EX. 6

From:	Ex 6	<Doddcv@[redacted] C Dodd
To:		KP_DO.kp1_po(WLS) W Schmidt
Date:		Tue, Jul 11, 2000 8:40 AM
Subject:		Monkey tube

Wayne:

Here is my write-up on the monkey tube in the sludge pile. I am not as confident of the detection of all of the defects in the sludge pile as I am of the U-bend. The noise in general is a problem at this plant as well as a number of other plants, some of which are in your region. When we get a breather, maybe we can look at this problem.

Caius

6/8

Profiles of tube r34c51 of Steam Generator 22

Tube r34c51 was profiled in the sludge region. This tube had two rather long cracks and two shorter cracks. All four were profiled, and are given in the figures below. All of the cracks were just above the tube sheet. The profiles were done using the 200 kHz and the 300 kHz test frequencies of the plus-point probe. Data were taken at 10 kHz, 100 kHz, 200 kHz and 300 kHz with both the plus point and the 0.115-inch diameter pancake coil. The 0.080-inch diameter high-frequency pancake coil was also used at 600 kHz and 300 kHz. The plus-point had the best signal-to-noise ratio for the tubes that I examined in the sludge pile region. The 0.080-inch diameter probe gave a sharp spike-like signal for the cracks. This coil may give better signal-to-noise at 800 kHz, where the noise should be rotated horizontal. Crack 1, as shown in Figure1 was one of the larger ones, and had a voltage signal close to one volt. While this crack appeared to grow about 25% in voltage amplitude due to the pressurization, this is not the point were the tube burst.

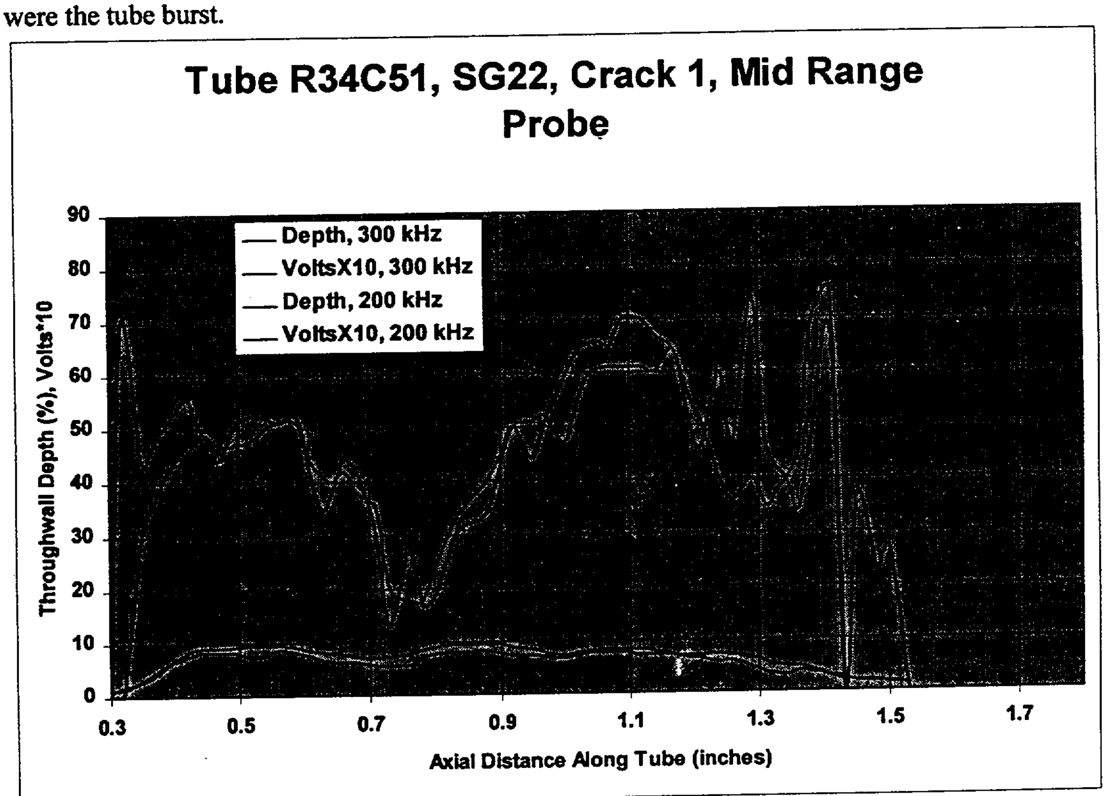

Figure 1 Profile of crack1 in tube R34C51 of steam generator 22.

