Savannah River Remediation

We do the right thing.

Results of Tank 29 Inspection

Date August 26, 2009

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Savannah River Remediation

Non-Destructive Examination
Independent Review

SRR-STI-2009-00524

Outline

- In-Service Inspection (ISI) Program
- Results Summary
- Inspection Results
- Statistical Results
- Inspection Considerations
- Tank History
- Conclusion

ISI Program

- Ultrasonic inspection (UT) is used to detect wall thinning, pitting, interface attack and cracking.
- The 1st cycle of the inspections are complete.
- The results of the inspections confirm the efficacy of corrosion controls used to preclude localized and general corrosion of the tanks.
- The second cycle of UT plans to use a single strip for all subsequent inspections under bases of:
  - Circumferentially uniform corrosion
  - Coverage of all historical interfaces known to be the highest risk areas for corrosion.
- Tank 29 inspection provides the rigorous technical bases for these assumptions prior to conducting the next cycle of inspections.

Results Summary

- The UT is reliable and repeatable.
- Identified pitting is consistent with pre-service conditions.
  - The mean value of the pits is consistent with the operational acceptance level of 31 mils.
  - The pits identified in 2006 do not exhibit preferential growth.
  - All identified pits are far less than the reportable depth of 25%
- Mean thinning from 2006 to 2009 is circumferentially imperceptible (less than 1 mil).

Results Summary

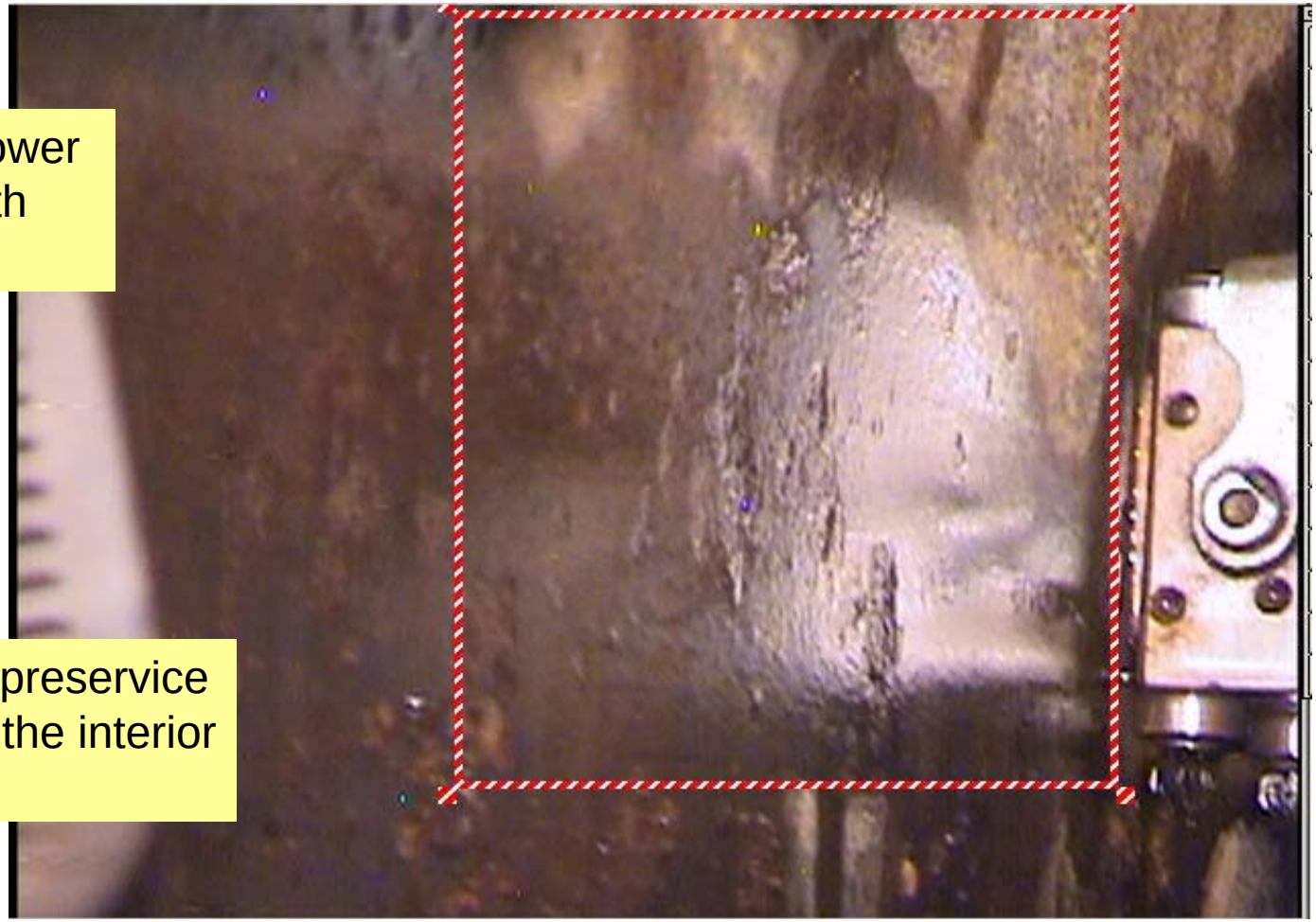
- Total thinning is negligible after 38 years of operation.
- A statistical approach has been developed to disposition data and evaluate pit depths.
- Currently this approach results in a 99% upper tolerance limit of 70 mils with 95% confidence.

