Item #12 - #6

Subj: Profile of tube 2-67
Date: 8/1/2000
To: elm@nrc.gov, smc1@nrc.gov Emmett Murphy
CC: WLS@nrc.gov

File: C:\WP\FI\INDIAN18.NRR (133929 bytes)
DL Time (32000 bps): < 1 minute

Emmett:
here is the profile of tube 2-67 that you asked for. I threw in a c-scan for good measure.

At my request, Scot Redner Emailed me a copy of his presentation at the EPRI NDE Conference, and at NRR headquarters. In it he states that the Midrange plus-point is not qualified at plant I (guess which one this is) due the fact that the signal-to-noise for plant I is greater than that on the EPRI qualification data set. Stephanie, you may have met Scott when he was at plant I.

Caius Dodd

Subj: Data tape
Date: 8/2/2000
To: pieringp@westinghouse.com
CC: (elm@nrc.gov), (smc1@nrc.gov)

Gary:
Someone from Westinghouse called yesterday afternoon saying that a courier would be delivering a tape late last night. I stayed awake until after midnight waiting for him, but no one came. Do you have any information on this?

Thanks, Caius

Subj: Re: Courier Package
Date: 8/2/2000
To: irasm@westinghouse.com
CC: elm@nrc.gov, (ejs@nrc.gov), smc1@nrc.gov

Steve:
No, I did not receive it. I waited up until after midnight for the disk but no one came. Let me know if you can find out anything about the package.

Caius Dodd

Subj: Fwd: Optical Disc - Courier Update
Date: 8/2/2000
To: elm@nrc.gov, smc1@nrc.gov

I'll look for it later today.

Caius

J 177

Subj: Data Disk
Date: 8/2/2000
To: irasm@westinghouse.com, elm@nrc.gov, smc1@nrc.gov

Emmett, Stephanie, and Steve:
The optical disk has arrived and I am reviewing the data.
Caius

Subj: Noise and such
Date: 8/3/2000
To: elm@nrc.gov, smc1@nrc.gov

Emmett:
I have looked at the noise on the u-bend tubes and they look reasonable. I do not see any problem there, but I need to do a signal-to-noise measurements, where I compare this noise to the signals form the EDM notches, using the high-frequency probe. Also, the noise that we measure on the tubes depends on how wide the window is opened. Sager called me this morning and we discussed this some. He also told me to tell you that he had not had time to write up something for you. I'll talk to you later.
Caius

Subj: Noise Survey
Date: 8/3/2000
To: elm@nrc.gov
CC: smc1@nrc.gov, WLS@nrc.gov
CC: DCL.kp1_po.KP_DO@nrc.gov (David Lew)

File: C:\WP\FI\INDIAN17.NRR (6627 bytes)
DL Time (32000 bps): < 1 minute

Emmett:
I have taken a quick look at the noise samples that Westinghouse sent me and they are at least in line with their claims. I believe that the signals that they will get from defects in the u-bend will be higher than those from their midrange probe in the POD determination, which will be conservative. I still have some work to do on this, but things appear to be okay.

I am attaching a slightly more detailed write-up. It is appended to the end of another write-up that I sent earlier. Talk to you at 3:00 PM.
Caius

Subj: Crack Profiles
Date: 8/3/2000
To: irasm@westinghouse.com
CC: elm@nrc.gov

Steve:
Could I get a copy of the crack profiles with the voltage amplitudes on the graphs that Westinghouse made for NRR? Email them to me if you have them in Excel or Word. Otherwise, just send them by snail mail.
Thanks, Caius Dodd

Subj: Review of July 28 response
Date: 8/9/2000
To: elm@nrc.gov, smc1@nrc.gov

Emmett:
Westinghouse sent me the 10-page document that they had previously sent NRR, and I have reviewed it. In Table 1-2 they list tube 2/71 as having been found with the 400 kHz inspection. However, in the request for data that we made, they were not able to supply this to me, only partial scans of the tube with the 400 kHz probe. Also, Don Adamonis in his May 23 presentation said that 2/71 was one of the four tubes that was initially found with the high-frequency probe. In their table they show 2/5 as having been initially detected with the high-frequency probe. However, it was never scanned with this probe, and the 400 kHz data shown is for 1997.

I have some reservations about the POD study that was done for egg-crate cracks. I believe that it will be applicable only if the defects are located entirely in the high noise region of the support plate and if the majority of the defects are not lab produced.

The plot shown in Figure 1 includes the 1997 indications. Note that the 1997 indications are not too much smaller than the POD database, and keep in mind that eight of nine defective tubes were missed in 1997.

