

From: Gregory Cranston
To: David Lew, Lawrence Doerflein, Pete Eselgroth
Date: Mon, Mar 27, 2000 11:47 AM
Subject: IP2 Steam Generator Tube Inspection Update

See attached. This revision supercedes previous revisions and includes information presented in previous revisions (i.e., you can throw the old revisions away if you want).

CC: Brian Holian, Michael Modes, Raymond Lorson, William Raymond

ITEM #

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A/5/

(6)

STEAM GENERATOR TUBE TESTING STATUS

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I. BACKGROUND

- A. Each steam generator (SG) has 3,260 tubes.
- B. The number of tubes currently plugged are:
 - 1. SG21 - 313
 - 2. SG22 - 405
 - 3. SG23 - 301
 - 4. SG24 - 306

II. ITEMS OF NOTE

- A. The tube leak on SG24 was in Row 2, Column 5 and is currently reported as a 2" crack. Copies of the eddy current data analysis ('topographical map') ave been faxed to Dave Lew. The picture labeled Figure 5-1 is the data from the 1997 eddy current testing. The parallel ridges are indicative of crud build up on the tube OD. The ridge on the left contains the indication that was not appropriately interpreted as a precursor in 1997. This particular picture used the data from the setup of the 1997 outage but was enhanced in this presentation by resetting the 20% ID signal to be at about 10 degrees. The specific location of the indication in the ridge is where the lines of the map are spaced further apart, which is on the right side of the left ridge, just below halfway down from the top of the picture. The second figure (dated 3/24/00) is the data presentation of the 24SG leaking tube which was done with a RPC +Point probe. This is the presentation dated 3/24/00. On that presentation the peaks represent the location of the crack that caused the event.
- B. The three new leaks discovered in SG 22 are in:
 - 1. Row 44, Column 42
 - 2. Row 45, Column 39
 - 3. Row 45, Column 44
 - 4. The leak was very slow - about 1 drop per 30 minutes for two tubes and 1 drop per 60 minutes for the third.
 - 5. The potential significance of the findings is that the ECT examinations had not identified defects in these tubes. The ECT data for one of the tubes had one finding categorized as non qualified indication (NQI) which had not yet been profiled with a RPC probe. Further licensee review of the ECT data for these tubes, as well as an engineering evaluation of the hydro results, continues.
 - 6. The location of the leak was the same on all three tubes and was at the tube to tube sheet filet weld.
 - 7. This is the same issue described in NRC Information Notice 98-27. The Information Notice was written primarily for Once Thru Steam Generators (OTSG) but stated that the tube end cracking may not be limited to OTSGs.
 - 8. The leaks were detected using the mid-range +Point probe at 300 KHz. Picked up using RPC but cannot see with Cecco.
- C. The licensee is planning to redo all Row 2 & 3 tubes with the high frequency probe. They currently only have two probes but expect more to arrive on Sunday, 3/26,2000.
- D. There are two indications in the U bend area of 24SG that they are scheduled for insitu testing. No schedule date yet.
- E. The last table shown below, Pluggable Tube Summary, shows the minimum number of additional tubes that will be plugged for each SG. This includes all Row 2 tubes and all tubes that had indications at the support plates (SPI). Not identified are those tubes that had indications in the U bend area, sludge area and tube sheet area that will be retested using the high frequency probe. So the list of tubes to be plugged will grow. I have faxed the Row and Column numbers of these tubes with the Support Plate Indications (SPI) to Dave Lew.