Inspection Results

- 18 full height UT strips were completed in Tank 29.
- 93 preservice pits, 15 mils or greater, were identified in the 18 strips by the UT inspector.
  - 80 lower plate (15 – 63 mils vs reportable of 187 mils)
  - 12 middle plate (15 – 24 mils vs reportable of 156 mils)
  - 1 upper plate (18 mils vs reportable of 125 mils)
- Acceptance Criteria: reportable pit depth is 25% through wall.
- From the statistical analysis, the mean pit depth is consistent with the 31 mil acceptance criteria.
- Only 19 pits exceed the 31 mil criteria. All except one is less than 62 mils.
- Incipient pits originally identified in 2006 exhibit no preferential growth.

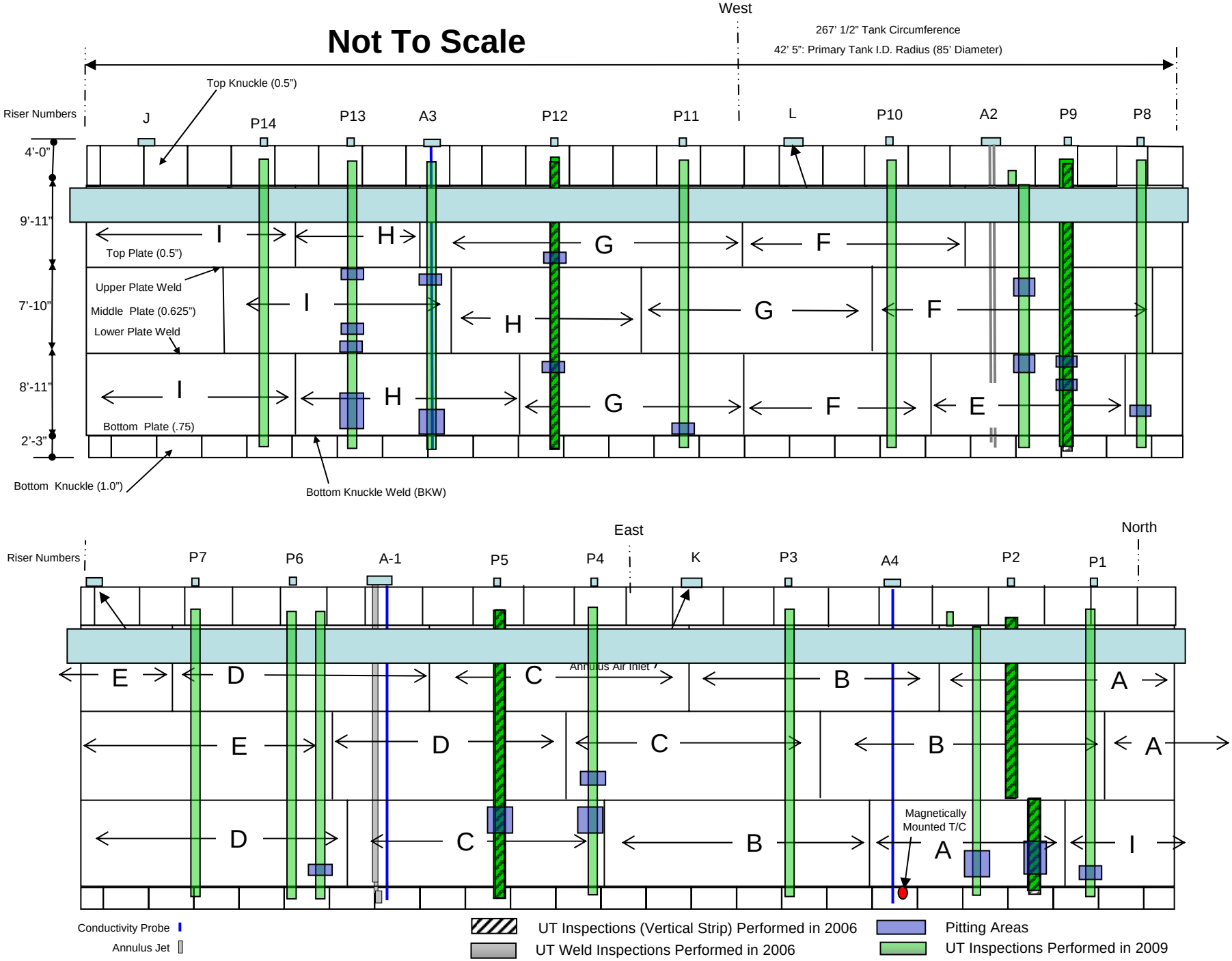
Annulus Side Preservice Pitting

Pitting in the lower plate E beneath riser P-08.

