SRS Liquid Waste Tank Integrity and Inspection Program

Savannah River Remediation
A URS COMPANY TEAMED
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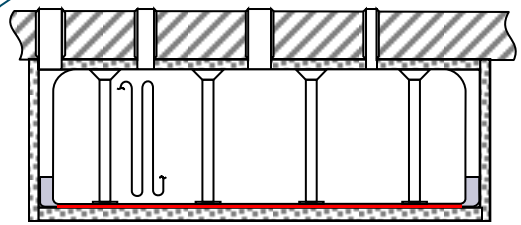
Kent Fortenberry
SRR Chief Engineer
October 9, 2014

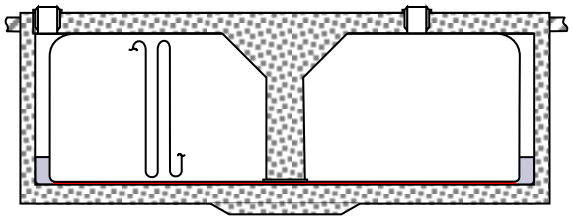
Outline

- Waste Tank Overview
- Structural Integrity Program
- Degradation Mechanisms
- Corrosion Control Program
- Inspection Program
- Program Status

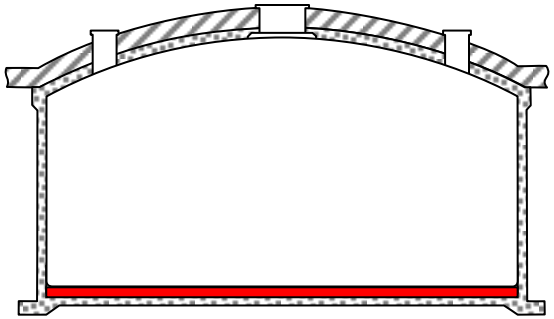
Waste Tank Overview



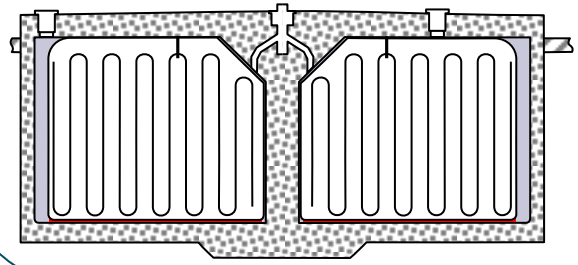
Type I (12)
Tanks 1-12
Older Design
750 kgal
1954



