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SUBJECT: Forwards response to GL 95-03, "Circumferential Cracking of  
SG Tubes." GL issued on 950418 to notify licensees of recent  
SG tube insp findings at MYAPS & safety significance of  
findings. O

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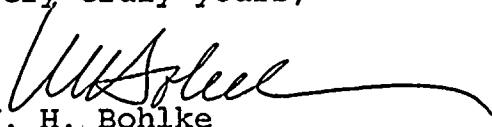
Re: Turkey Point Units 3 and 4  
Docket Nos. 50-250 and 50-251  
Response to Generic Letter 95-03,  
Circumferential Cracking  
of Steam Generator Tubes

Generic Letter (GL) 95-03, "Circumferential Cracking of Steam Generator Tubes," was issued by the NRC on April 18, 1995, to notify licensees of recent steam generator tube inspection findings at Maine Yankee Atomic Power Station and the safety significance of these findings.

In accordance with the GL, Florida Power and Light Company (FPL) provides the attached response relative to the Turkey Point Plant. The attached information is provided pursuant to the requirements of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

Should there be any questions concerning this response, please contact us.

Very truly yours,

  
W. H. Bohlke  
Vice President  
Nuclear Engineering and Licensing

OIH

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, Region II, USNRC  
T. P. Johnson, Senior Resident Inspector, USNRC, Turkey Point  
Nuclear Plant

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ADD 1

STATE OF FLORIDA            )  
                                  ) ss.  
COUNTY OF PALM BEACH )

W. H. Bohlke being first duly sworn, deposes and says:

That he is Vice President, Nuclear Engineering and Licensing, of Florida Power and Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

  
W. H. Bohlke

Subscribed and sworn to before me this

22nd day of June, 1995.

  
\_\_\_\_\_

Susan M. Mann  
Name of Notary Public (Type or Print)

NOTARY PUBLIC, in and for the County of  
Palm Beach, State of Florida

My Commission expires \_\_\_\_\_  
Commission No. \_\_\_\_\_



SUSAN MARIE MANN  
Comm. No. CC 426358  
My Comm. Exp. Feb. 18, 1999  
Bonded thru Pichard Ins. Agcy.

W. H. Bohlke is personally known to me.

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NRC GENERIC LETTER 95-03  
CIRCUMFERENTIAL CRACKING OF STEAM GENERATOR TUBES

**BACKGROUND**

Generic Letter (GL) 95-03, "Circumferential Cracking of Steam Generator Tubes," was issued by the NRC on April 18, 1995, to notify licensees of recent steam generator tube inspection findings at Maine Yankee Atomic Power Station and the safety significance of these findings. The NRC is requesting that licensees take recommended actions which will provide assurance that steam generator tube degradation will be reliably detected so that the potential for steam generator tube rupture is maintained at an acceptable level.

**REQUESTED ACTION 1**

Addressees are requested to evaluate recent operating experience with respect to the detection and sizing of circumferential indications to determine the applicability to their plant.

**FPL RESPONSE**

FPL has reviewed recent operating experience information obtained from the Electric Power Research Institute (EPRI) Steam Generator Strategic Management Program and the Pressurized Water Reactor Nuclear Steam Supply System (NSSS) vendors and compiled and reviewed by Nuclear Energy Institute (NEI) through industry wide surveys. Turkey Point Units 3 and 4 steam generators (SGs) were replaced in 1982 and 1983, respectively, with Westinghouse Model 44F SGs. The replacement SGs have alloy 600 thermally treated (TT) tubing, full depth hydraulic tubesheet expansion joints and stainless steel broached tube support plates. While circumferential cracking has been reported in several models of Westinghouse SGs, no circumferential cracks have been reported in Model 44F SGs.

