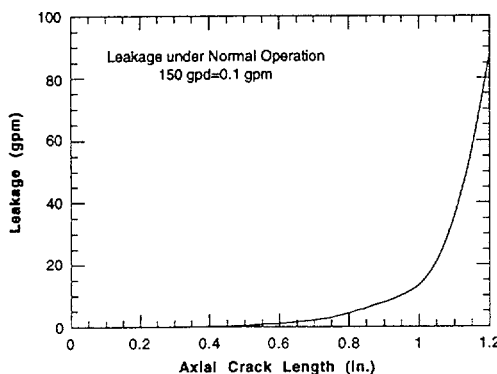
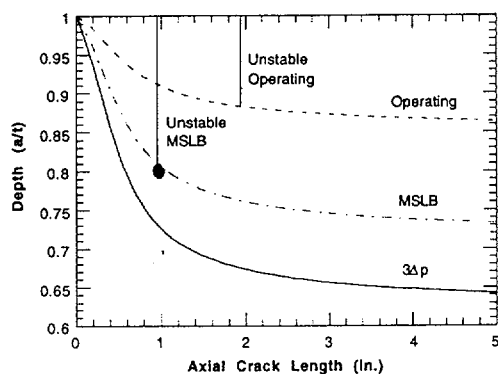
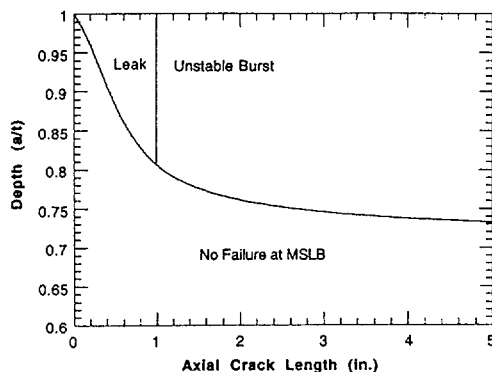
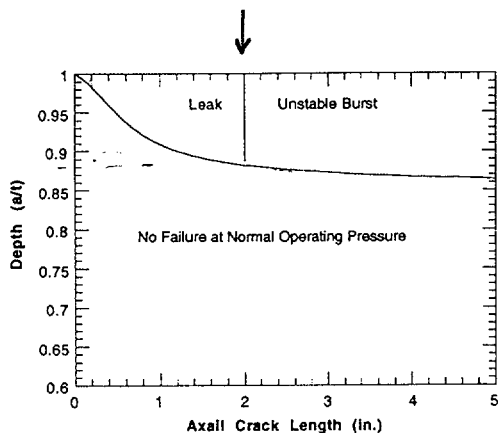


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6/28

all SIs are degraded

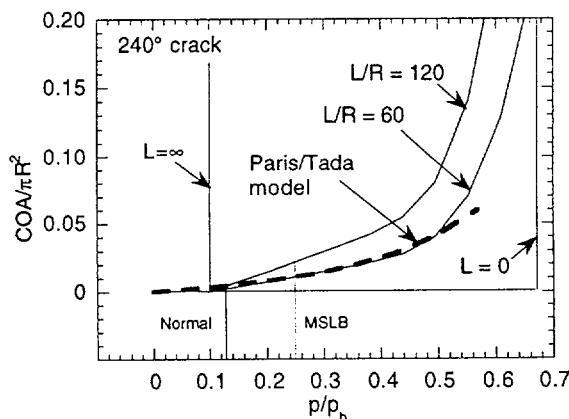
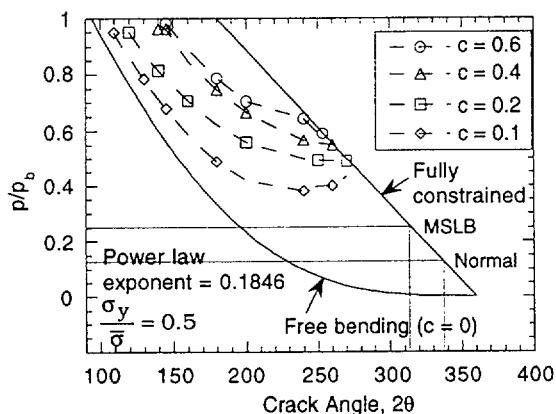


length is driven

hoop & 2x axial ; axial cracks limiting

Design Basis Look

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Very large circumferential cracks can be tolerated because the axial stresses induced by the pressure loading are only half the value of the hoop stresses. Even this assumption is probably conservative because of locking by corrosion products in the TSP.

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large circumferential cracks can be tolerated.

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Steam Generator Failure Modes

Primary mode of interest current generators is SCC

- SCC primarily associated with regions of high residual stresses or aggressive chemistries
 - Tube support plate; crevice regions promote aggressive chemistry
 - Roll transition; high residual stresses promote ID (PWSCC). Sludge and residual stresses also promote OD SCC both axial and circumferential.
 - Small radius U-bends; residual stresses introduced during fabrication process. Additional stresses can be introduced by “hour glassing” of flow slots by denting

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Cracks in small radius U-bends have the greatest potential for gross failure

- TSP cracks are limited in length by thickness of TSP and opening and leakage is constrained by TSP.
- High stress region at roll transition is limited in extent. Axial PWSCC typically less than 10 mm. Circumferential cracking can be extensive but because of loading does not result in concomitant reduction in margin or increase in leakage.