Type II (4)
Tanks 13-16
Older Design
1.0 Mgal
1955-1956



Type IV (8)
Tanks 17-24
Older Design
1.3 Mgal
1959-1965

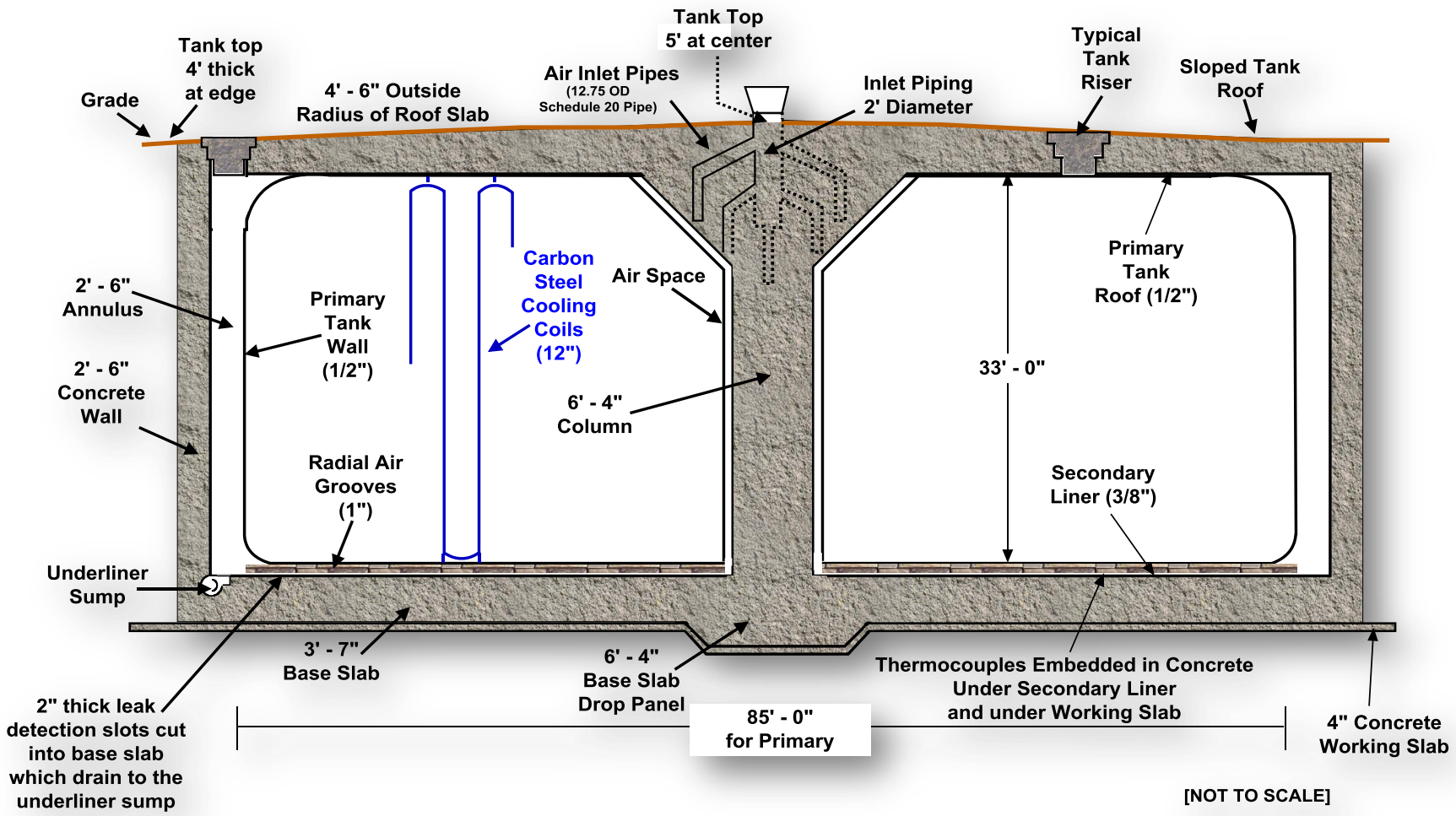


Type III (27)
Tanks 25-51
Later Design
1.3 Mgal
1969-1986

- (24) Older Design Tanks (6 closed)
  - Up to 60 years old
  - Do not have full secondary containment
  - No *active* leaksites today
  - 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
- (27) Later Design Tanks
  - Up to 45 years old
  - Full secondary containment
  - No leakage
  - Used for main processing activities
  - Comprehensive inspection program
    - Visual inspections
    - UT inspections

