Hanford In-Service Inspections

Jason Engeman

Washington River
Protection Solutions

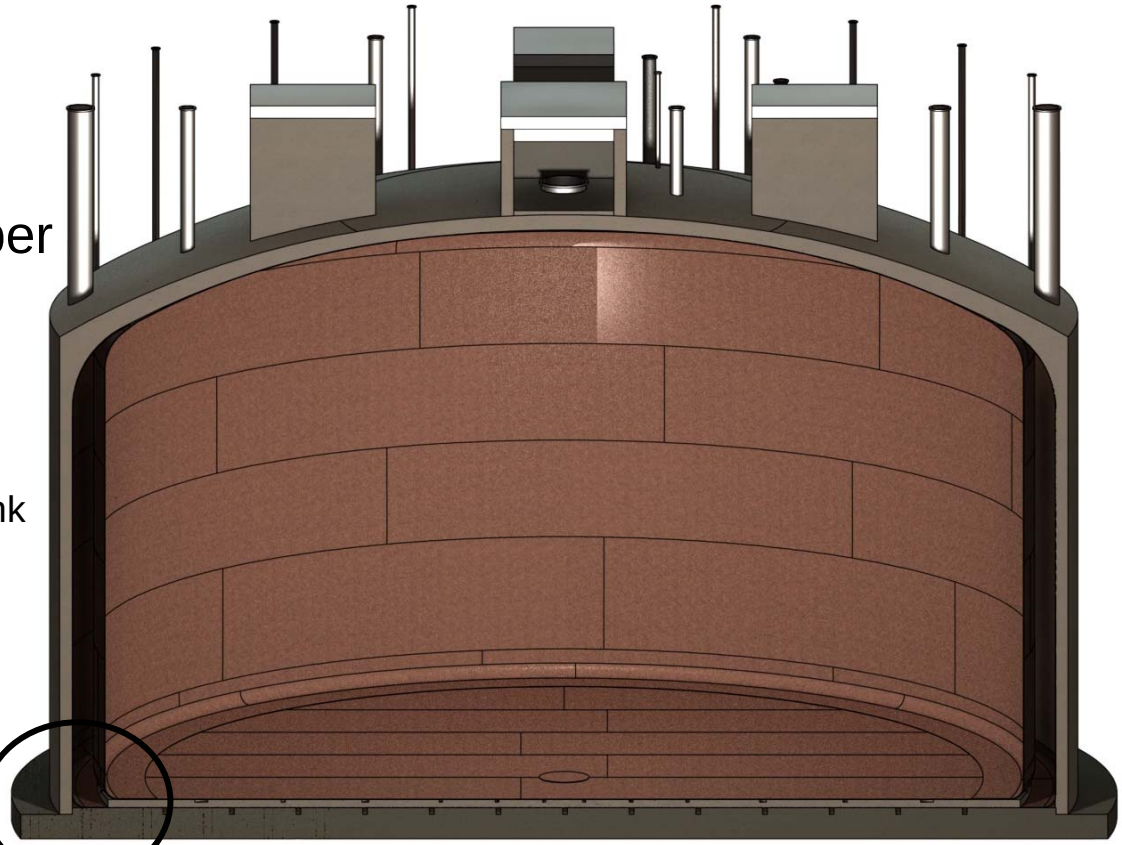
8/25/2009

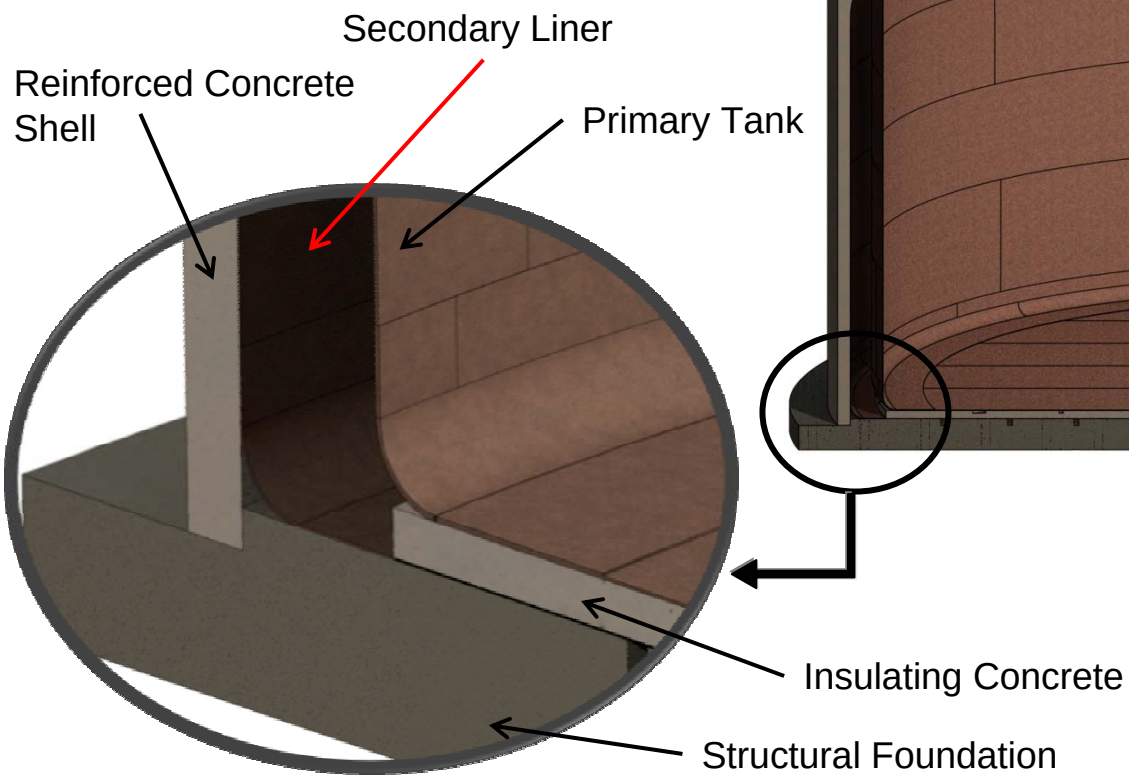
Agenda

- Double-Shell Tank and Single-Shell Tank Descriptions
- DST Steel Liner Inspections
  - Ultrasonic Testing
  - Visual Inspections
- Concrete Inspections
  - Dome Survey and Loads
  - Past Visual Inspections
  - Past Core Samples
- SST Inspection Program
  - FY2010 Visual Inspections
  - Technology