Crack 2, as shown in Figure 2, is slightly longer and slightly deeper. This is the crack that burst. The voltage amplitude of this crack is about the same, and probably averages less than that of crack one. This demonstrates that voltage is not a good measure of crack size, depth or severity. Crack 2 appeared to go through wall, and the voltage amplitude increased by a large factor. This tube also had a large voltage increase of a crevice crack due to the pressurization.

In Figure 3 and Figure 4 we show smaller cracks. In the post pressure-test scan these cracks

were still visible, but could not be profiled due to the large increase in signal from crack 2. Its signal distorted the phase of the smaller cracks, which were adjacent to it.

The positions of each of the cracks is labeled in the C-scan that is shown in Figure 5. Note the large voltage signal from the cracks in this tube, and the low noise. Other tubes do not have as good a signal-to-noise ratio and are more difficult to inspect in this region.

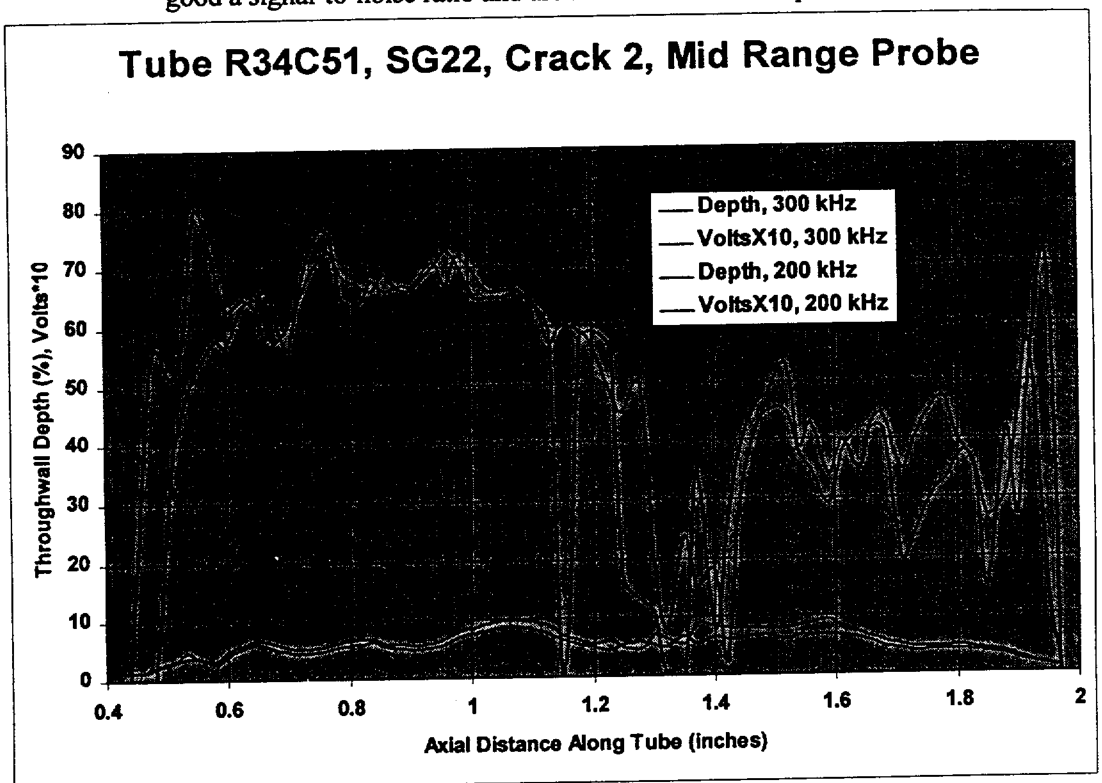

Figure 2 Profile of crack 2 of tube r34c51 in steam generator 22.