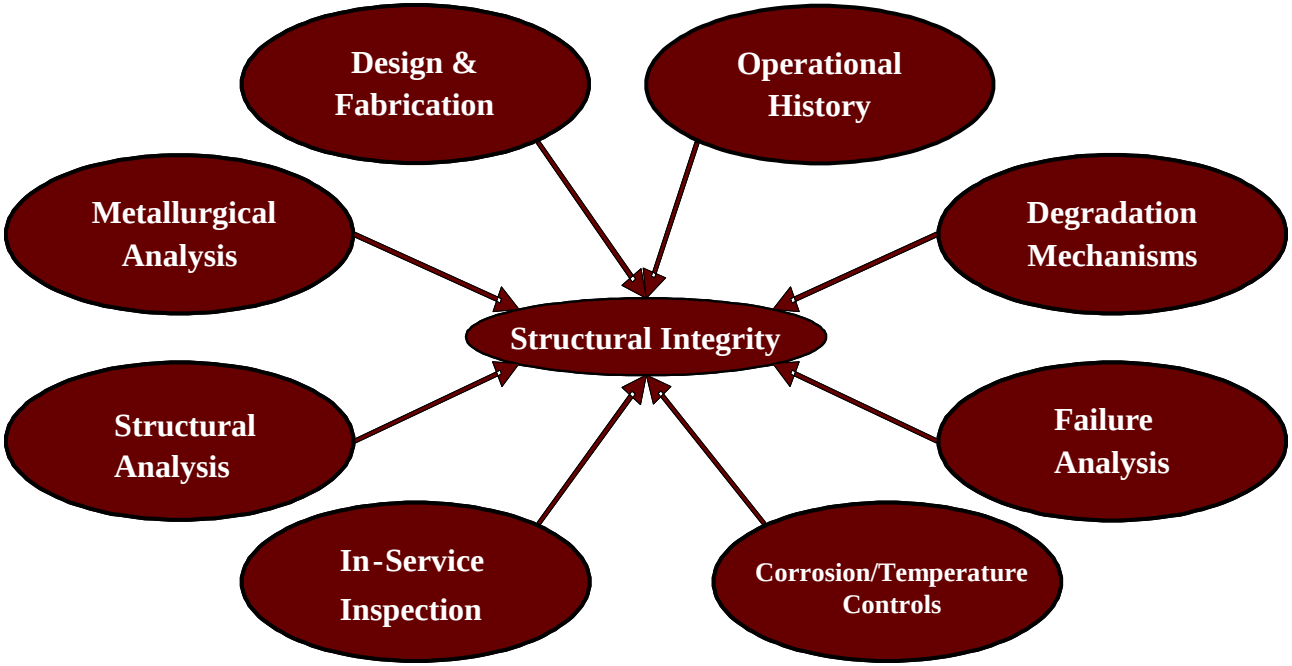
Waste Tank Overview

Type III Tank



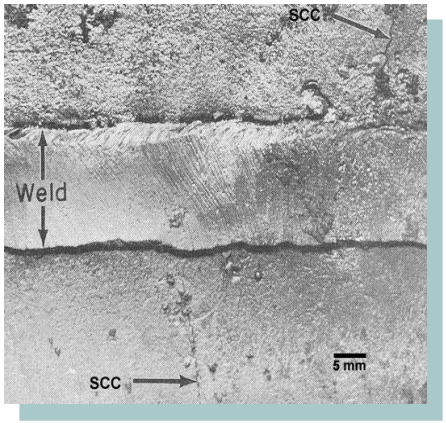
Structural Integrity Program

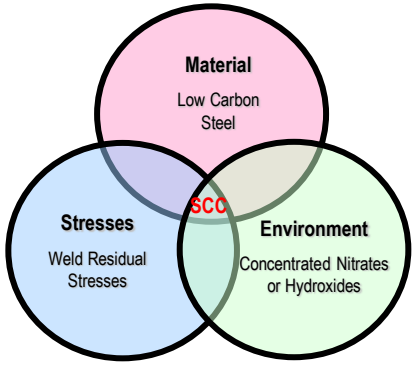
- Comprehensive integrated approach to maintaining structural integrity of tanks
- Evolving program to incorporate new information, address emerging issues, and preclude consequential degradation



Degradation Mechanisms

- Primary modes of observed degradation are general corrosion, corrosion pitting, and stress corrosion cracking
- Nitrate-induced stress corrosion cracking (SCC) is observed near fabrication welds or repair welds in Type I/II Tanks
- Most observed degradation 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

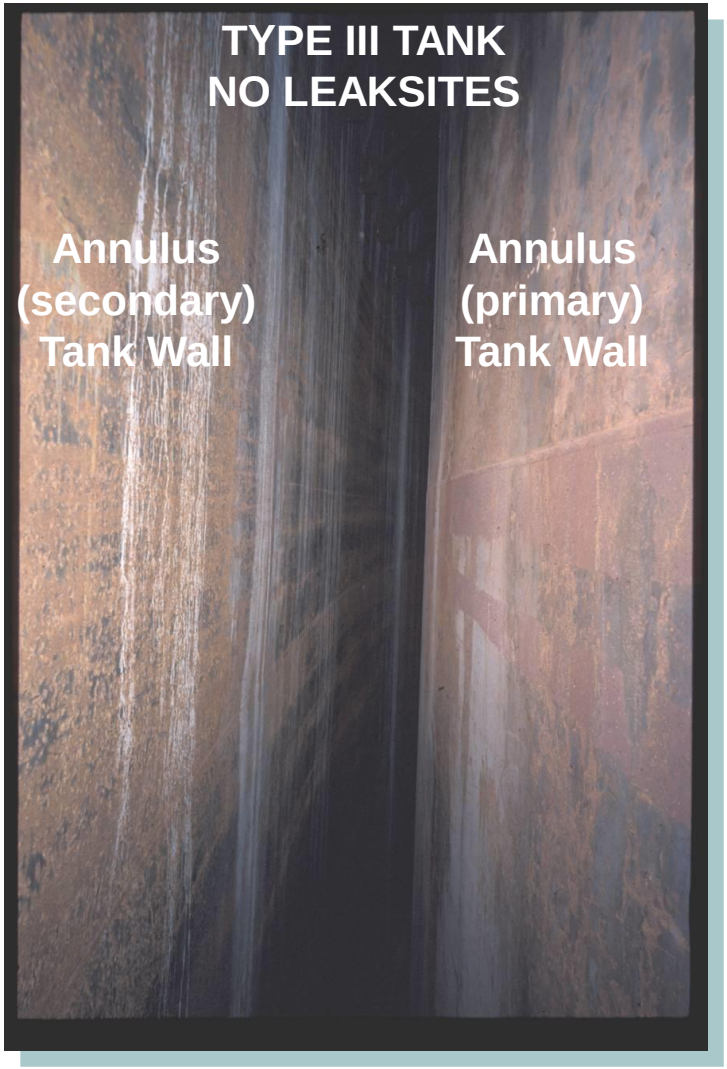




Corrosion Control Program

Three Primary Elements

- Maintain corrosion inhibitors
  - Envelope of nitrite, hydroxide, nitrate concentrations
- Maintain temperatures
  - Concentration dependent temperature limits
- Maintain annulus ventilation (moisture)