Double-Shell Tank Description

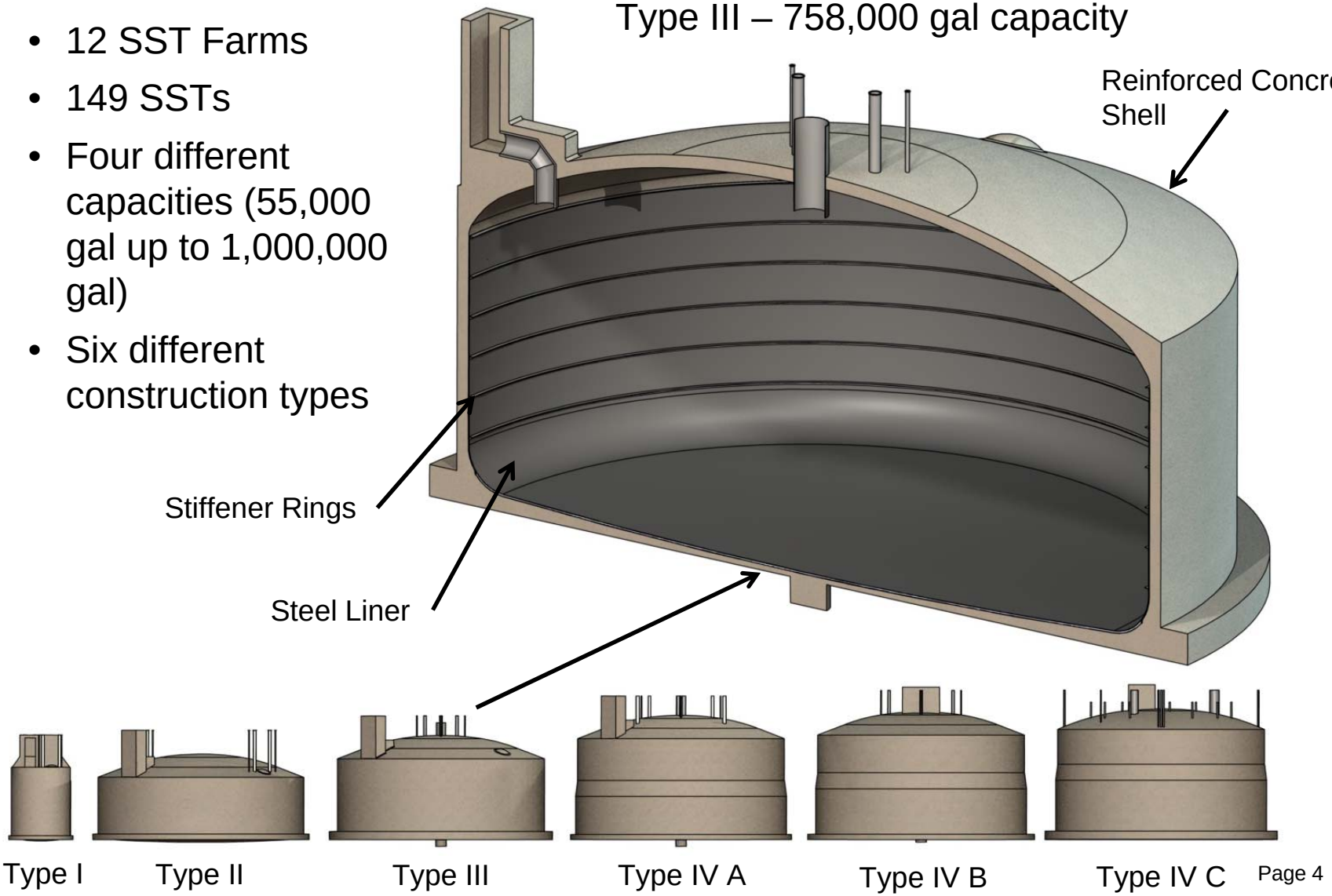
- Six DST Farms
- 28 DSTs
- 1,000,000 gal capacity per tank





Single-Shell Tank Description

- 12 SST Farms
- 149 SSTs
- Four different capacities (55,000 gal up to 1,000,000 gal)
- Six different construction types