However, I believe that their conclusion that PWSCC in the u-bends is detected well enough for safe operation for 4 months is valid.
Caius

Subj: Indian13a.wpd
Date: 8/10/2000
To: WLS@nrc.gov

File: C:\wp\fi\indian13a.wpd (1743312 bytes)
DL Time (32000 bps): < 15 minutes

Wayne:
Here is a version modeled after R2C72. I will make another version that I think will be better for black and white printing. You can choose.
Caius

Subj: Figures
Date: 8/11/2000

To: WLS@nrc.gov
CC: elm@nrc.gov, smc1@nrc.gov

File: C:\Zip\fi\Ind13a.exe (341591 bytes)
DL Time (32000 bps): < 3 minutes

Wayne:
I am sending you the copy of indian13a.wpd. I had to shorten the name to zip it, and have made it self extracting.

I am working on your report and have some general comments. I have changed the references to EC to ET. The general acronym used for eddy-current testing is ET, and this is the way the method is referred to by the American Society for Nondestructive Testing.

The figures have been gathered at the end of the text and some of them are distorted due to resizing, at least in my copy. I gave both the Utility and Westinghouse a very hard time for writing their reports with the figures gathered at the end, so they may bring this up if we do it. I will be glad to go through the report and put the figures in with the text, and try to remove the distortion if you want me to.

Finally, the average depth that I measured in 1997 for tube 2/5, using only the depth readings where the voltage was greater than 1.0 volt was 87%.

I hope to have all of the eddy-current section reviewed by noon today and will compress it and send it to you.
Caius

Subj: Corrections
Date: 8/11/2000
To: WLS@nrc.gov

File: C:\Zip\fi\Cvdcorr.exe (718417 bytes)
DL Time (32000 bps): < 6 minutes

Wayne:
I am attaching a self-extracting file with my changes in red. You can make any that you want to. I renamed the file so that it would not overwrite anything of yours. One note is that the TC6700 was used at Indian Point, which does uses multiple frequency and filtering, rather than multiplexing. More about eddy-current testing. EPRI uses ECT for this, and ASNT uses ET. Do what you want to about this. Also, I am not a contractor, but a part time employee of NRC. In some places you use u-bend and other places you use U-bend. I do not know which is correct, but it should be the same.

Again, I will attempt to put all the figures in with the text if you want me to, and correct the distortion problem with some of them.

Did you get the figures that I sent with Indian13a.wpd?
Caius

Subj: Figures
Date: 8/14/2000
To: WLS@nrc.gov

File: C:\Zip\fi\Figures.exe (785863 bytes)
DL Time (32000 bps): < 7 minutes

Wayne:
This version contains the better figures. If you want me to put these in the final version, send me your final version (preferably zipped) and I will correct them in it. If you want any changes, let me know.
Caius

Subj: 2/67
Date: 8/15/2000
To: WLS@nrc.gov

File: C:\wp\fi\sg4r2c67.nrr (64293 bytes)
DL Time (32000 bps): < 1 minute

Wayne:
Here is the profile of tube 2/67 of sg24.
Caius

Subj: sg24r2c5
Date: 8/15/2000
To: WLS@nrc.gov

File: C:\wp\fi\sg4r2c5.nrr (433667 bytes)
DL Time (32000 bps): < 4 minutes

Wayne:
Here is the requested profile.
Caius

Subj: Probe voltage measurements
Date: 8/16/2000
To: elm@nrc.gov

File: C:\wp\fi\indian19.nrr (120153 bytes)
DL Time (32000 bps): < 1 minute

Emmett:
Here is a brief write-up on the amplitude of the PWSCC defect signals using the two probes.

Caius

Subj: Re: Sample size
Date: 8/17/2000
To: WLS@nrc.gov, SMC1@nrc.gov

Wayne:
The sample size of NDD tubes that I reviewed in the U-bend was about 10 tubes. This was too small to have any statistical significance, based on the total number of defective tubes found in the generators. It did give me a flavor of what was being called and how hard the tubes were to inspect with the new probe. Also, there were differences in the data quality with the new probe. I am wondering if Kewaunee and Prairie Island had lower noise with the new probe.

The use of a pressure test on the tubes made the defects grow in amplitude. If the utility had pressure tested a significant number of tubes (25 ?) in the suspect region of steam generator 24, then there would be greater assurance that nothing was missed. However, from the limited number of tubes that I reviewed, I believe that there are no tubes with U-bend PWSCC that would present a danger to restart for a 4-month period. The midrange probe inspection caught all the defects that leaked under pressure testing, and the high frequency probe caught additional smaller defects.