In Figure 6 we show the post pressurization scan of this tube. The signal form crack 2 is now much greater than the other cracks, indicating that this was the crack where the tube leaked. It appears that the crack opened to within about 0.3-inches of the tube sheet, and the voltage increased from near 1-volt to over 10-volts in places.

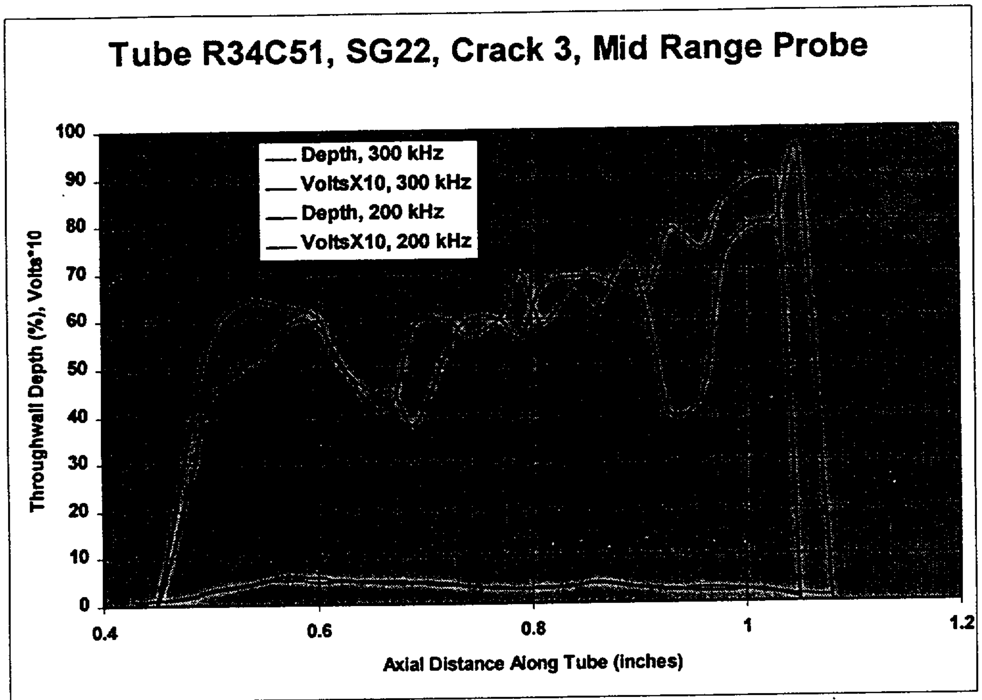

Figure 3 Profile of crack 3 in tube r34c51 of Steam Generator 22.