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NDE

Adequacy of 1997 and 2000 techniques to detect cracking in IP-2 matter of controversy among NDE experts.* Consensus that crack "could a" been detected. Disagreement on "should a."

- For indications that were missed, signals were small but visible above background. Conventional analysis of signals reveals "crack-like" nature.

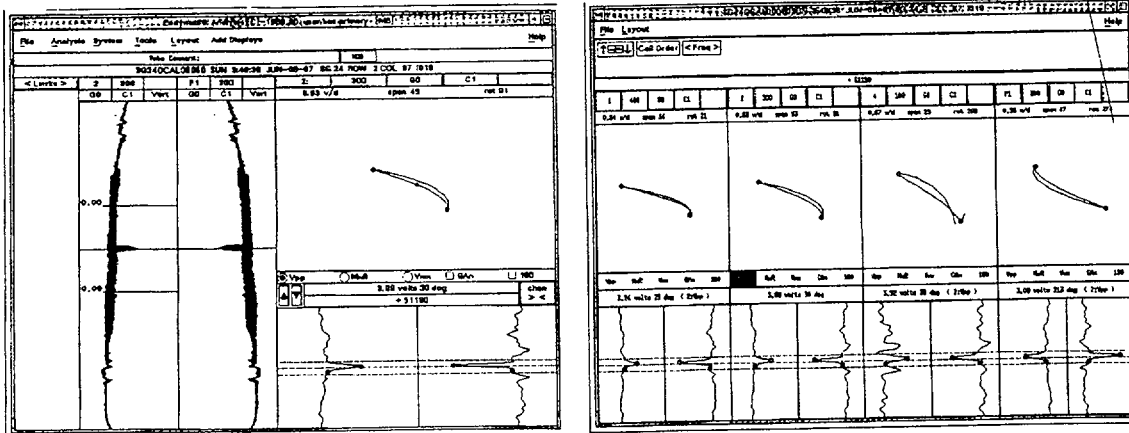
U-bends ^{in general} have poor signal to noise ratio because deformation of U-bend results in ovalization which leads to probe wobble. Copper deposits at IP-2 compound problem.

- Problems with signal/noise are not unique to IP
- Industry experience, difficulties in inspection, and potential consequences of cracking in U-bends should lead to high inspection sensitivity expectation by management
 - Other utilities have chosen to plug small radius U-bends
- Detection of a crack in 1997 should have heightened management attention to inspections

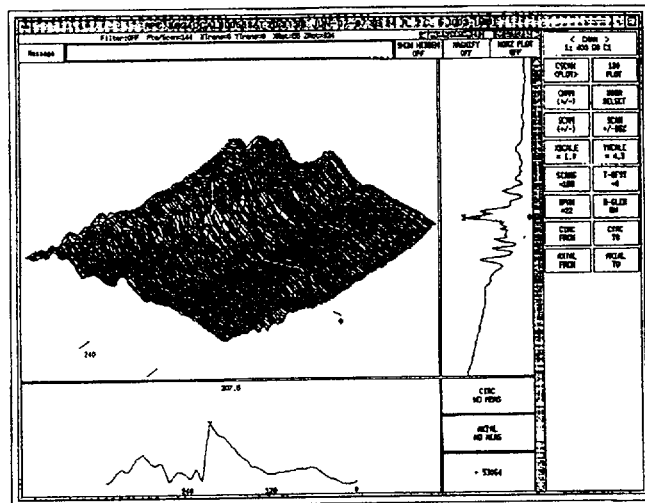
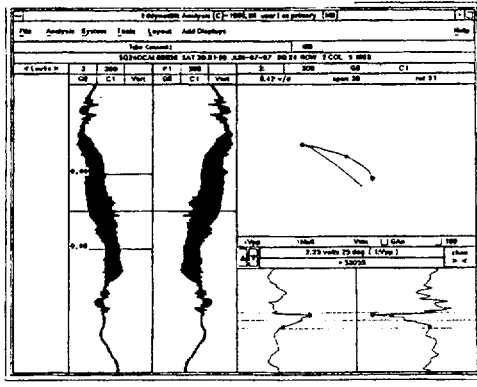
mgmt issue
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* 3 in the
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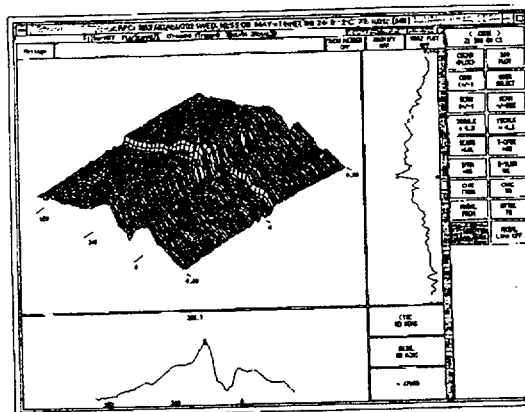
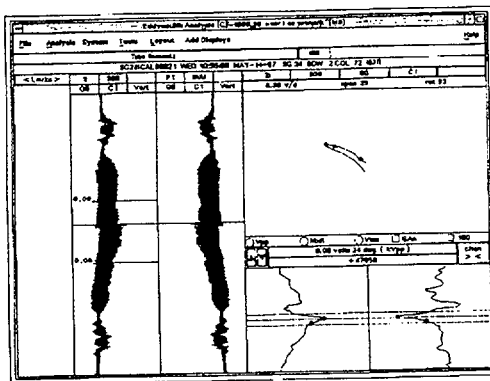