Caius

Subj: Ratio of defect voltages
Date: 8/21/2000
To: elm@nrc.gov, LXL@nrc.gov (Louise Lund)
CC: ejs@nrc.gov

Emmett and Louise:
One of the keys in recognizing that noise would be a problem is the signal amplitude that tube 2/67 had in 1997, compared to the signal amplitude of the calibration standard. The amplitude of the signals from stress corrosion cracks are smaller than the signals from the EDM notch standards. The ratio of the signals are between 20% and 70% of that of the EDM notches, except in the cases of the Westinghouse lab-grown samples. The amplitude of SCC seems to increase with time, even when the depth of the cracks seems to be fairly stable. This may be due to the increase in the resistivity of the corrosion film on the crack-face that caused the crack in the first place.

We need to generate a table of amplitude ratios for the SCC at Indian Point and from other plants so that analysts can compare the voltages that cracks would produce (if present) to the noise levels in the tubes. I believe that something like this was done years ago for ODSCC for the alternate plugging criteria, but I have not been able to find the data.

I believe that these ratios will vary somewhat with the probe type, but that the average ratios will be the same. I also believe that signal from SCC will always be less than that from an EDM, so that if it appears to be equal to the signal from a standard, then the crack depth was probably undersized. Such was the case for tube 2/67. This should have been another red flag to the analysts that something was wrong with the sizing of tube 2/67.

As a part of this, the response of the probes to different notch standards needs to be measured and plotted, so that these ratios can be computed.

Caius

Subj: OD defects in the u-bends
Date: 8/22/2000
To: elm@nrc.gov, smc1@nrc.gov
CC: ejs@nrc.gov

File: C:\wp\fi\indian20.nrr (1019763 bytes)
DL Time (32000 bps): < 9 minutes

Emmett:
This is my first guess at the ability to detect OD defects in the u-bends. I believe that we will first start seeing them when they reach 70% or greater. After thinking back over the years, I believe that Main Yankee and Palo Verde both had some OD cracking in the horizontal section of their u-bends. Of course, both of these were CE plants, and may not apply here. This is a guess, and it may change somewhat when I measure the noise at 600 kHz.

As I mentioned, I only have two days left this fiscal year to work for NRR that I will get paid for. However, I will continue to support your effort on my own.

Caius

Subj: Tube Noise
Date: 8/22/2000
To: LXL@nrc.gov (Louise Lund)
CC: ejs@nrc.gov

Louise:
I have not talked to Ted lately, but I have concerns about POD qualifications in general, particularly when you consider that the 1997 inspection of the u-bends was advertised as being qualified and they missed 8 out of 9 defects. I believe that they are taking liberties with their qualification studies, which NRR needs to look at very critically.

I am glad that you are getting to take the level IIA class at Zetec. Have fun and learn a lot out there.

Caius

Subj: Revised version of Indian20.nrr
Date: 8/24/2000
To: elm@nrc.gov

File: C:\wp\fi\indian20.nrr (1240364 bytes)
DL Time (32000 bps): < 11 minutes

Emmett:
I have added a plot of the measurements of the depth of the 40% OD notch, measured at 300 kHz, with and without filters. The filters improved the depth measurement considerable, as you can see in the plot.

Caius

Subj: One man's noise is another man's signal
Date: 8/31/2000
To: LXL@nrc.gov (Louise Lund)
CC: ejs@nrc.gov

Louise:
I do not believe the results of the POD studies that have been done using EDM notches and actual tubes from generators, for U-bends or any other defects. The EDM notches make a signal 2 to 5 times greater in amplitude than the PWSCC cracks, and this is just the cracks that we detect. There well could be others that have always been missed. The actual generator cracks that are detected and used in the POD studies may only be a small subset of the actual cracks in the generator. They may be ones that are in a favorable location or have a larger than usual signal.

We need to generate tables of the signals from the standard EDM notches for the different probes that are used, and then compare these to the SCC (both primary and secondary) that have been detected to date. Then we need to compute these ratios and factor them into the POD studies, with the random noise.

Although NRC has been pushing the industry for many years to develop a written guide for noise in eddy-current tests, nothing significant has appeared in the guidelines that I know of.

The Vic3d program that Ted is buying for me has a noise generator that may help simulate this. We can add random noise to the cracks that have been reduced in amplitude and see how easy to detect.

Part of the problems is in the stress corrosion cracks themselves. We picture them as two dimensional in our minds, but they are actually three-dimensional and tend to wonder all over the place. They are not well defined. At Indian Point they grew in amplitude over the inspection cycle, but very little in depth.

I will be here until around 1:00 PM, and start to work around 7:00 AM tomorrow if you want to call at anytime.

Caius