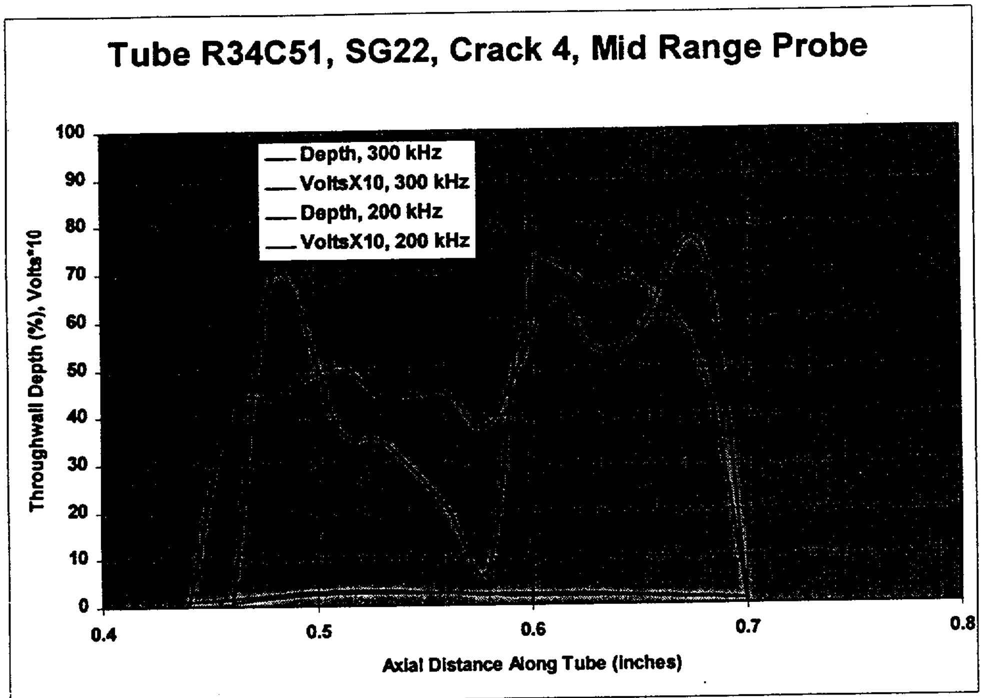

Figure 4 Profile of crack4 in tube r34c51 of Steam Generator 22.

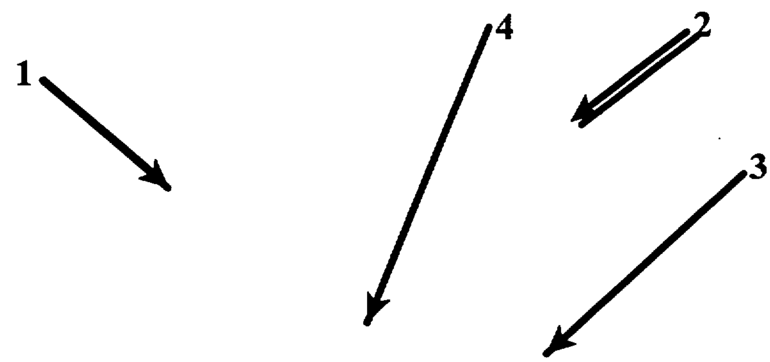

Figure 5 C-scan to tube r34c51 of steam generator 22 before pressurization.

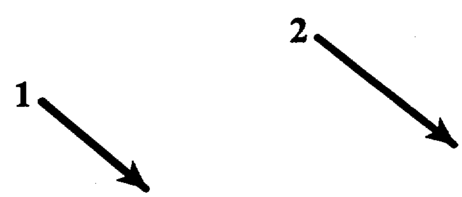

Figure 6 C-scan of tube r34c51 of steam generator 22 after pressurization.

