From: William Raymond
To: Jefferey Harold
Date: Thu, Apr 27, 2000 1:08 PM
Subject: Re: Fwd: Q's

Jeff,

Thanks for the questions.
The 4th queston on the first page deals with the leakage monitoring program. I think ConEd will respond that the leak rate from N16 and SJAE monitors was about 3.5 gpd up to 15 minutes prior to the onset of major leakage on February 15, 2000. I would add the following question to the set:

"How will the leakage monitoring program be changed to assure the operator can complete a timely plant shutdown prior to the onset of major leakage?"

If the action level for plant shutdown for leakage is set lower, to 10 gpd for example, I would ask...

"Why is the 10 gpd action level acceptable in light of the experience on February 15 where the leak rate changed from 3.5 gpd to about 100 gpm in 15 minutes?

Bill

>>> Jefferey Harold 04/27 11:54 AM >>>

CC: David Lew, Pete Eselgroth, Peter Habighorst

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- Section 2, second paragraph states that excessive noise prevented detection of R2C5 precursor signal in 1997. This is an over-simplification. Calibration setup during the 1997 inspection was not performed properly. A proper setup could have rendered the precursor signal detectable in 1997. In addition, the licensee does not appear to have performed a site specific performance demonstration in accordance with industry guidelines which likely would have demonstrated the weaknesses of the generically qualified eddy current technique to detect PWSCC in the IP-2 small radius u-bends due to large amount of noise associated with surface deposits. The u-bend eddy current data obtained during the 1997 inspection appears to have been of very poor quality, beyond the bounds of that considered in the generic qualification, and should have been rejected. The IP-2 data analysis procedures do not appear to have adequately addressed the subject of noise and data quality.

- Section 2, second paragraph states that based on eddy current sizing measurements R2C69 satisfies all structural criteria at the time of the year 2000 inspection. No mention is made of the insitu pressure test demonstrating that the tube only just meets the limiting structural criterion.

- Section 3.0, "IP-2 SG Summary of Inspection History," provides a 3-sentence description of the steam generators and an extremely brief description of the evolution of various degradation mechanisms in the IP-2 Sgs. This discussion ignores historical details which should have alerted the licensee to the high likelihood of experiencing an SGTR event. For example, early evidence of flow slot hourglassing of the uppermost support in SG 23 is not discussed. The basis for not considering this hourglassing as significant (making it reportable in accordance with the technical specifications) is not discussed. The earlier criteria, and their basis, for considering hourglassing to be significant is not discussed. The basis for not being concerned that more significant top support plate hourglassing might be present in SG 24 and 21 is not discussed nor is the basis for why it wasn't found necessary to install hill side ports at this time to permit inspection of the upper TSP flow slots in these Sgs. (This is what sample inspections are all about. You do a sample inspection and if you find problems you increase the sample.)

- The root cause report should assess the leakage trends leading up to the failure event, a description of and assessment of the effectiveness of the leakage monitoring program, and whether their were any shortcomings in this program which prevented plant shutdown prior to the event. What was the alarm set point on the N-16 monitor? For how long was the N-16 recorder out of service prior to the event? What were the N-16 leakage measurements as a function of time in the hours and minutes leading up to the event? What was the time interval between the last reading and the failure event? What were the air ejector rad monitor readings during the hours and minutes leading up to the event? To what leak rate was the alarm set point on the air ejector monitor set?

- Section 4.3 should address flow slot hourglassing data for all of the u-bend indications found in 1997 and 2000. This is necessary to demonstrate a relationship between the occurrence of hourglassing and u-bend cracks.

- Section 5 states that an apex indication was found in SG 24, R2C67, in 1997 with a length of .4 inches. The licensee elected not to perform an insitu pressure test of this location on grounds that the Westinghouse screening criteria were met. These screening criteria are intended to account for eddy current measurement error. What was the basis for the assumed measurement error? Was this assumption applicable to the to the very low signal to noise ratio existing for the subject tube? Describe the supporting qualification data for samples simulating the IP-2 specific noise conditions. Apart from plugging the tube, the licensee apparently took no further action at that time to assess the potential for significant flaws developing in the u-bend during the next operating cycle. Given the evidence of hourglassing of the uppermost support plates, the apex location of the R2C67 indication, and the very poor quality of the eddy current inspection data for the inner row u-bends, why wasn't imminent failure of the inner row u-bends ala Surry 2 anticipated?