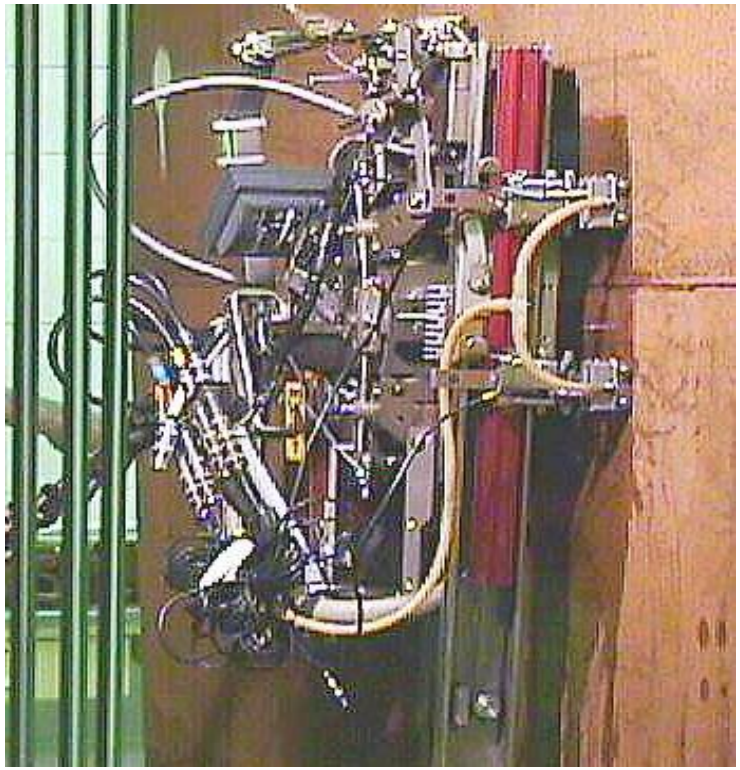


DST Ultrasonic Testing

- Ultrasonic Testing
  - Coverage Area
    - Four 15-inch wide vertical scans each being 35 feet long.
    - 20 feet of horizontal weld.
    - 20 feet of vertical weld.
    - Scan for thinning, pitting, and cracks.
  - Equipment
    - FORCE Technology PSP-4 and PSP-4Plus.
    - 0.035” x 0.035” resolution capability.

Ultrasonic Testing with Force Institute P Scan

- UT examinations on 8 to 10 year cycle
  - Scan 15-inch wide swaths
  - Inspection10 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)

DST Ultrasonic Inspections

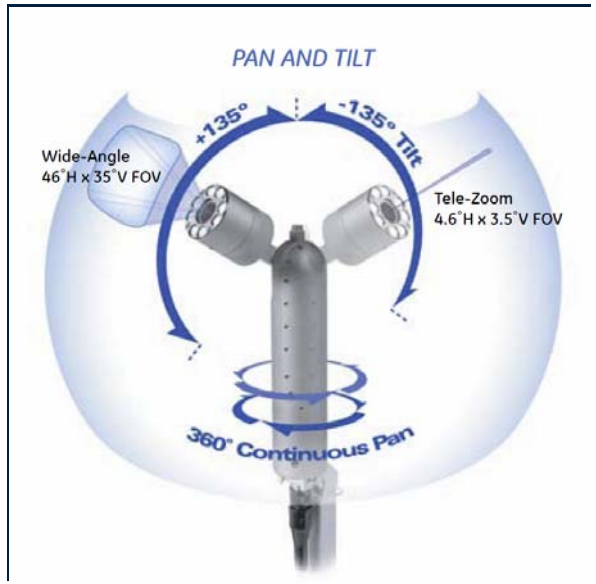
- Ultrasonic Testing
  - All 28 DSTs have been ultrasonically tested 12 DSTs have received the second round of testing.
  - General corrosion results
    - Tank wall experience little general corrosion
    - Data indicates that uncertainties exist between tank to tank wall thickness measurements.
      - Low general corrosion rates have been measured by coupons and Tafel slopes.
      - Performing uncertainty analysis to improve future measurements (e.g. surface conditions, temperatures, etc.).
  - Pit corrosion has been found in some tanks

DST Visual Inspections

- Visual Inspections
  - Coverage Area
    - Primary Inspections
      - 100% of the viewable primary tank wall and dome from a single tank penetration.
    - Annulus Inspections
      - ~42% of the exterior of the primary tank wall through four annulus penetrations
      - ~87% of the interior of the secondary liner through four annulus penetrations.
  - Inspection Frequency
    - Approximately every 5 years (not to exceed 7 years between inspections).
    - When ultrasonic testing of the primary tank exhibit conditions/indications requiring additional assessments.