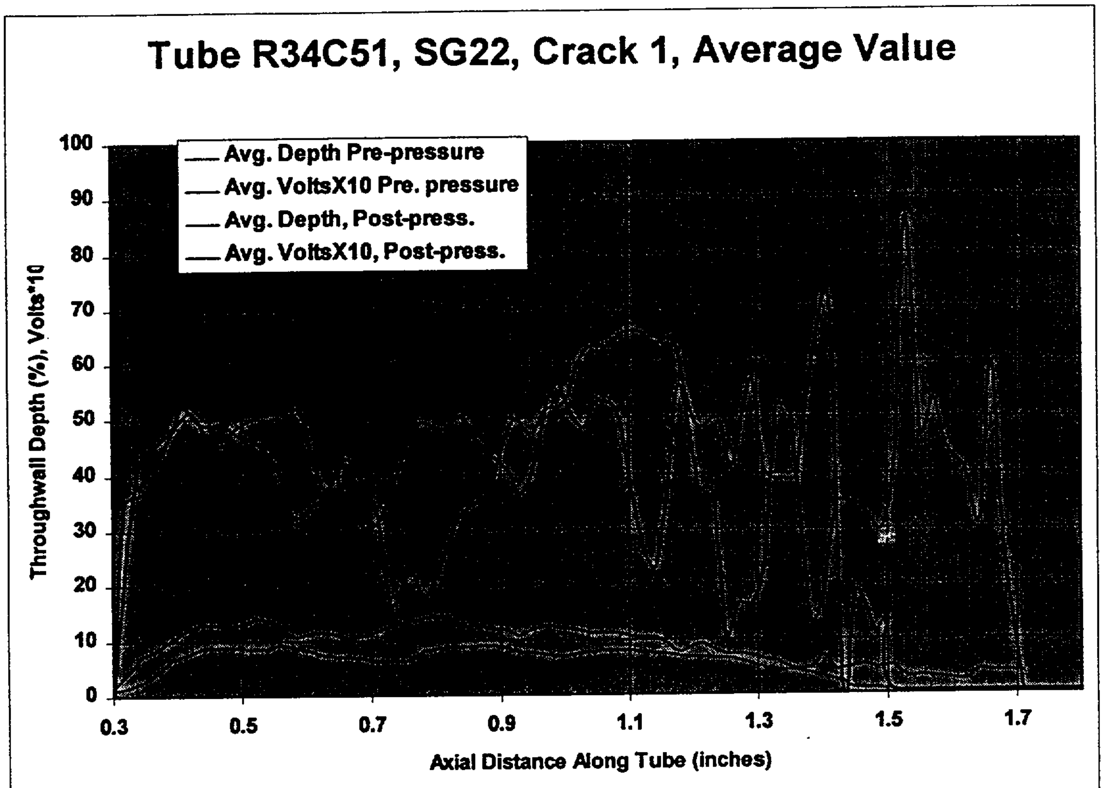

Figure 7 Effect of pressurization on Crack 1 for tube R34C51 of steam generator 22.

In Figure 7 we show the profiles averaged for the plus-point probe for the 300 kHz and the 200 kHz frequencies. The first part of the crack nearer the tube sheet seems to be about the same. For the second part of the crack, the readings seem to have become unreliable. The signals form all the coils were reviewed. The pancake coils showed a deeper crack, but there also was evidence of increased lift-off. The crack may have spread apart somewhat, due to the pressure test, and is no longer strictly crack shaped. The amplitude of the signal increased for all of the coils. This increase was about 25% for most of the crack for the plus-point coils. There probably would have been more increase if Crack 2 had not opened up, relieving the stress.

Measurements made on this crack with the 0.080-inch high frequency probe showed a very sharp spike-like response before pressurization, and a more broad response afterwards, also indicating some spreading of the crack. A comparison of Crack1 in figures 5 and 6 show that the base of the crack is much fatter as the distance from the tube sheet has increased. Another crack parallel to Crack1 may have opened in this region, causing errors in the depth readings.

In Figure 8 we show the profiles for Crack 2, for the plus-point probe, averaged over the 300 kHz and the 200 kHz frequencies. These readings appear to be more regular, but they were also

considerably distorted. This crack reading switched from od to id a number of places along the length, and the crack signal was not the classic shape that occurs on the calibration standards. When the signal went to id, the crack was assigned a value of 100%.

The amplitude of this crack signal increased to 12 volts. The amplitude calibration was set for a 100% EDM notch to have a voltage of 20-volts. Even a through wall crack must have some current bridging across the crack face to cause the signal to decrease to this value.