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- F. For tubes with indications in the tube sheet area, including the three tubes in 22SG that leaked (see B above), a decision will be made later as to whether to plug those tubes or apply the F* criteria and re-roll the tubes. The decision will be based on cost/benefit and ALARA considerations.
- G. Work activities on Sunday are related to closing out open items, i.e., the retests identified on the tables below.
- H. The additional, new high frequency probes arrived early Sunday morning and are available to speed up the retests to be done using the new probes. The advantage of the high frequency probe is that the signal does not penetrate as far. Consequently, if there is crud on the tube OD it will not appear as a ridge on the data analysis presentation as described in I.A. above, which makes it easier to see a crack indication.
- I. Twelve (12) hot leg tubes in 24SG will be re-rolled starting Sunday night (3/26/00) due to indications observed in the tube to tube sheet area per F*. The length of the re-roll varies for each tube. The original roll length is about 2.25". The tube sheet is about 22" thick. The re-rolls will vary from about 2" to 7" in length, done in about 2" increments with some overlap. The tubes being re-rolled are:

Row	Col
13	33
15	8
15	7
16	42
18	24
19	30
20	32
20	46
26	32
28	43
33	29
39	42

- J. In conjunction with determining the readiness for restart it may be prudent to plot an exponential curve of indications using the 1997 and 2000 data, plus any previous data. This is because, as stated by NRR, the appearance of the first stress corrosion crack typically indicates that the incubation phase has passed and that more cracks are likely. And, once stress corrosion cracks initiate, the number is likely to increase exponentially with time. The exponential curve would be used in conjunction with the operational assessment (forward looking assessment) to determine reasonable assurance that continued operation is acceptable (no significant tube leaks or ruptures) until the next tube inspection. The licensee is doing condition monitoring (backward looking assessment) to confirm that tube integrity was maintained for all tubes (other than 24SG - R2, C5) since the time of the 1997 inspection.

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III. TESTING STATUS

A. The number of tests to be conducted and their status is as follows:

1. Cecco Inspection Program:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	3858	3855	3855	3	99.92%	3
22	3837	3835	3835	2	99.95%	2
23	3949	3929	3929	20	99.49%	20
24	3943	3942	3942	1	99.97%	1
Total	15587	15561	15561	26	99.83%	26

2. Bobbin Inspection Program:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	4284	4282	4282	2	99.95%	2
22	4397	4397	4397	0	100.00%	0
23	4520	4518	4518	2	99.96%	2
24	4257	4257	4257	0	100.00%	0
Total	17458	17454	17454	4	99.98%	4

3. U-Bend +Point Inspection:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	248	87	82	5	33.06%	161
22	184	75	66	9	35.87%	109
23	208	91	90	1	43.27%	117
24	227	223	223	4	98.24%	4
Total	867	476	461	19	53.17%	391

The four retests in 24SG are Row 2, columns 4, 43, 71, & 74.

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4. B&W Roll Plug Inspection

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	57	56	56	1	98.25%	1
22	85	85	85	0	100.00%	0
23	10	10	10	0	100.00%	0
24	42	42	42	0	100.00%	0
Total	194	193	193	1	99.48%	1

5. Special Interest +Point Inspection:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	186	85	58	1	31.18%	101
22	203	0	0	0	0.00%	203
23	130	0	0	0	0.00%	130
24	137	137	137	0	100.00%	0
Total	656	222	195	1	29.73%	434

6. Special Interest Re-roll Candidate Inspection:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	127	0	0	0	0.00%	127
22	19	0	0	0	0.00%	19
23	852	0	0	0	0.00%	852
24	52	52	52	0	100.00%	0
Total	1050	52	52	0	4.95%	998

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7. All Programs Summary:

SG	Tube Inspections	Tests Acquired	Tests Analyzed and Complete	Retests	Percent Complete	Total Remaining Inspections
21	8760	8365	8333	12	95.13%	395
22	8725	8392	8383	11	96.08%	333
23	9669	8548	8547	23	88.40%	1121
24	8658	8653	8653	5	99.94%	5
Total	35812	33958	33916	51	94.71%	1854

8. Pluggable Tube Summary:

Steam Generator	21	22	23	24	Total
Row 2 Tubes	72	49	45	57	223
SPI Indications	27	9	19	32	87
Total	99	58	64	89	310