DST Visual Inspections

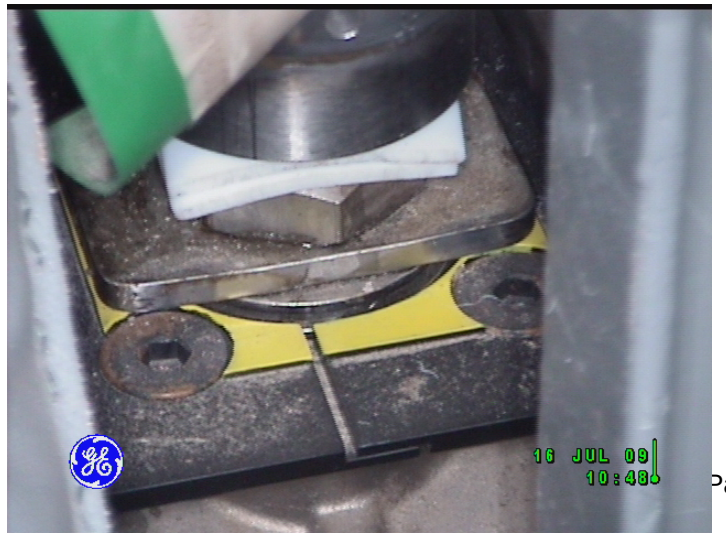
- Visual Inspections
  - Equipment
    - GE Inspection Technologies PTZ70
      - Fits through a 3-inch ID tank penetration.
      - 10X Optical / 4X Digital Zoom
      - 20W flood / 20W spot lighting using white LEDs.



GE Camera Equipment

241-AP-107 Annulus Circumferential Weld - 2007

241-AN-01A Pump Pit Valve Inspection

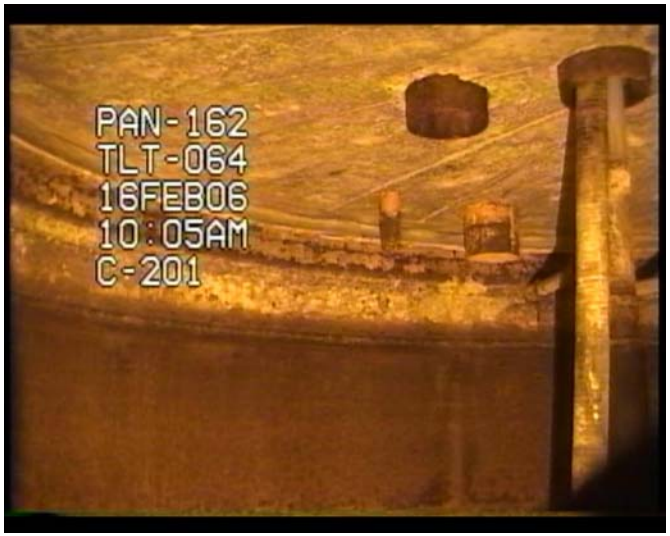


DST Visual Inspections

- Visual Inspections
  - Equipment
    - RJ Electronics
      - Fits through a 3-inch ID tank penetration.
      - 10X Optical / 4X Digital Zoom
      - Equipped with a single 71 watt lamp. Standard beam pattern is 15^0, but can be substituted for required lighting requirements (i.e. spot light versus flood light).
      - Pan scan range – 360^0(+/- 180^0). Not a continuous 360^0 pan.
      - Tilt scan range – 150^0 (straight down to 60^0 above horizontal).

RJ Electronics Camera Equipment

241-C-201 Concrete Dome Region - 2006



241-AY-102 Vertical Weld - 2006

DST Visual Inspection Results

- Visual Inspections Results
  - Primary Inspections
    - Light layer of corrosion throughout.
    - Weld regions contain increased corrosion relative to the rest of the tanks.
    - Historic liquid-air-interfaces show signs of past pitting in select DSTs.
  - Annulus Inspections
    - Most DST annuli display relatively very light corrosion (Exception: The 241-AY DSTs were subject to heavy corrosion ~10 years ago due to water intrusion into the annulus).
    - Mill scale still present in various tanks.
    - No tanks show signs of active water intrusion into the annulus.