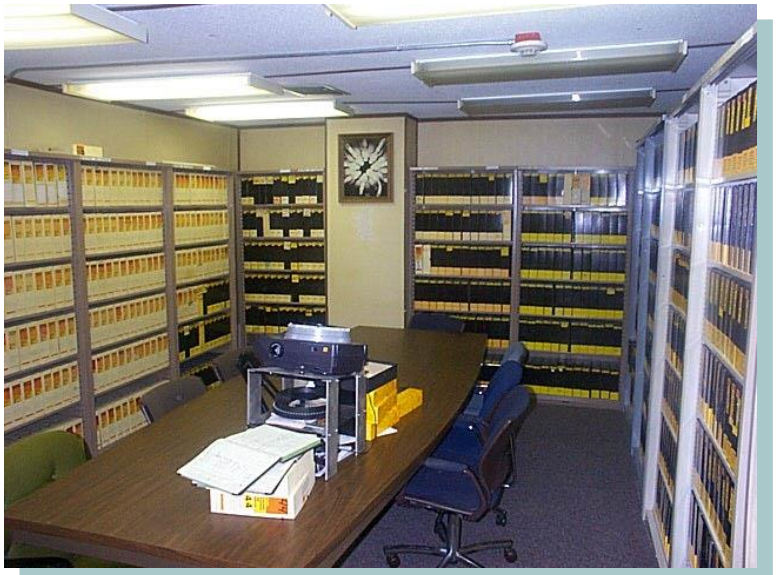


Inspection Program

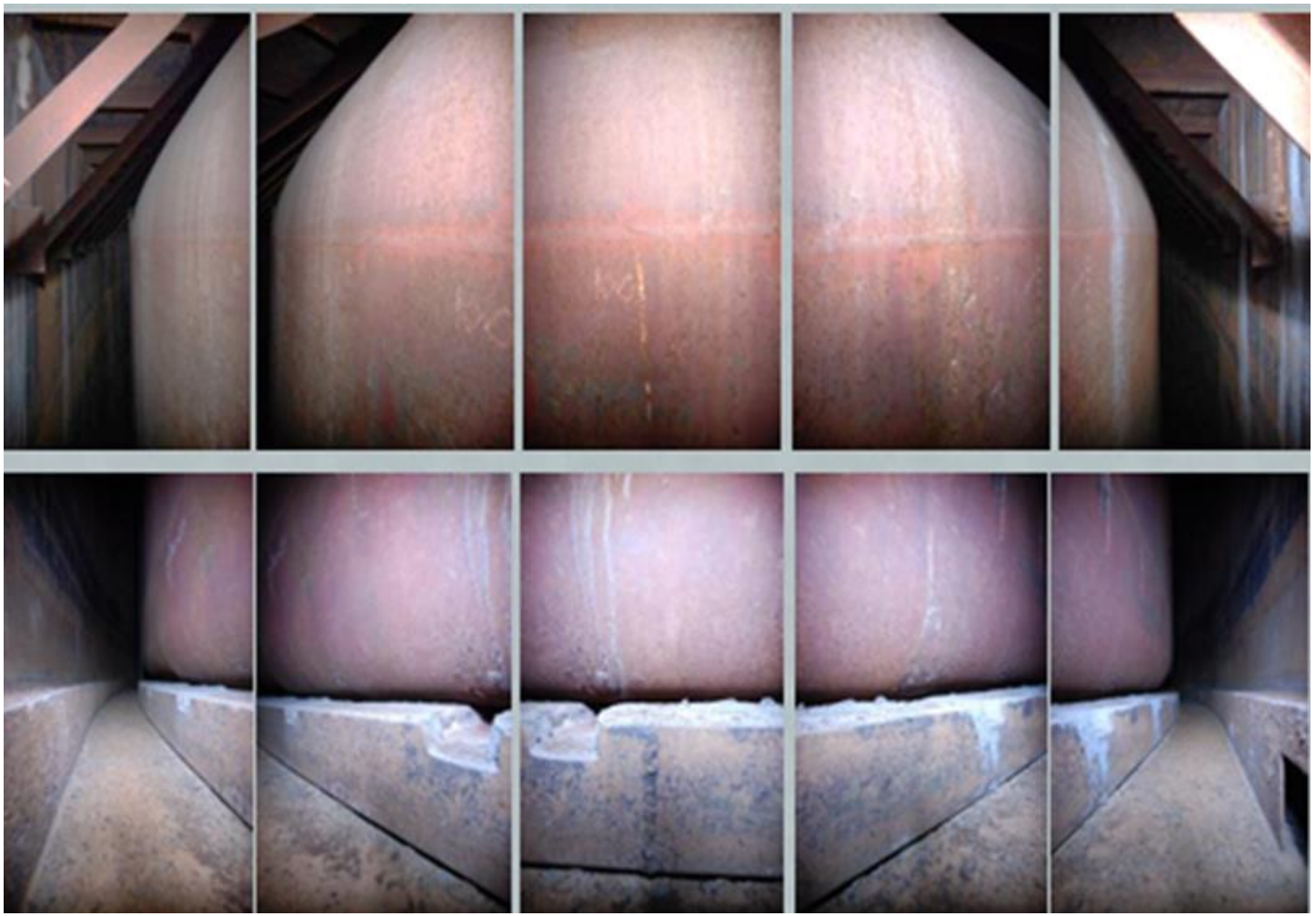
- Visual Inspections (all tanks)
- Ultrasonic (UT) Inspections (primarily Type III tanks)
- Operational Monitoring (all tanks)