Circumferential cracking has been reported in nineteen non-Model 44F SGs of the fifty-one Westinghouse SGs reviewed. Circumferential cracks have occurred mainly in units with alloy 600 mil annealed (MA) tubing and partial depth hardroll, full depth hardroll, or Wextex tubesheet joint designs. The circumferential cracks have been located almost entirely at tube expansion transitions at the top of the tubesheet and at small radius U-bends. One unit (now replaced) reported circumferential cracks at dented tube support plate intersections. A small number of circumferential cracks has recently been reported in one unit with alloy 600 MA tubing with hydraulic tubesheet joints. Both outer diameter (ODSCC) and inner diameter stress corrosion cracking (PWSCC) have been reported. Two of sixteen SGs with sleeves have also reported circumferential cracks at the upper hybrid expansion joint (HEJ) of installed sleeves. The Turkey Point Units 3 and 4 SGs do not contain sleeves of any design.



The severity of circumferential cracking in Westinghouse SGs can be assessed from the metallurgical examination results of pulled tubes and in-situ pressure testing. A total of fifteen tubes have been removed from six operating units for circumferential cracks. Available burst test data and destructive analysis results indicate that structural limits have not been violated. The following table summarizes circumferential cracking in Westinghouse units by plant category.

CIRCUMFERENTIAL CRACKING BY WESTINGHOUSE PLANT CATEGORY			
CATEGORY	U-BENDS	DENTED TUBE SUPPORT PLATE INTERSECTIONS	TUBE EXPANSION TRANSITIONS
Partial Depth Hardroll <sup>1</sup> Alloy 600 MA Tubing	YES	NO	YES
Full Depth Hardroll <sup>2</sup> Alloy 600 MA Tubing	YES	NO	YES
Wextex <sup>3</sup> Alloy 600 MA Tubing	YES	YES	YES
Hydraulic <sup>4</sup> Alloy 600 MA Tubing	NO	NO	YES
Hydraulic (Turkey Point) Alloy 600 TT Tubing	NO	NO	NO
Hydraulic Alloy 690 TT Tubing	NO	NO	NO

- |   |  |
|---|--|
| 1. Older units: low incidence of PWSCC reported | 3. Mainly PWSCC and limited ODSCC          |
| 2. Mainly ODSCC and limited PWSCC               | 4. One event; probable PWSCC; small number |

#### REQUESTED ACTION 2

Addressees are requested to, on the basis of the evaluation in Action 1 above, past inspection scope and results, susceptibility to circumferential cracking, threshold of detection, expected or inferred crack growth rates, and other relevant factors, develop a safety assessment justifying continued operation until the next scheduled steam generator tube inspections are performed.

#### FPL RESPONSE

##### Previous Inspections

As previously discussed and shown in the table above, Turkey Point replacement SGs do not contain circumferential cracks and have a low susceptibility to the occurrence of circumferential cracking. The table





below provides the scope and results for the past three inspections at Turkey Point Units 3 and 4. Since 1990, FPL has conducted full length examinations of 100% of active tubes in each SG at each inspection. Examinations utilize conventional bobbin coil techniques with digital multi-frequency instrumentation. Also, conventional motorized rotating pancake coil (MRPC) techniques are routinely used to further characterize selected bobbin indications. These inspections exceed Turkey Point Units 3 and 4 Technical Specification requirements and EPRI "PWR Steam Generator Examination Guidelines" (Reference 1).

MRPC techniques are also used to inspect a sample of manufacturing anomalies which include dented tube support intersections and overexpanded tubesheet joints. Minor denting occurred at upper support plates during manufacturing and affects a maximum of 341 intersections in each SG hot leg. Tubesheet joint overexpansion occurred when a hydraulic expansion tool was set at a depth exceeding the thickness of the tubesheet. This produced a slight bulge in the tube at the top of the tubesheet and affects a maximum of 300 tubes in each hot leg.

