

From: Wayne Schmidt  
To: David Lew  
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Subject: Best shot, getting late!

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**Indian Point 2 Steam Generator Special Inspection Summary**

The NRC conducted a special team inspection to review the causes of the failure of a steam generator tube on February 15, 2000. The NRC team members included personnel from the Office of Nuclear Reactor Regulation and Region I, and NRC-contracted specialists in steam generator eddy current testing. The team determined the adequacy of Con Edison's performance during the 1997 steam generator inspections and assessed Con Edison's root cause evaluation, date April 14, 2000.

The team exited with Con Edison on July 18, 2000. This information is provided as a quick summary of the team's finding. The findings and the overall safety determination process for this event are still being developed and are subject to management review, prior to issuance of the inspection report.

In 1997, the Con Edison steam generator inspection program did not adequately account for factors that caused significant limitations and uncertainties in data collection and analyses, and that gave rise to the increased likelihood of steam generator tubes with detectable flaws being left in service. In the low radius U-bend areas, Con Edison did not focus attention and adjust efforts as necessary to compensate for steam generator conditions and technique challenges that negatively affected flaw detection capability. Also Con Edison failed to consolidate steam generator condition information to assess the significance of the newly discovered inside diameter (ID) primary water stress corrosion cracking (PWSCC) degradation mechanism that increased the likelihood of tube integrity problems.

Failure to identify and address these significant performance issues resulted from Con Edison's weak technical oversight of this program and led to an inadequate, integrated technical understanding of the steam generator conditions. As an overall result during the 1997 inspection Con Edison did not identify detectable flaws in six small radius U-bend SG tubes, including tube R2C5 in SG 24, which failed in February 2000.

Con Edison's root cause determination for the February 2000 tube failure, dated April 14, 2000, did not adequately address the failure to identify the tube flaws in the low radius U-bend region during the 1997 outage. While the root cause analysis attributed the tube failure to a flaw that was obscured by eddy current signal noise, the inadequacies in Con Edison's technical oversight of the 1997 steam generator inspections were not identified. The root cause analysis failed to address Con Edison's lack of corrective action in response to a new SG degradation mechanism.

The team identified the following significant performance issues:

1. Based on a independent NRC review of the eight U-bend PWSCC indications detected during the 2000 inspection, the NRC determined that Con Edison should have identified six of these defects and removed the associated tubes from service in 1997. This

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included SG 24, R2C5, the tube that leaked on February 15, 2000. The following issues decreased the probability of defect detection and increased the likelihood of apex flaws in the small radius U-bend steam generator tubes.

1. Con Edison did not identify and evaluate the flaw masking effects of the encountered high eddy current signal noise (low signal to noise ratios). The data analysis techniques were not adjusted to compensate for the noise to allow identification of flaw signal and ensure the appropriate probability of detection.
2. Con Edison did not adequately responded to a PWSCC indication in the U-bend area of tube R2C67 in SG 24. This indication, which was located in the apex of this small diameter tube, was a new and significant degradation mechanism at Indian Point 2. Apex cracking is more likely to burst than other u-bend cracks. Con Edison took no actions to determine the root cause and took on actions to ensure that this new mechanism understood.
3. Con Edison did not sufficiently assess eddy current probe restrictions in the upper support plate, with respect to flow slot hourglassing and on the potentials for increased apex stresses and PWSCC.
2. Con Edison did not properly set-up the U-bend plus-point eddy current probe, which negatively affected the probability of detection of U-bend indications. The probe was not set-up with the required calibration standard or with the phase rotation required by the EPRI qualified technique sheet.
3. Con Edison did not have an accurate method of measuring nor some criteria for determining when significant hourglassing of the upper tube support plates had taken

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