Visual Inspections

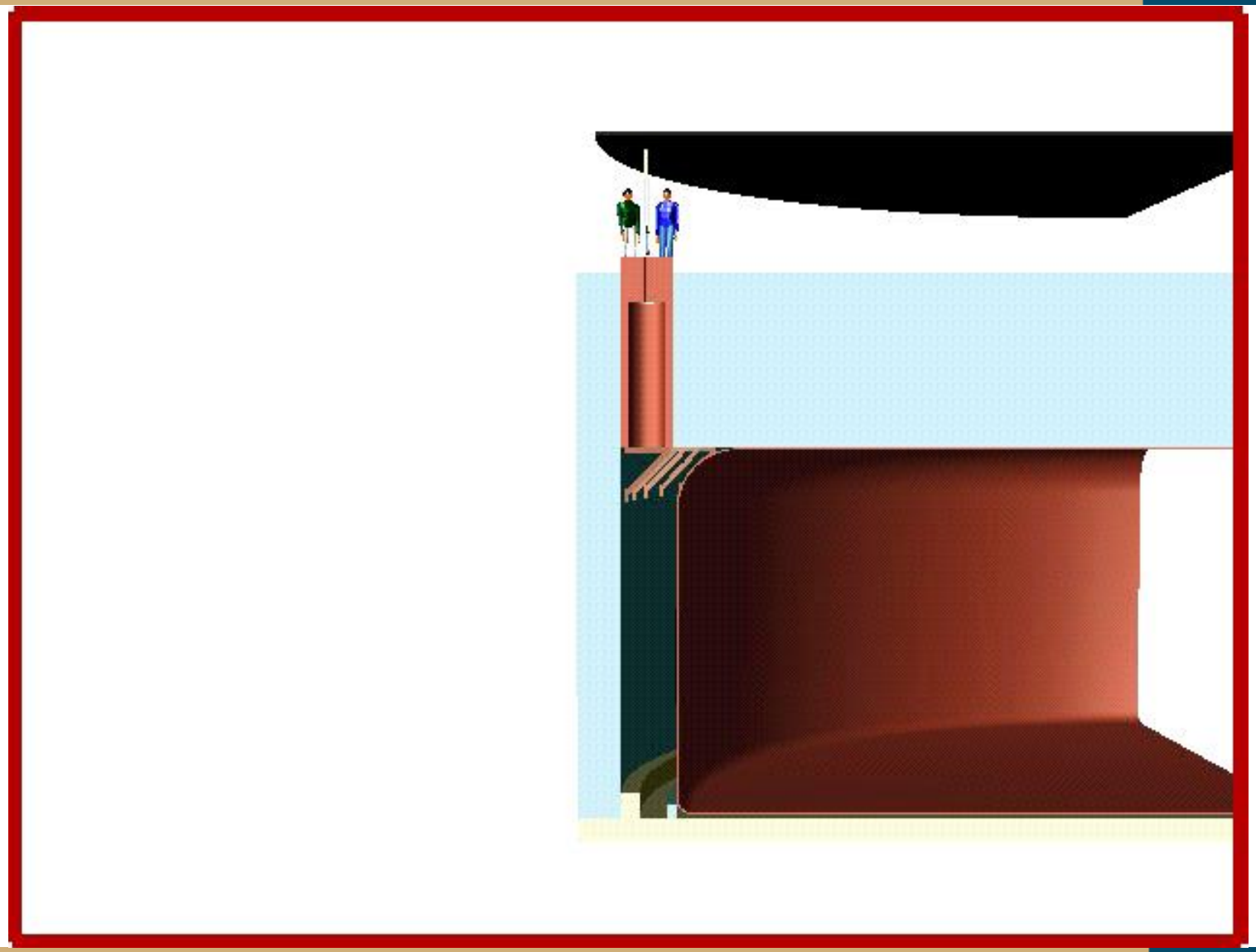
- Visual inspections are performed for all tanks
  - Still photography – (~5000 photos/year)
  - Wide Angle
  - Direct
  - Video Camera Inspections (over ~1000 video/visual exams/year)
- Looking for changes in appearance
  - Leak sites
  - Corrosion
  - Abnormal conditions
- 100% of tank walls (Type III)