DST Visual Inspection Challenges

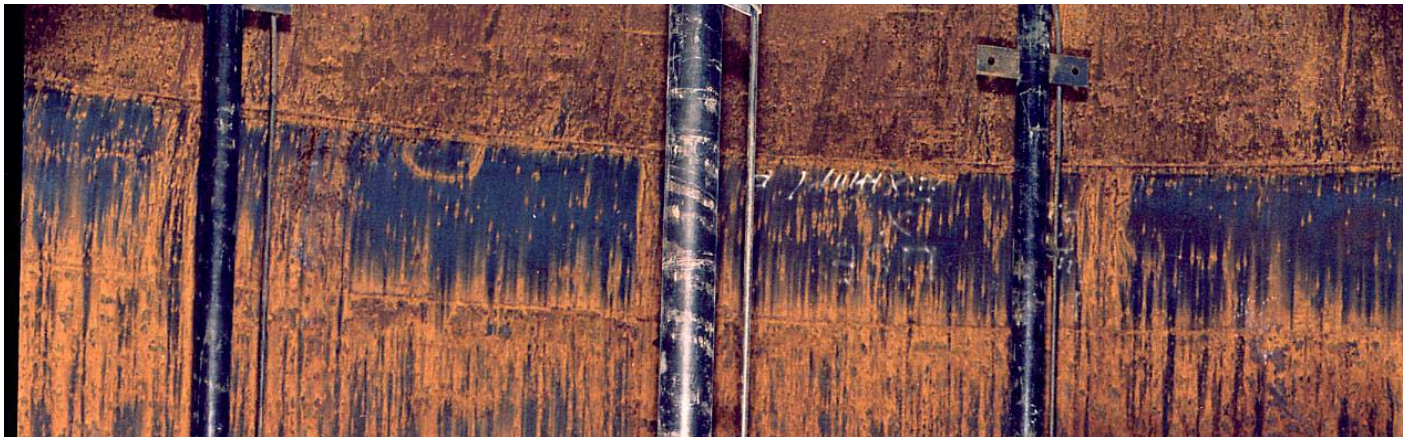
- Visual Inspections Challenges
  - Inadequate Primary Inspection Lighting
    - Reduces the effective zoom capability of the inspection camera.
    - Substituting “spot light” style lighting to achieve greater viewable distances creates shadows. This makes the determination and classification of anomalies substantially more difficult as well as limiting the overall viewable region due to the focal point of the light.
  - Limited Camera Resolution
    - Currently utilized 10X/4X optical/digital zoom is insufficient for inspections requiring more than general condition monitoring at 30+ feet from area of interest.

DST Primary Inspection Requirements

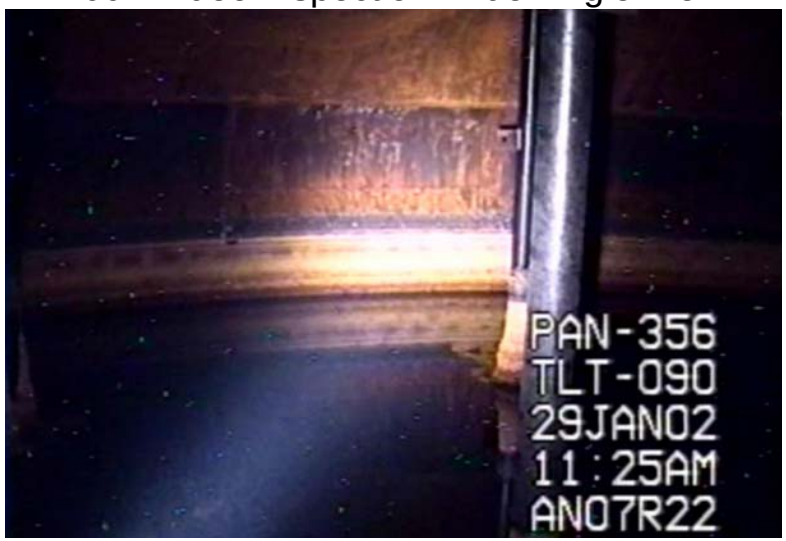
- Primary Tank Inspection Camera Requirements
  - Must utilize a Type X Purge System for use in various DSTs due to flammable gas control requirements.
  - Able to deploy through a 3-inch Schedule 40 pipe penetration.
  - Able to withstand ~100 R/hr radiation dose.
  - Remote operation by Hanford workforce.

