

REACTOR COOLANT SYSTEM

SURVEILLANCE REQUIREMENTS (Continued)

5. Defect means an imperfection of such severity that it exceeds the plugging limit. A tube containing a defect is defective. Any tube which does not permit the passage of the eddy-current inspection probe shall be deemed a defective tube.
  6. Plugging Limit means the imperfection depth at or beyond which the tube shall be removed from service because it may become unserviceable prior to the next inspection and is equal to 40% of the nominal tube wall thickness.
  7. Unserviceable describes the condition of a tube if it leaks or contains a defect large enough to affect its structural integrity in the event of an Operating Basis Earthquake, a loss-of-coolant accident, or a steam line or feedwater line break as specified in 4.4.5.3.c, above.
  8. Tube Inspection means an inspection of the steam generator tube from the point of entry (hot leg side) completely around the U-bend to the top support of the cold leg.
- b. The steam generator shall be determined OPERABLE after completing the corresponding actions (plug all tubes exceeding the plugging limit and all tubes containing through-wall cracks) required by Table 4.4-2.

4.4.5.5 Reports

- a. Following each inservice inspection of steam generator tubes, the number of tubes plugged in each steam generator shall be reported to the Commission within 15 days.
- b. The complete results of the steam generator tube inservice inspection shall be included in the Annual Operating Report for the period in which this inspection was completed. This report shall include:
  1. Number and extent of tubes inspected.
  2. Location and percent of wall-thickness penetration for each indication of an imperfection.
  3. Identification of tubes plugged.

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ST. LUCIE - UNIT 1

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\* This 40% plugging limit is not applicable during the Cycle 7 operation up to June 30, 1986. If at anytime during the period, the Unit enters any Modes other than Modes 1 and 2, or Mode 3 for greater than 24 hours, the unit will be placed in cold shutdown and the tubes with indications greater than 40% through-wall penetration shall be removed from service prior to exceeding 200° F.

## Attachment 2

St. Lucie Unit 1  
Docket Nos. 50-335  
Emergency License Amendment  
Steam Generator Plugging Limit

### SAFETY EVALUATION

Three steam generator tubes were removed from the A steam generator of St. Lucie Unit 1 (PSL-1) during the October-December 1985 outage. These were then sent to B & W for examination in order to better characterize the eddy current (ET) indications noted during the 1984 and 1985 exams. The summary of the laboratory work and its correlation to the field ET results are shown on the attached table. The presence of grain boundary degradation in the form of intergranular attack (IGA) with some stress corrosion cracking (SCC) caused a review of all the 1985 ET data, and a historical review of a population of defects, Distorted Support Signals (DSS) and Undefined Signals (UDS) as well as 1984-1985 plugged tubes. Additionally, a sample of greater than 50% of distorted signals were compared to the 1984 data to assess growth.

Using the B & W results as an indicator the results of the 1985 ET exam revealed the presence of seventeen indications having depth 40%. These indications had typically been classified as either DSS or UDS. While direct comparisons of previous ET data are difficult due to the use of differing equipment and techniques, the following conclusions can be reached:

- a) There is no significant change in indication depth or signal amplitude between the 1984 and 1985 data.
- b) Indications can be identified in certain tubes as early as 1981 in the majority of cases. A small number can be tracked to 1979.

The industry data on IGA/SCC demonstrates that the tube material below the surface area of uniformly degraded IGA/SCC remains sound and does not suffer from incipient degradation in the grain boundaries. Tests have shown that tubes with IGA will sustain pressure differentials substantially greater than predicted during the worst case design basis accident (MSLB) prior to burst. Testing has also shown that through wall cracks of 1 inch in length leak before break.

In order to verify the industry results for PSL-1, samples of tubing were obtained from CE for the purpose of leak rate testing. The tests run at Chattanooga used thru-wall cracks of 3/8", 15/16", and 1 1/2" in length for the leak-before-break test. The results demonstrate that the leakage of through wall cracks of the size seen on PSL-1 post Main Steam Line Break (MSLB) are

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The source has advised that he has observed certain activities which are of interest to the United States. These activities are being carried out in the area of [redacted] and are being conducted in a clandestine manner.

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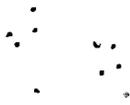
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well below those assumed in the Safety Evaluation. These results are conservative in that the maximum crack length seen at PSL-1 is approximately .6". In addition burst tests run on CE tubing for 3" long, fully circumferential IGA verify that IGA at 70% could withstand over twice the MSLB pressure differential prior to bursting. These results are also conservative as compared to St. Lucie Unit 1.

Therefore, it can be concluded that PSL-1 can continue to be safely operated due to the following:

- 1) The IGA/SCC can be detected and sized through ET means. In addition, the results of the historical data review demonstrate that the attack has occurred early in the operating life of the plant, and has not grown significantly during the latest cycle. That the corrosion occurred early in the operating life of St. Lucie Unit 1 is further evidenced in the improvement in steam generator water chemistry beginning in 1978. Furthermore, since late 1982, the St. Lucie Units have been operating with a very stringent secondary water chemistry control program based upon the EPRI Steam Generator Owner's Group (SGOG) PWR Secondary Water Chemistry Guidelines. This conclusion can also be supported by the improvement in secondary water chemistry since the adoption of EPRI Water Chemistry Guidelines.
- 2) Both FPL and industry tests demonstrate that through wall cracks will leak before break, and that IGA affected tubes will resist bursting until a pressure much greater than the PSL design basis is reached. Therefore, a potential problem will be detected prior to it becoming a safety concern, and that the existing condition will not lead to exceeding the design basis.