#### TURKEY POINT UNIT 3 PAST INSPECTION SCOPE & RESULTS

<u>END OF CYCLE</u>	<u>FULL LENGTH BOBBIN EXAM</u>	<u>HL MRPC OVEREXP<sup>1</sup></u>	<u>HL MRPC DENTS<sup>1</sup></u>	<u># TUBES PLUGGED<sup>1</sup></u>
EOC 11	100%	0%	0%	11
EOC 12	100%	0%	0%	7
EOC 13	100%	100% <sup>2</sup>	2% <sup>3</sup>	4

1 - No corrosion related damage was reported.

2 - In 2 of 3 SGs.

3 - In 1 SG.

#### TURKEY POINT UNIT 4 PAST INSPECTION SCOPE & RESULTS

<u>END OF CYCLE</u>	<u>FULL LENGTH BOBBIN EXAM</u>	<u>HL MRPC OVEREXP<sup>1</sup></u>	<u>HL MRPC DENTS<sup>1</sup></u>	<u># TUBES PLUGGED<sup>1</sup></u>
EOC 12	100%	74% <sup>2</sup>	0%	1
EOC 13	100%	85% <sup>2</sup>	0%	0
EOC 14	100%	12% <sup>2</sup>	54% <sup>2</sup>	0

1 - No corrosion related damage was reported.

2 - In 1 SG.

#### Threshold of Detection

Conventional MRPC technology is qualified to Appendix H of the EPRI "PWR Steam Generator Examination Guidelines" (Reference 1) for detection of ODSCC and PWSCC. This qualification requires that a technique demonstrate, at a minimum, a probability of detection (POD) of 0.80 at a 0.90 confidence level (CL) for flaws 60% or greater through wall, on a suitable specimen set, as defined by Table S2-2 of Appendix H. The



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actual performance of conventional MRPC for detection of circumferential cracks based on field data for a pulled tube specimen set is a POD of 83% at a 90% CL.

#### Growth Rates

No circumferential cracks have been reported at Turkey Point Unit 3 and 4, or other Model 44F units. A total of fifteen tubes have been removed from six operating units for circumferential cracks. Available burst test data and destructive analysis results indicate that structural limits have not been violated.

#### Justification for Continued Operation

Continued operation to the next scheduled SG inspection for Turkey Point Unit 3 and 4 is justified based on the low susceptibility to occurrence of circumferential cracks, scope and results of the inspections conducted as discussed above. These inspections meet or exceed Turkey Point Units 3 and 4 Technical Specification requirements and the EPRI PWR Steam Generator Examination Guidelines (Reference 1). Conventional MRPC techniques have been qualified for detection of circumferential cracking under Appendix H of Reference 1, since 1992. Available pulled tube and burst test data provided by utility owners groups and NSSS vendors indicate that structural limits have not been violated.

In addition, Turkey Point maintains a stringent water chemistry program in accordance with industry standards, including on line monitoring and response procedures, to mitigate tube degradation. The SGs are monitored closely for leakage during operation and shutdown periods. There has been no leakage from the SGs due to corrosion since the SGs were replaced in 1982 and 1983. Operators are trained to identify conditions which may indicate a SG tube leak. In the event that a tube leak occurs, Turkey Point has operator training programs, simulator exercises, and procedures in place to mitigate the consequences of failed tubes.

#### REQUESTED ACTION 3

Addressees are requested to develop plans for the next steam generator tube inspections as they pertain to the detection of circumferential cracking. The inspection plans should address, but not be limited to, scope (including sample expansion criteria, if applicable), methods, equipment, and criteria (including personnel training and qualification).

#### FPL RESPONSE

The scope of future inspections (including sample expansion criteria), methods, equipment, and criteria for personnel training and qualification at Turkey Point Unit 3 and 4 will be conducted, as a minimum, in accordance with the examination protocol established in the PWR Steam Generator Examination Guidelines (Reference 1). FPL currently plans to continue full length bobbin coil inspection of all active tubes at each examination, with MRPC inspections to further characterize indications, as required. Conventional MRPC techniques will be used to examine a minimum 20% sample of dented hot leg tube support intersections and

overexpanded tube transitions in one or more SGs, with larger dents and overexpansions receiving priority.