Primary Tank Inspections

241-AN-107 Primary Tank Wall – 1980 Still Photography

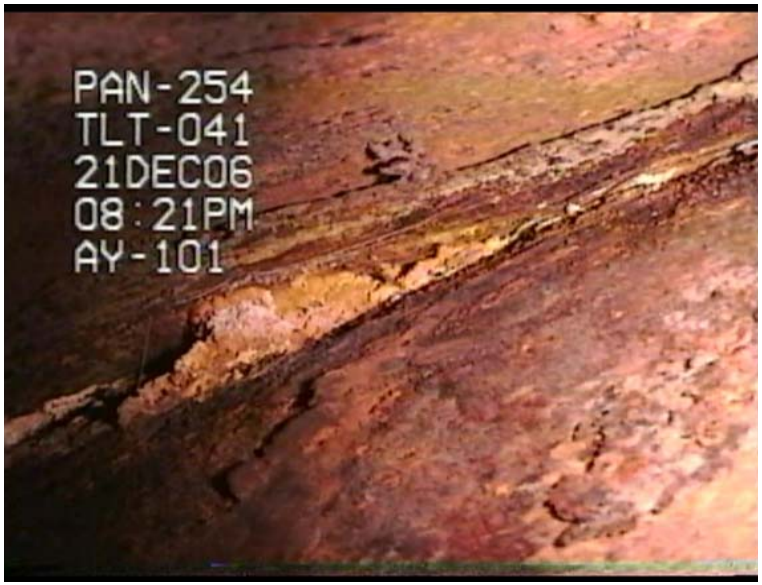


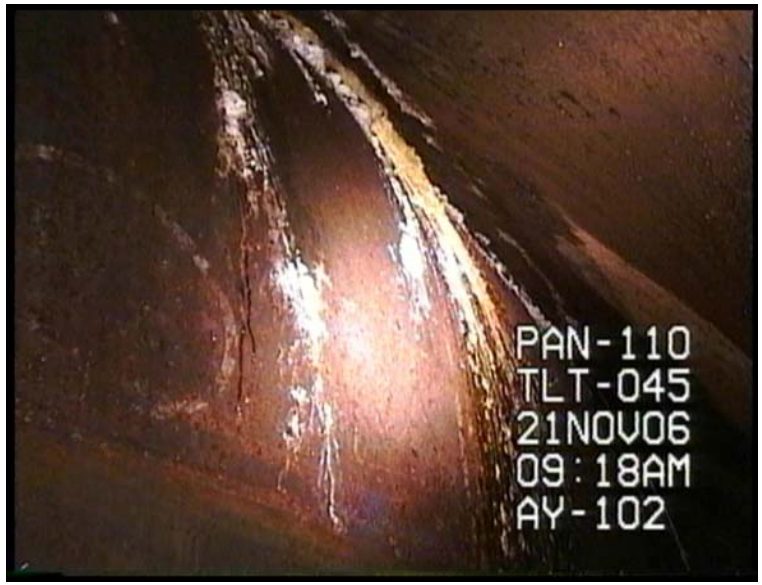
241-AN-107 Primary Tank Wall
2002 Video Inspection Wide-Angle View