Visual Inspections

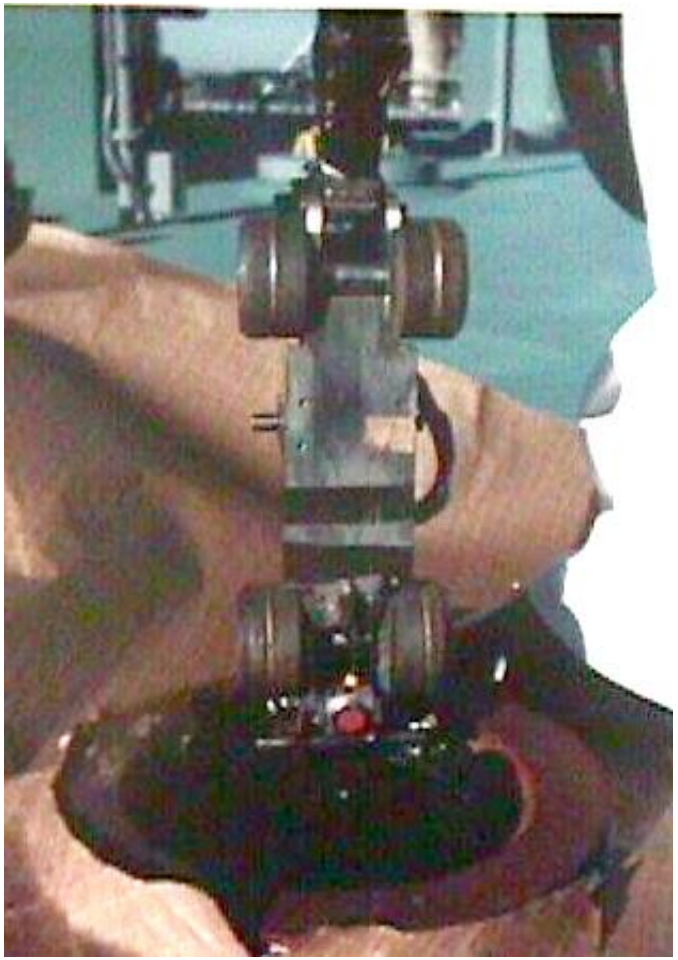


Ultrasonic Inspections



Probe travels over 1 mile during a tank inspection

Ultrasonic Inspections



Phase I: Historic Inspections (1967 to 1985)

- UT inspections from 1972 – 1985
- Collected over 24,000 spot/skate measurements
- General wall loss/thinning only; not for pitting or cracking
- Readings taken every 6” down the tank wall (2” intervals near welds)
- Solenoid activated transducer contact
- Water for coupling

Ultrasonic Inspections

Phase II: Enhanced UT inspection for thinning, pitting, and cracking (2002-2008)

- 1st cycle completed in 2008, with all 27 Type III tanks inspected
- Type II Tank 15 inspected twice
- Inspect primary and secondary walls
- Formal criteria for disposition of results

A: 1 vertical strip (corrosion rates, pitting, etc..)