- What was the basis for assuming the generic EPRI Appendix H qualification of the plus point mid-range probe for small radius u-bend inspection to be applicable to the site specific conditions at IP-2 (high noise due to copper and magnitite surface deposits)? Why wasn't a site-specific qualification performed as called for in the EPRI guidelines?

- Section 5 states that the 1997 precursor signal for R2C5 in SG 24 was not permitted to be seen because of the noise levels which were present. Why was this noise considered acceptable? Why weren't steps taken to reduce the noise?

- Section 5 states that as a result of the tube failure investigation, an number of changes were incorporated into the analysis process. It is further stated that more stringent criteria were established for data quality. This implies that data quality criteria were employed during previous inspections. Please describe in detail the data quality criteria used previously. Were these documented? Where? In the data analysis procedures? Were they addressed in the analyst training process? Please describe in detail the current data quality requirements and where documented. It is also stated in Section 5 that the analysis setup process was "changed" to achieve better resolution of the 20% ID calibration notch. The staff's review indicates that this sentence should more properly read that the setup process was "corrected" to achieve "proper" resolution of the calibration notch. The staff believes that the 1997 precursor signal for R2C5 could have been detected had the setup process been correct.

- Describe the Appendix H qualification of the high frequency plus point for small radius u-bend inspections. What number of samples were included in the data set and what flaw sizes were represented? Did the data set include representative copper and magnitite deposits and ovality? What kind of flaws were included in the data set (e.g., EDM notches, IGSCC)? Did these flaws produce signals and exhibit signal to noise comparable to the situation at IP-2? What were the results? What was the indicated POD as a function of depth?

- Section 6 states that only 22 tubes have been plugged due to tube restrictions since 1989, twenty of these were plugged in 1997 due to restrictions at, **or above**, TSP 6. The July 29, 1997, inspection report states that virtually all these restrictions involve restrictions in the u-bend. These restrictions included tubes in rows 2 through 4. Do these restrictions imply abnormal ovality in these u-bends? Describe your actions to characterize the current degree of ovalization and which tubes are affected. Is this ovality related to abnormal u-bend fabrication effects such as occurred at Doel and which led to a tube rupture at that plant? Might this be the root causal mechanism for the u-bend cracks at IP-2? If not, why not? Alternatively, might this ovality have been induced by flow slot hourglassing?

- Section 6 further states that the 1997 inspection was the first 100% inspection since startup and thus the noted plugging of restricted tubes in 1997 is believed to be the result of a larger inspection sample in 1997. The staff believes this not to be a credible explanation since the most affected SG (SG 22) received a 47% sample full length inspection in 1995 with the finding of no tube restrictions. Full length inspection samples in the other Sgs ranged from 67 to 100% with the finding of only one restricted tube.

- Figure 5 is illegible. Please show each of the pictures on full page. Pictures should indicate previously plugged tubes in rows 1 through 4 and at wedge supports. Also include pictures for inspection previous to 1995. Provide similar pictures for SG 22.

- The root cause report should discuss the relative susceptibility of Alloy 600 MA tubing at IP-2 to PWSCC relative to that for other plants. What was the range of mill anneal temperatures?

- The root cause report should assess primary water chemistry as a potential contributing factor.

- Section 7 doesn't address specified ovality limits on the small radius u-bends which may have been introduced during fabrication. What kind of post process inspections were performed to verify acceptable ovality? Ball gauge measurements? The data cited for Turkey Point isn't helpful here since the Turkey Point generators had experienced significant hourglassing in 1976.

- Section 9.1 states that prior to the IP-2 event, there have been no significant industry leakage events at the row 2 apex location. Have there been reported row 2 apex cracks? What were the circumstances? What about row 3? Apart from axial apex cracks and tangent point cracks, have there been other kinds of axial or circ ID or OD cracks affecting row 2 or row 3 u-bends? (NUREG/CR-5117 reported OD SCC at the apex of row 2 u-bends at Surry 2.)