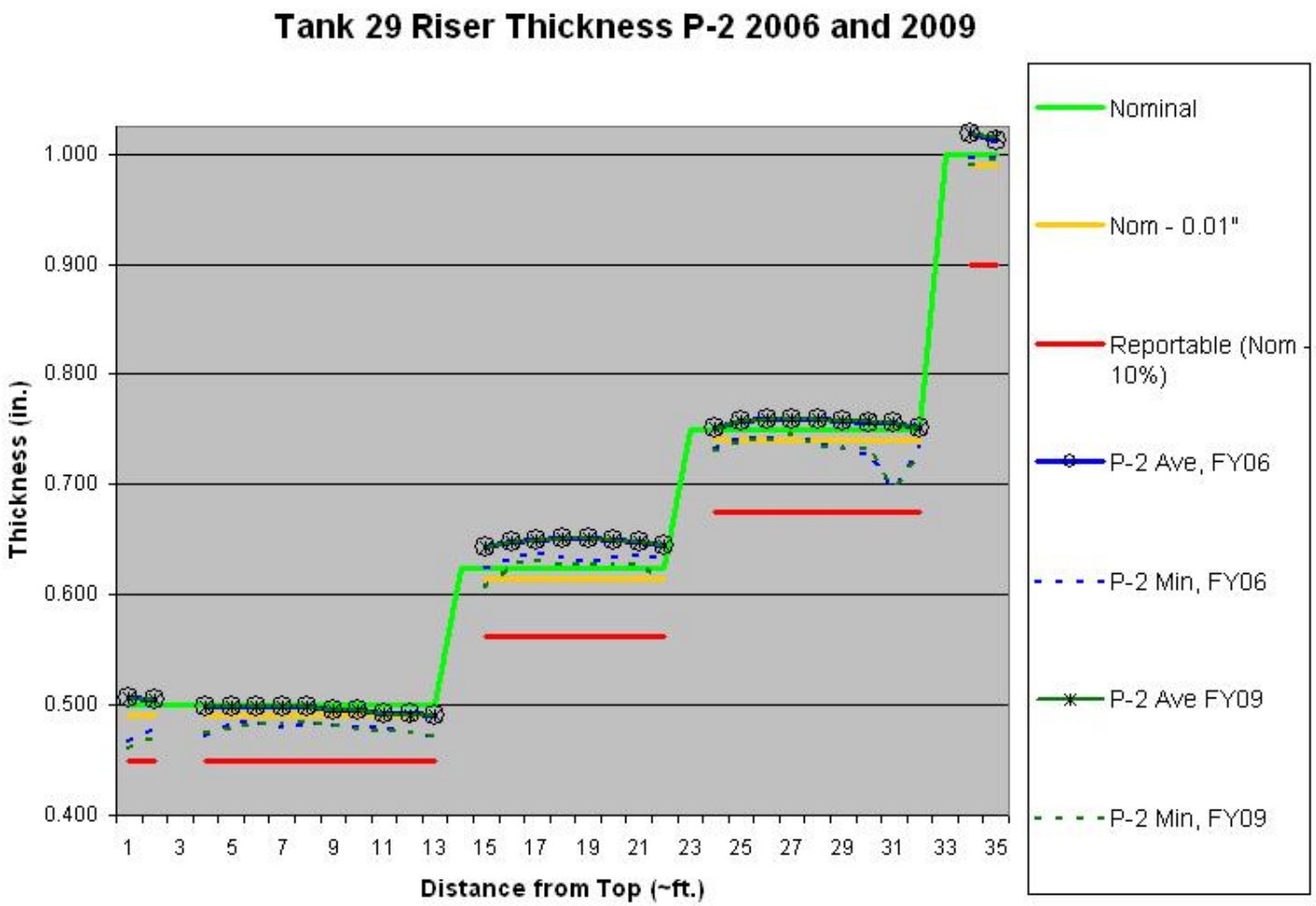


Consistent with preservice pitting found on the interior side of the tank.

Not To Scale


West
267' 1/2" Tank Circumference
42' 5": Primary Tank I.D. Radius (85' Diameter)
Top Knuckle (0.5")
Riser Numbers
J
P14
P13
A3
P12
P11
L
P10
A2
P9
P8
4'-0"
9'-11"
7'-10"
8'-11"
2'-3"
Top Plate (0.5")
Upper Plate Weld
Middle Plate (0.625")
Lower Plate Weld
Bottom Plate (.75)
Bottom Knuckle (1.0")
Bottom Knuckle Weld (BKW)
I
H
G
F
E
East
North
Riser Numbers
P7
P6
A-1
P5
P4
K
P3
A4
P2
P1
Annulus Air Inlet
D
C
B
A
Magnetically Mounted T/C
Conductivity Probe
Annulus Jet
UT Inspections (Vertical Strip) Performed in 2006
UT Weld Inspections Performed in 2006
Pitting Areas
UT Inspections Performed in 2009

UT Results @ 38 Years of Service



Statistical Results

- The wall thinning measurements from P2, P5, P9 and P12 were repeated to within 2 mils. Mean difference is less than 1 mil.
- A statistical review of thinning both vertically and horizontally shows that thinning is virtually identical throughout the tank.
- This indicates no spatially preferential corrosion is occurring within tank 29.

Statistical Analysis of Pitting Data

- Based upon the pre-service pitting data, a log normal distribution was used to project the upper bound values of pitting. The extreme value distribution produced the same bound.
- The projected maximum pit depth is 70 mils with 95% confidence that 99% are less than 70 mils.
- Consistent with the pre-service acceptance criteria.

Inspection Considerations

- As incipient pitting is identified in tanks a review will be performed by the In-Service Inspection Review Committee (ISIRC) in each instance to disposition data.
- Acceptance criteria levels for pitting are currently clearly defined in WSRC-TR-2002-00063.

Tank 29 History

- In 1967 construction began and was finished in 1971.
- In 1971 tank 29 was accepted into operations.
- Four annulus access ports (A1-A4) were initially constructed for inspection of this tank.
- In 1973 the first NDE inspection of tank 29 was performed. No detectable thinning was identified.
- In 1977 the formal SRS corrosion control program began.
- In 1979 initial visual inspection was conducted in the A risers.
- In 1982 fourteen additional 8 inch ports were core drilled into the annulus for inspection purposes.
- Visual inspection of the entire primary tank is performed each year.