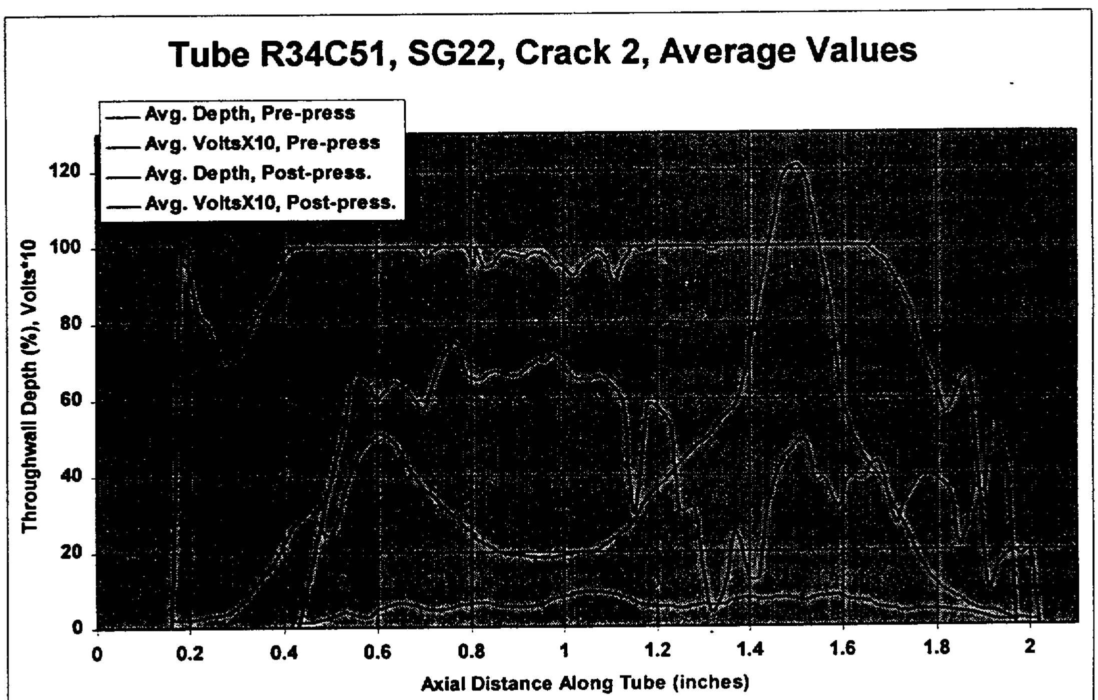

Figure 8 Effects of pressurization on Crack 2 in tube R34C51 of Steam Generator 22.

I just got off the phone with John McCann - I discussed the preliminary team findings with him - I used the most recent summary performance issues as an outline.

1. Leaving Tubes in service with indications that they have said could have been identified. Con Ed has a CR and a CMOA indicating that there were indication in the U-bend and sludge pile that would have been > 40 % TW in 1997.

   He stated that the current that they currently believe that the four U-bend indications they reported in the CR were not detectable - I asked him then why was the issue sent to be dispositioned in the CR for the C-3 determination, without any discussion as to them believing that the reported condition was not correct. He did not have an answer. He said that the CMOA dealt with this, but that he would look at it.

   With Respect to the sludge pile CMOA - he said that the indications in 1997 were looked at with 2000 inspection setups and analysis techniques and that this made them easier to see.

   He said that to sight the TS for leaving tubes in service is not correct since the POD assumes that you may leave things in service with possibly greater than 40 % TW.

   We had previously discussed this with the licensing engineer several times.

2. In effective identification of U-bent indications. We went over the noise, R2C67 in action, and the dent/hourglassing issues - leading to the fact that some additional actions should have been taken in 1997 to cause the defects to be identified.

   He stated that we needed to make sure that we used the 1997 analysis techniques on the 1997 data to actually see what the analyst saw - I told him that I was fairly sure that this was what we had done.

   He added that they knew that there was PWSCC in the SGs and that at the time finding one indication was not unexpected. He said that Westinghouse has taken this position and that they (West.) believe that nothing more should have been done (imagine that).

   From the noise standpoint I added that we believe that the noise in 2-5 could have obscured a 70 -100 % TW indication, I told him that this was a major concern for POD, and that we believe that it should have been addressed at the time. He started to get into individual analyst performance, but I said that we were looking at the program in an overall view.

3. With respect to the Plus Point Set up - he said that there was no requirement for

them to have had the phase angle and calibration standard as per the EPRI Performance Demonstration Database ETTS sheet. He said that this was discussed in the responses to the questions. I said that we believed that the response was poorly worded and confusing and that they we believe that they needed to follow the EPRI.

4. With respect to not having a criteria or method of measuring significant hourglassing he had no questions.

5. I then talked about the overall conclusion and the fact that it appeared to us based on the above that the root cause had not been thorough.

I left it with him that we would look at what standards we used to look at the 1997 data - he added that there had been a lot of data manipulation done on the 1997 data to make it easier to find the indications. I said that I would verify that our look at this data was done as near as the1997 data analysis as we possibly could do.

I also said that I would take a look at the 1997 setup issue