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PSL #1  
1985 POST OUTAGE  
STEAM GENERATOR DATA REVIEW

<u>"A" Gen.</u>			<u>"B" Gen.</u>		
<u>Line</u>	<u>Row</u>	<u>% through wall</u>	<u>Line</u>	<u>Row</u>	<u>% through wall</u>
62	96	61	92	44	42
82	40	51	149	3	58
96	94	54	109	23	45
106	110	51	104	88	59
129	41	61			
137	107	41			
155	49	66			
162	48	59			
86	50	51			
69	29	47			
69	35	46			
77	65	54			
113	73	62			
<u>Total</u>	<u>13</u>		<u>Total</u>	<u>4</u>	

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St. Lucie Unit 1  
Eddy Current - Metallography Correlation

<u>Location</u>	<u>FPL Field</u>	<u>Lab</u>	B&W	<u>8x1</u>	<u>Actual Depth</u>	<u>Defect Appearance</u>
Sludge Pile (120/12-2) 1.3" ATS	41%	40%		-	30%	IG/TG SCC Parallel Axial cracks. 0.4" longest over 1" axial length across 360° of tube circ. Most over 90°.
Sludge Pile (79/91-2) 1.4"ATS	UDS	20%		50%	16%	IGA PATCH "axial" circ. 1/2"x1/2".
4.4"ATS	57%	50%		60%	42%	IGA PATCH "axial" circ. .8"x1/2".
#1 Egg Crate (59/95-4)	DSS	not seen		50%	52%	IGA PATCH (0.7 axia x 0.3 circ.)
#2 Egg Crate (59/95-5)	29%	25%		30%	13%	IGA PATCH (0.4 axia x 0.3 circ)
#3 Egg Crate (120/12-7)	82%	80%		90%	72%	IGA/TG SCC PARALLEL axial cracks in lan area 0.6" longest over 2 inches axial across 0.1" of tube circ.

### ATTACHMENT 3

#### NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The standards used to arrive at a determination that a request for amendment involves no significant hazards consideration are included in the Commission's regulations, 10 CFR 50.92, which states that no significant hazards considerations are involved if the operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows:

- (1) Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The events of concern for this amendment are those which could potentially lead to a steam generator tube rupture during normal operation or accident conditions. Recent metallurgical analyses of tube samples removed from a St. Lucie Unit 1 steam generator during the late-1985 refueling outage and an extensive review of eddy-current data for 100% of the tubes in both steam generators indicates that the condition of the tubes has been characterized with a high degree of confidence and that the phenomenon of concern (intergranular attack, or IGA) has not progressed significantly during the latest cycle. Furthermore, the effective time period of the amendment is limited to 30 days. Thus, the use of the modified specification under these circumstances does not involve a significant increase in the probability of occurrence of a steam generator tube rupture event or any other event previously evaluated. In addition, recent results of FPL and industry leak rate testing indicate that through-wall cracks will "leak before break," and that IGA-affected tubes will maintain integrity to a pressure greater than the design basis pressure applicable in this situation to the St. Lucie Unit 1 steam generators; therefore, the consequences of previously evaluated accidents are not significantly increased by this amendment.

- (2) Use of the modified specification would not create the possibility of a new or different kind of accident from any accident previously evaluated.

The evaluation performed by CE, of steam generator tubes with greater degradation than that present at PSL 1, ensures that this modification will not create the possibility of a new or different kind of accident from any accident previously evaluated.

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- (3) Use of the modified specification would not involve a significant reduction in a margin of safety.

Industry data has demonstrated that tube material below the area of uniformly degraded IGA remains sound, and tests have shown that tubes with IGA will sustain differential pressures substantially greater than those predicted during design basis accidents. The limiting stress condition for tubes are those requirements of Regulatory Guide 1.121 which calls for tubing to be able to withstand three times normal operating differential pressure without bursting. Sixteen of the seventeen defects meet this requirement. The seventeenth has a safety factor of approximately 2.75. Tests specific to FPL have been conducted to verify that the leak-before-break concept applies to the St. Lucie Unit 1 steam generators and that potential problems will be detected before they become significant safety concerns. Thus, use of the modified specification, especially over a limited 30-day time period, does not involve a significant reduction in a margin of safety in that the ASME Section III Code limits (NB-3225) are not surpassed, and that the requirements of Regulatory Guide 1.121 are met by all defects with the exception of one which has a slightly reduced margin of safety.

Based on our compilation of a reliable and conservative eddy-current data base, our determination that IGA is progressing at a slow rate of growth, the applicability of the leak-before-break concept, and the short-term interim nature of the modified specification (as described above), we have determined that the amendment request does not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the probability of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety; and therefore does not involve a significant hazards consideration.

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