysis

Leon Stock
Waste Chemistry

John Beavers
Stress Corrosion Cracking

Jerry Frankel
and
Bruce Wiersma
Electrochemistry

Panel has met for 2 workshops

SSTIP Findings

- A catastrophic failure of the tanks under non-seismic loading is not a likely event.
  - Primary structural concern is the condition of the rebar and there are currently no signs that rebar has corroded significantly in the dome.
- Future efforts should be focused on meeting clearly defined programmatic needs
- Demonstrate the leak integrity of sound tanks
- Develop deployable NDE screening and characterization technique(s)
- Assess methods to improve leak integrity of sound tanks for extended mission

SSTIP Leak Integrity Recommendations

- Continue current leak detection and monitoring activities
- Compare supernatant levels and chemistry to identify most likely to form new Stress Corrosion Cracking and leaks
- Understand liquid leakage from saltcake and sludge through cracks in liners
- Assess viability of electrochemical approach for sensing ionic path in cracked/leaking liners including EIS
- Assess techniques for liquid removal and liquid immobilization
- Assess methods for deposition of materials to cover leaks/cracks in liner and facilitate retrieval.
- Assess methods to improve leak integrity of sound tanks for extended mission: metal deposition or bladder

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Questions?

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