Reanalysis of 1997 ISI MRPC/+Point™ data for R02C67 tube. Stripchart and multiple lissajous figures are displayed. Analysis of inspection results suggests presence of $\approx 3v$ (call made at 300 kHz) primary side indication. The phase angle information suggests $>80\%$ TW degradation

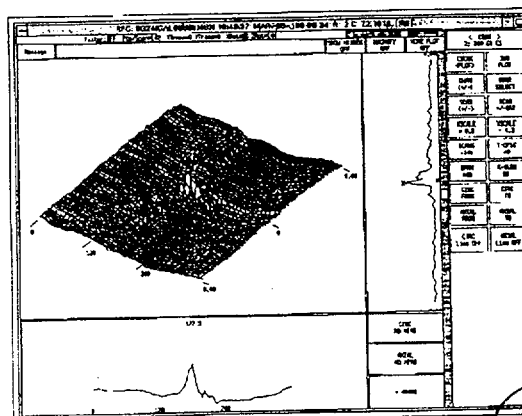
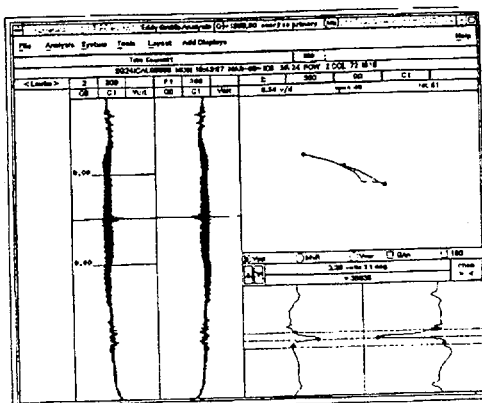


Reanalysis of 1997 ISI MRPC/+Point™ data for R02C05. Analysis of inspection results suggests presence of $\approx 1.8v$ (call made at 300 kHz) primary side indication. The phase angle information suggests $>60\%$ TW degradation..

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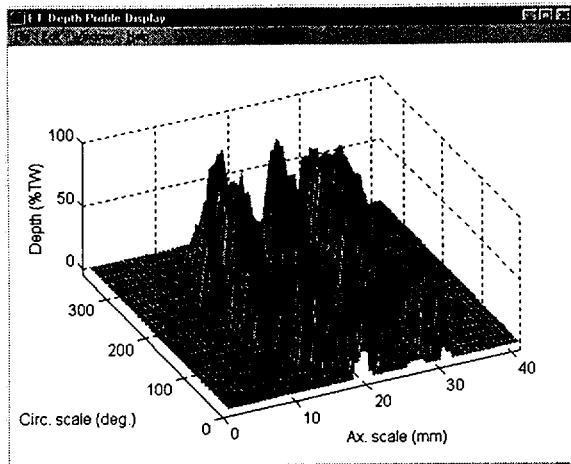


1997

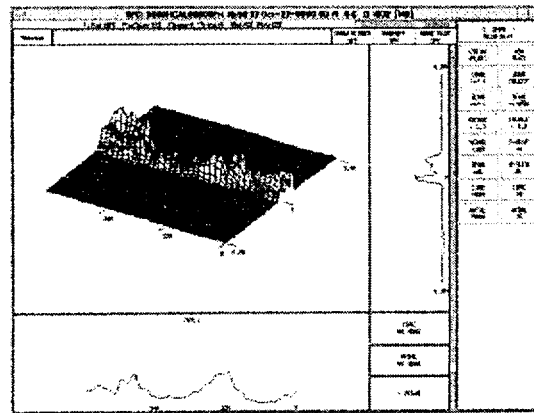


2000

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Lab-grown specimen with circumferential ODSCC indications. Results suggest presence of $\approx 360^\circ$ staggered cracking with maximum depth $>80\%$ TW.



Conventional isometric plot (EddynetTM) of +PointTM probe amplitude response for the same specimen shown on the left.

- Benefits of approach are improved detection and sizing, better identification of flaw orientation and origin, better spatial resolution, and more efficient processing of large amount of data generated by rotating probes