B: 1 vertical weld on lower plate (highest stress weld)

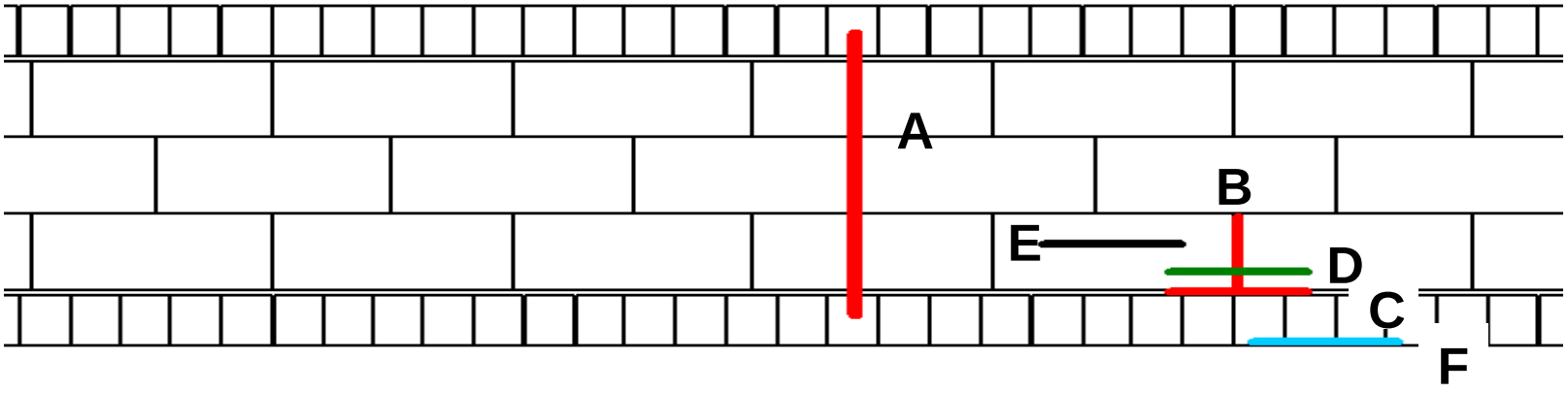
C: Lower horizontal weld (highest stress weld)

D: High stress region in base metal (~35" above tank bottom, Tank 50 only)

E: Incipient pitting horizontal scan (Tank 49)

F: Primary knuckle base metal (Tanks 26, 32, 40, 47, 49, 50)

+ Secondary wall (2 ft^2 each plate and floor)

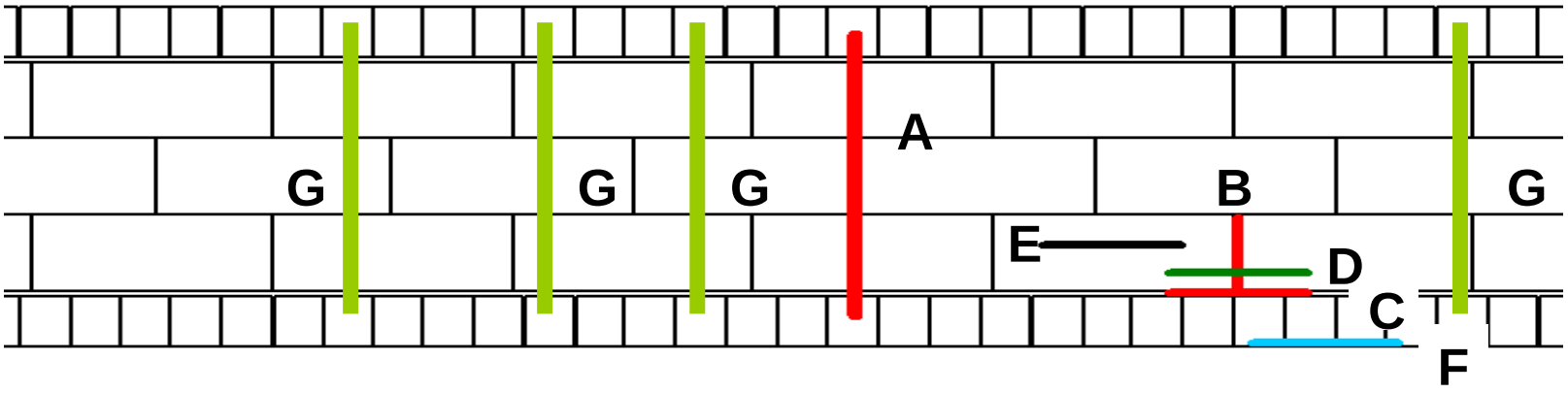


Ultrasonic Inspections

Phase III: Enhanced inspection with statistical selection (2008 - present)

- Increased circumferential inspections using a statistical approach to increase confidence
- All 27 Type III tanks (every 6 to 10 yrs)
- One base line strip and 4 random strips
- 60% complete
- Tank 15 scheduled for FY'15