Weld Examination

- All butt welds on the primary tank were subject to radiographic inspection.
- All welded attachments were removed and ground smooth.
- These locations were assessed for defects through magnetic particle examination.
- The completed primary tank was hydrostatically tested to a height of 32 feet for 48 hours prior to acceptance.
- All butt welds on the secondary tank were vacuum leak tested to 6 psi.

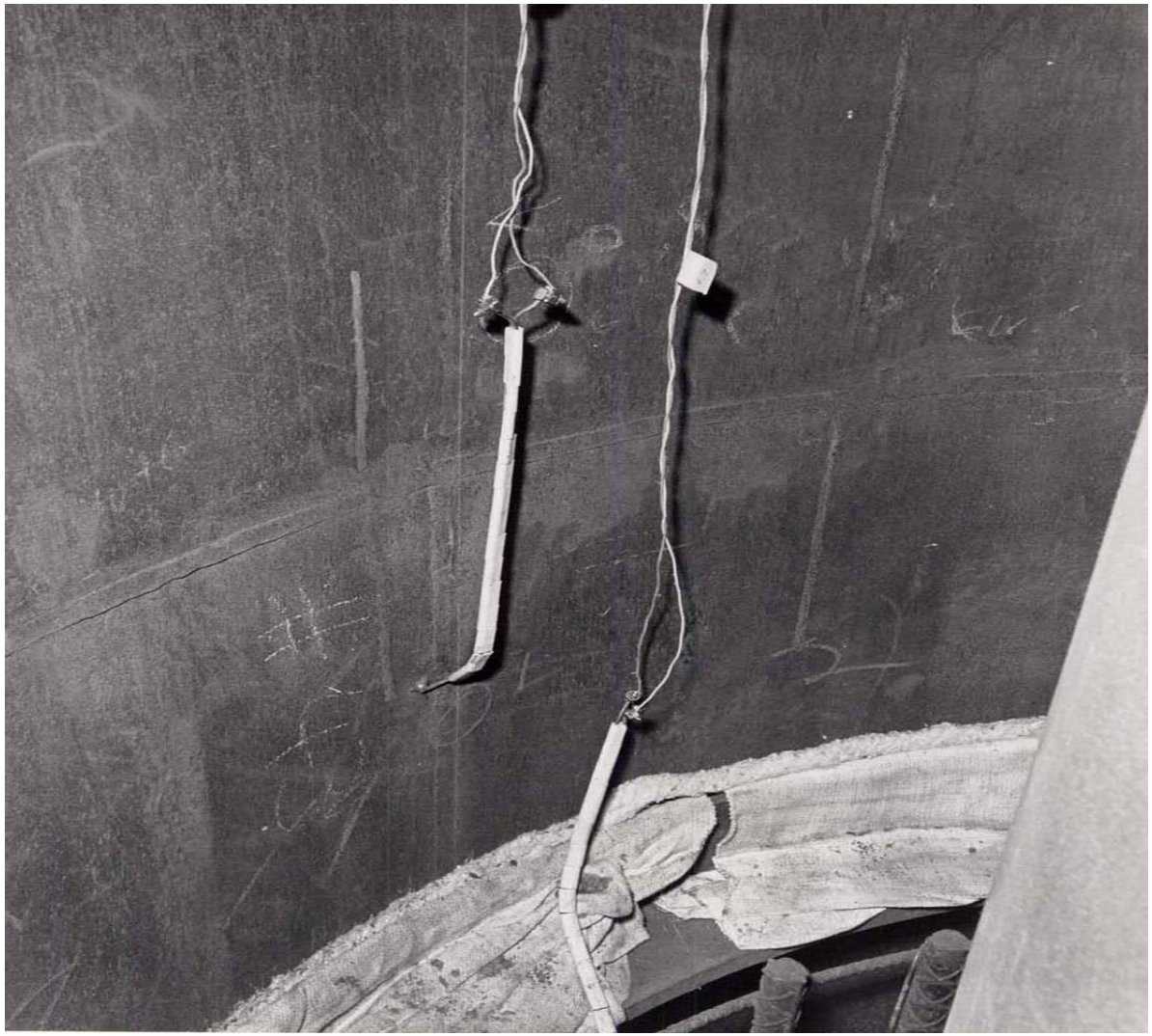