Upon completion of review and evaluation by industry groups and FPL, new technology has been routinely phased in at Turkey Point in accordance with Reference 1, to provide a link to prior examination data. FPL will consider examination techniques which further improve detection capability when qualified sizing techniques or alternate plugging criteria (APC) for circumferential cracks are available.

#### REQUESTED INFORMATION ITEM 1

Addressees are requested to submit a safety assessment justifying continued operation that is based on the evaluations performed in accordance with Requested Actions (1) and (2) above.

#### FPL RESPONSE

Continued operation is justified based on the scope and results of prior inspections conducted for Turkey Point Unit 3 and 4, as discussed above. The inspections have met or exceeded Turkey Point Units 3 and 4 Technical Specification requirements and the EPRI PWR Steam Generator Examination Guidelines (Reference 1). Reference 1 provides a protocol for developing and applying technology to manage existing and emerging damage forms, including circumferential cracking. Conventional MRPC techniques have been formally qualified since 1992 for detection of stress corrosion cracks. Field tube pull data indicate that, for circumferential cracks, the performance exceeds the minimum requirements of Appendix H of Reference 1. Experience data provided by the utility owners groups and NSSS vendors indicate that the technology and protocol have adequately managed circumferential cracking. It should be noted that the tube leak at Maine Yankee in July 1994 was due to a "missed" indication from a previous inspection and (2) available pulled tube and in-situ pressure test data indicate that structural limits have not been violated.

Turkey Point has not experienced circumferential cracking and has a low susceptibility to the occurrence of circumferential cracking. No circumferential cracking has been identified in any Model 44F Westinghouse SG with TT tubing. In addition, Turkey Point maintains a stringent water chemistry program, in accordance with industry standards, to mitigate tube degradation. The SGs are monitored closely for leakage during operation and shutdown periods. There has been no leakage from the SGs due to corrosion since replacement. Operators are trained to identify conditions which may indicate a SG tube leak. In the event that a tube leak occurs, Turkey Point has operator training programs, simulator exercises, and procedures in place to mitigate the consequences of failed tubes.



#### REQUESTED INFORMATION ITEM 2

Addressees are requested to submit a summary of the inspection plans developed in accordance with Requested Action (3) and a schedule for the next planned inspection.

#### FPL RESPONSE

The scope of the next planned inspection on both Turkey Point Units 3 and 4 (including sample expansion criteria), methods, equipment, and criteria for personnel training and qualification will be conducted, as a minimum, in accordance with the examination protocol established in the PWR Steam Generator Examination Guidelines (Reference 1). FPL currently plans to continue full length bobbin coil inspection of all active tubes at each examination with MRPC inspections to further characterize indications as required. Conventional MRPC techniques will be used to examine a minimum 20% sample of dented hot leg tube support intersections and overexpanded tube transitions in one or more SGs, with larger dents and overexpansions receiving priority. Current plans for scope and schedule for the next inspections are summarized below.

#### TURKEY POINT UNITS 3 AND 4 NEXT INSPECTION - SCOPE AND SCHEDULE

<u>UNIT</u>	<u>EOC/ DATE</u>	<u>BOBBIN EXAMS</u>	<u>HL MRPC OVEREXP<sup>(1)</sup></u>	<u>HL MRPC DENTS<sup>(1)</sup></u>
3	CY 14 9/95	100%	20%	20%
4	CY 15 3/96	100%	20%	20%

1 - In one or more SGs concentrated on larger dents & overexpansions .

Upon completion of review and evaluation by industry groups and FPL, proven new technology has been routinely phased in at Turkey Point in accordance with Reference 1 to provide a link to prior examination data. Examination techniques which demonstrate further improvement in detection capability may be implemented when a qualified sizing technique or alternate plugging criteria (APC) for circumferential cracks is also available.

#### REFERENCES

1. EPRI Report NP-6201, "PWR Steam Generator Examination Guidelines," Revision 3, November 1992.