241-AN-107 Primary Tank Wall
2002 Video Inspection Close-Up View

Annulus Water Intrusion



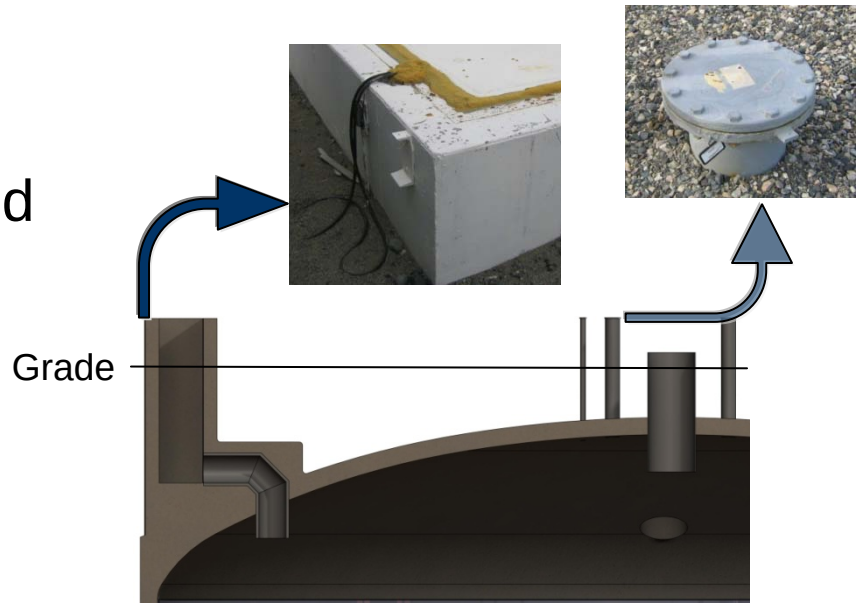


DST Inspection Lighting Effects

DST Inspection Lighting Effects

Dome Surveys

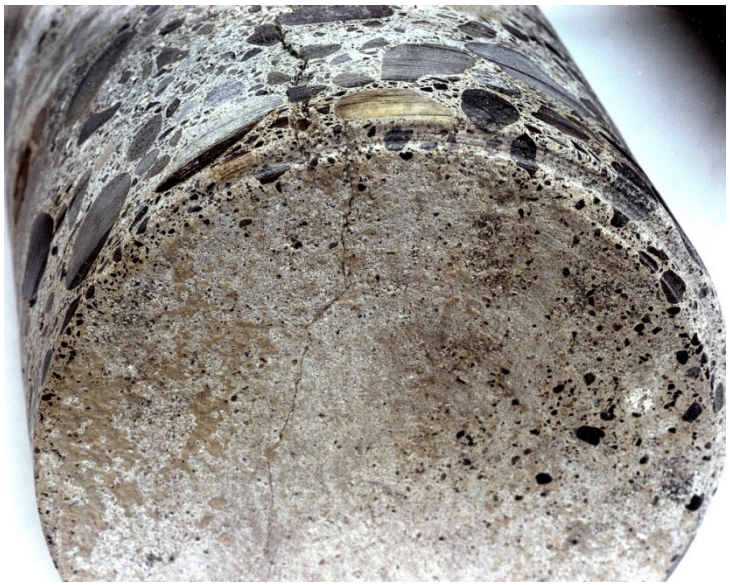
- Survey Benchmarks
  - Minimum of two benchmarks per SST.
    - Outer perimeter benchmark used as reference.
    - Inner benchmark used as measured deflection.
  - Typically no less than three benchmarks per DST.
- Survey Results
  - ~1979 - Present
  - Survey results have noted no dome deflection in either DSTs or SSTs.



Concrete Inspections

- Historic Core Samples
  - 241-SX-108, retrieved two core samples from the tank foundation.
    - Found very little cracking.
    - Core samples found aggregate to be well distributed through the concrete.
  - 241-SX-115
    - 2-Inch thick vertical core of entire SST sidewall was taken.
    - Test results showed concrete was greater than the required 28 day minimum compressive strength.

Concrete Inspections



Concrete Inspections

- Historic Visual Inspections
  - Single-Shell Tanks
    - Majority of SST inspections utilized still photography using a Hasselblad camera system.
    - SST inspections were halted in the early 1990's.

B-103 Concrete Dome (Type 2 – 100 Series Tank) - 1988