Tank 29 Construction

Tank 29 Construction

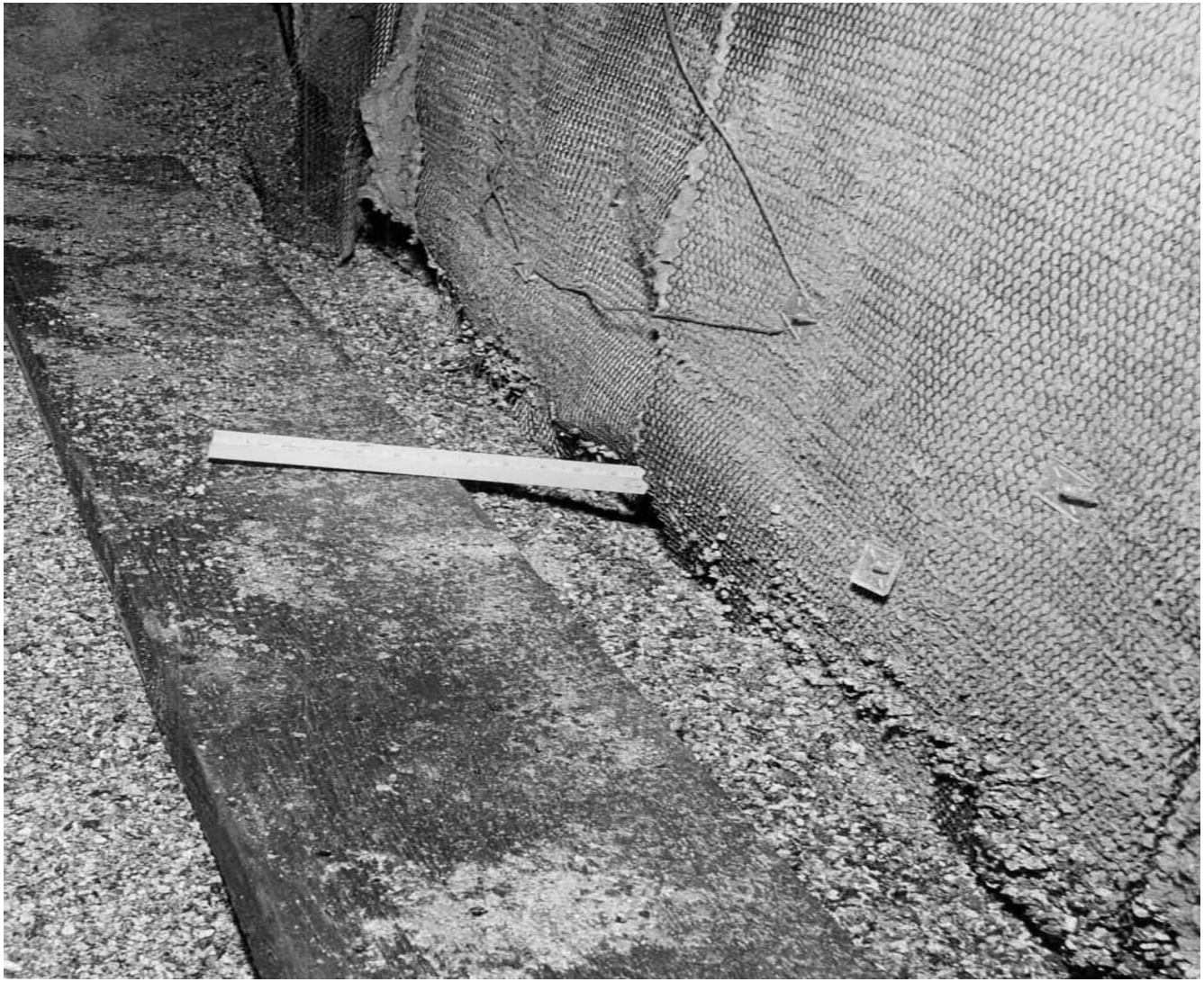
Post Weld Heat Treatment

- After completion of all welding on the primary steel tank it was fully stress relieved at 1100° F.
- Work was performed in accordance with ASME Section VIII.
- Thermocouples were placed on the outside of the tank to detect the heating profile of the tank.
- The tank was insulated to hold and evenly distribute the heat.
- All loose scale was removed after PWHT.