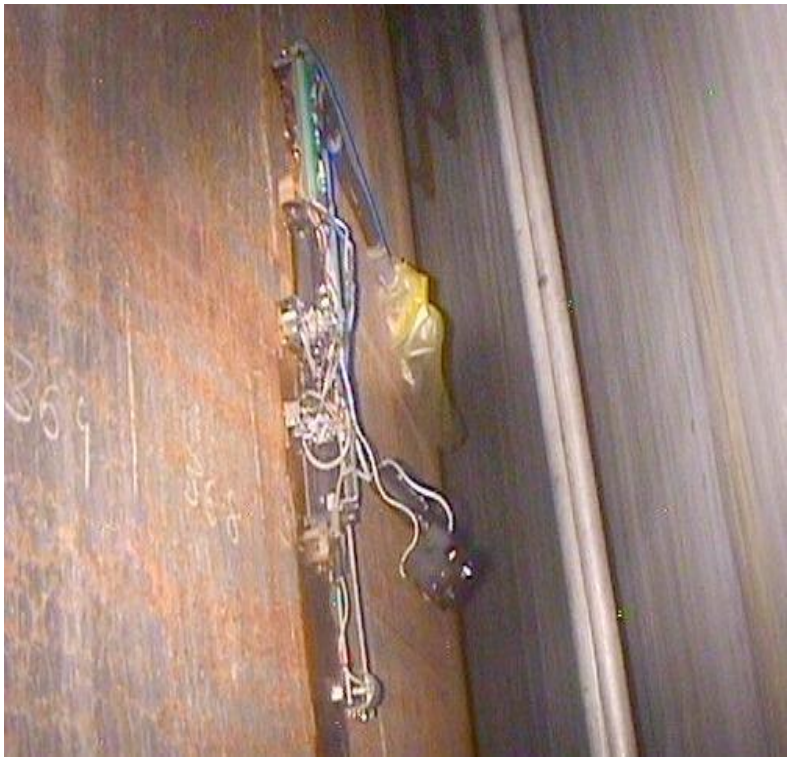
G: 4 random strip inspections
+ one-time 18 strip inspection of Tank 29



Ultrasonic Inspections

Evaluation of Inspection Results

- General Thinning
- Local Thinning
- Pitting
- Service Induced Flaws (cracks)



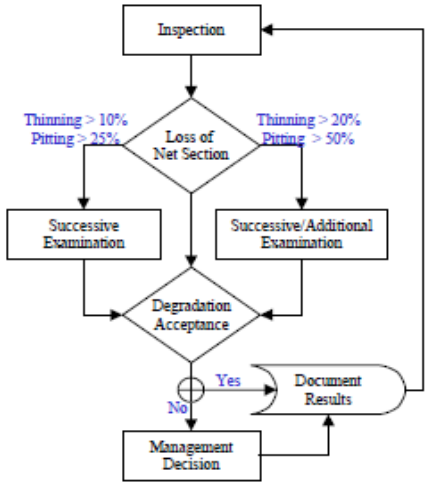


Figure 2: Decision Logic for Disposition of General Thinning, Pitting, and Local Thinning

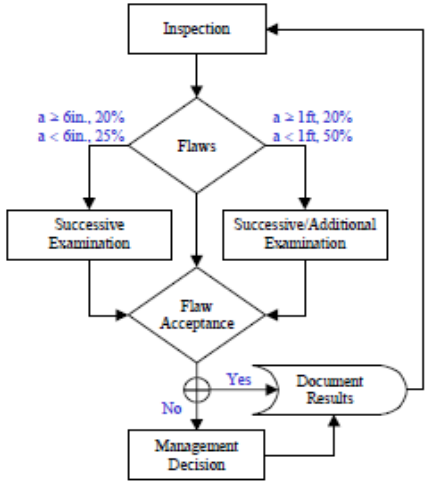


Figure 3: Decision Logic for Disposition of Service Induced Flaws

Operational Monitoring

Operational monitoring is performed for all tanks

- Tank Temperature
- Tank Chemistry
- Annulus ventilation (moisture)
- Annulus ventilation air monitors
- Annulus conductivity probes
- Tank level

Program Status

- No reportable, service induced indications (i.e., thinning, pitting, or cracking) on Type III primary tank walls
- *Incipient** pitting and non-reportable indications on the interior of a few primary Type III tank walls (most are pre-service)
- No indications of significant changes in older design tank conditions
- Formal review of the ISI program to be performed every three years (most recent review in 2013)

* small, pit-like indications; no indication that it has recently developed or is still growing

Summary

- The structural integrity program for the SRS tanks has more than 50 years of successful operation
- The program includes corrosion mitigation, inspections, analyses, and monitoring
  - Chemistry and temperature controls to preclude corrosion
  - Visual and volumetric inspections to confirm efficacy of corrosion mitigation
  - Monitoring and leak detection in place to ensure timely response to events
- The program continues to evolve
- Sharing information and technology with Hanford