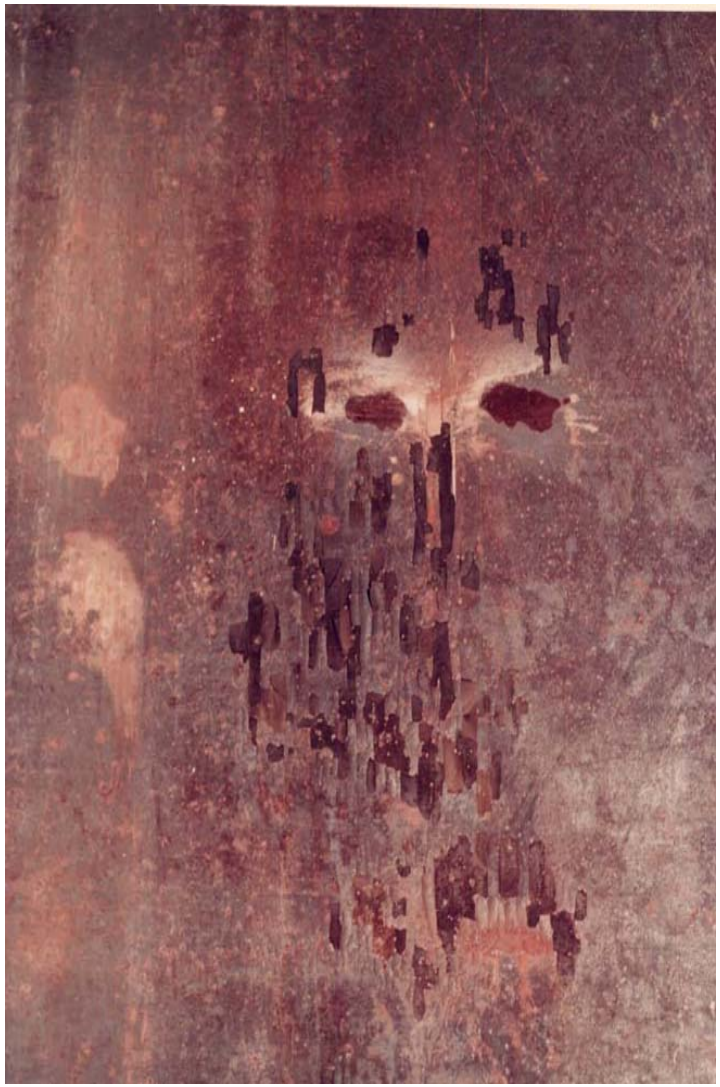
Tank 29 Construction



Tank 29 Construction



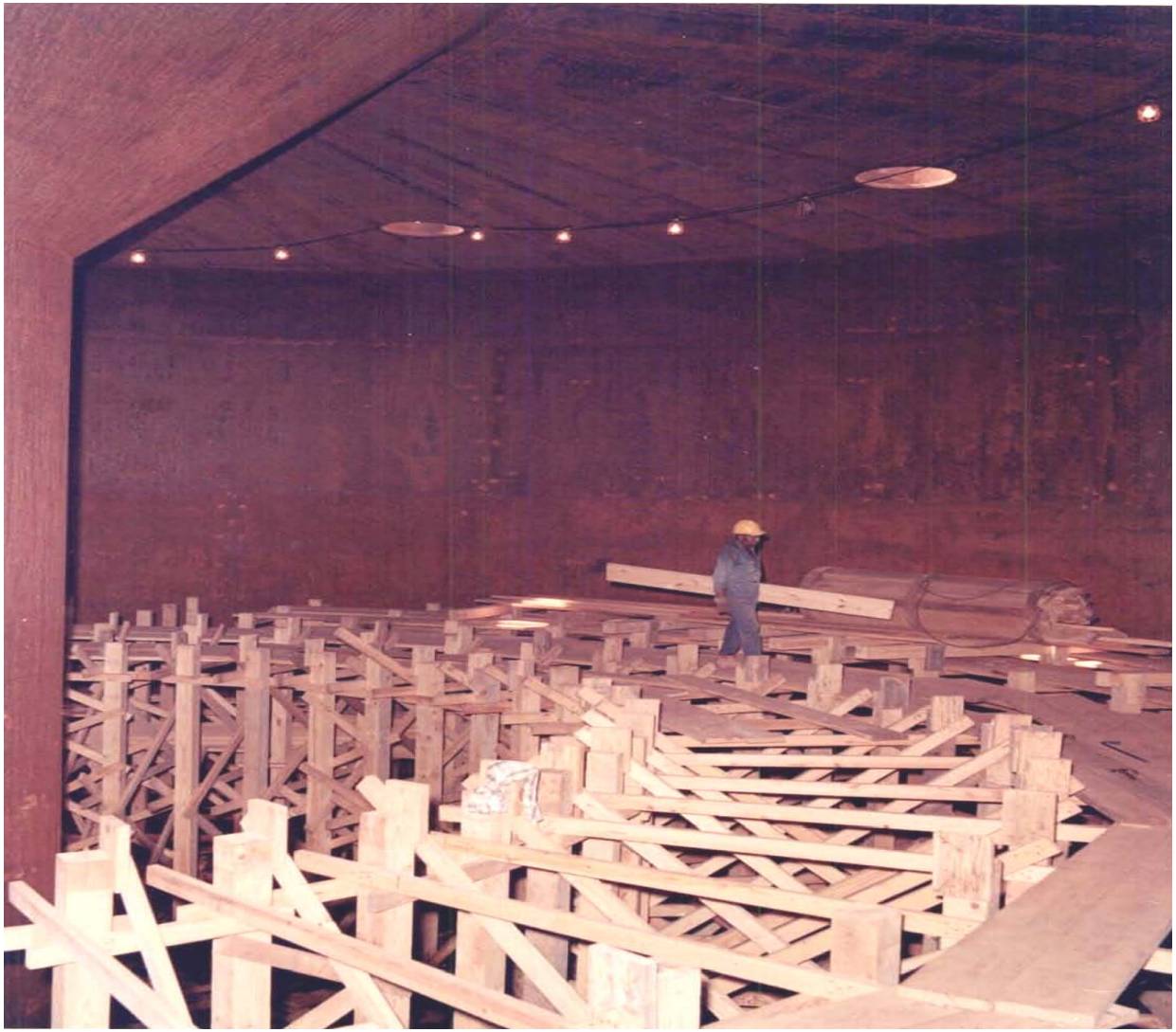
Tank 29 Construction



Operational Acceptance

- The following inspection was completed prior to accepting the tank for operations.
- All plates were inspected for gouges and pits.
  - Plates were to be free of surface imperfections greater than 31 mills.
  - Imperfections greater than 31 mils were to be ground smooth not to exceed 63 mils.
  - If greater than 63 mils the area was to be backfilled with weld metal to the original plate thickness and ground smooth

Tank 29 Construction



Tank 29 Construction

Tank 29 Construction

Conclusion

- The corrosion control and tank inspection programs are robust and provide dynamic feedback to the structural integrity program.
- Chemistry control has been effective at mitigating pitting and general corrosion.
- The inspection results of Tank 29 provide the rigorous technical bases for the next cycle of inspections.

Acknowledgements

- I would like to thank the dedicated team that made this presentation possible. Much personal time and literal sweat went into making this possible.
  - James Elder, Rod Vandekamp
  - Bruce Wiersma, PhD
  - Stephen Harris, PhD
  - Karthik Subramanian, PhD