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L-2019-166
10 CFR 50.55a
10 CFR 50.36

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Refueling Outage SL2-24 Steam Generator Tube Inspection Report RAI Response

References:

1. FPL Letter L-2019-064 dated March 22, 2019, "Refueling Outage SL2-24 Steam Generator Tube Inspection Report." Adams Accession No. ML19081A146
2. NRR E-mail Capture dated July 11, 2019, "Request for Additional Information - St. Lucie Plant, Unit No. 2, Fall 2018 Refueling Outage Steam Generator Tube Inspection Report (EPID L-2019-LRO-0023)." Adams Accession No. ML19192A137

In reference 1 above, Florida Power & Light Company (FPL) submitted the St. Lucie Unit 2 Technical Specification 6.9.1.12 steam generator tube inspection report for the fall 2018 refueling outage (SL2-24). During the NRC Staff review of the submittal, they determined that additional information was required in order to complete their review. This request for additional information (RAI) was made in reference 2 above.

FPL's response to the RAI request is contained in the attachment to this correspondence.

Please contact Ken Frehafer at (772) 467-7748 should you have any questions regarding this submittal.

Sincerely,

Katarzyna Pagi for Wyatt Godes (Acting)

Wyatt Godes
Licensing Manager
St. Lucie Plant.

MJS/KWF

Attachment

cc: USNRC Regional Administrator, Region II
USNRC Senior Resident Inspector, St. Lucie Nuclear Plant

Background:

The U.S. Nuclear Regulatory Commission (NRC) staff previously reviewed the licensee's spring 2014 SG tube inspection report and provided a summary to the licensee in a letter dated August 19, 2015 (ADAMS Accession No. ML15209A646). The spring 2014 inspections were performed during RFO 21. In the summary, the NRC staff noted that the four feedring inspection port covers (two per SG) were found to be loose during the secondary side inspections. The loose covers allowed the feedrings to drain, which created steam voids in the feedrings and resulted in a water hammer event that damaged the feedring supports for both SGs. The feedring supports were repaired during RFO 21 and all four inspection port covers were replaced with welded end caps to prevent loosening.

The licensee's fall 2015 SG tube inspection report, dated April 15, 2016 (ADAMS Accession No. ML16111B235), noted that during inspection of the SG 2B feedring, the inner support brackets were found to be slightly deformed. The new brackets had been installed during RFO 21 and appeared to have been displaced by a pressure transient in the feedring during the subsequent operating cycle. The licensee noted during the inspection that the welds remained intact. The condition was documented in the corrective action program, and the brackets were repaired with support braces/stiffeners. No deficiency was observed with the SG 2A feedring and supports. These inspections and repairs were performed during RFO 22.

In the fall 2018 SG tube inspection report, the licensee stated that the secondary side inspection activities were mainly comprised of a visual inspection of the feedwater ring support system in each SG. The inner support brackets of the SG 2A feedring were found to be slightly deformed from a pressure transient in the feedring during the previous operating cycle. The licensee also stated that this condition was expected for SG 2A, based on monitoring criteria established for this phenomenon, and does not jeopardize SG tube integrity. All welds of the feedring support system were noted to be intact. The as-found condition was documented in the corrective action program, and the brackets were repaired by attaching support braces/stiffeners to them. No deficiency was observed with the SG 2B feedring supports.

Issue:

The cause of the water hammer event that initially damaged the feedring supports for both SGs, was attributed to the loose inspection port covers, which allowed the feedrings to drain. Although repairs were made in RFO 21, additional repairs were required in RFO 22 and RFO 24, due to pressure transients in the SG feedrings.

Request:

1. The fall 2018 SG tube inspection report stated, "…this condition was expected for SG 2A, based on monitoring criteria established for this phenomenon and does not jeopardize SG tube integrity." Does this statement mean that the feedwater ring support system is designed to deform during pressure transients? Discuss why this does not pose a loose part threat to tube integrity.

Response to Request #1:

The feedwater ring support system was designed such that the inner supports (c-brackets) would plastically deform and absorb some of the loading if the loading is above a specified amount, and still maintain the allowable stress limits of the materials including the welds. In the event a loose part is developed due to a pressure transient, the SG is equipped with a fine-mesh, loose-part trapping (debris) screen, designed to preclude loose parts from entering the tube bundle. The screen is designed such that only very small objects such as small wires or small pieces of deposits can pass through. No loose parts from internal components of the SG have ever been identified within the tube bundle (i.e., downstream of the debris screens) during SG secondary-side inspections. For the above reasons, the recent pressure transients were considered to not pose a loose part threat to SG tube integrity.

2. Have feedring inspection port cover inspections confirmed the weld repairs to the end caps remain adequate and functioning as designed?

Response to Request #2:

As stated in the NRC summary for the SL2-21 SG Tube Inspection Report (Ref. 1), the SG feedring supports were repaired during RFO 21 and all four inspection port covers were replaced with welded end caps to prevent loosening. No damage or degradation has been identified during each subsequent inspection of the feedwater ring end caps. Inspections have confirmed that the original weld repairs on the end caps remain adequate and functioning as designed, without leakage.

3. Has a root cause analysis been performed on the initial water hammer event and the subsequent pressure transients? Is it possible for multiple transients or a larger magnitude transient to cause greater damage than has been experienced, generating loose parts that could challenge tube integrity?

Response to Request #3:

A root cause analysis has been performed on the initial water hammer events which led to repairs in RFO 21 and the subsequent pressure transient in Cycle 21 which led to repairs in RFO 22. The pressure transient in Cycle 23 which led to repairs in RFO 24 was also evaluated in the corrective action program. As noted in previous NRC Integrated Inspection Reports for the St. Lucie Plant (Ref. 2, 3 and 4), the condition report and root cause analysis were reviewed by the NRC inspection team. The inspectors reviewed the evaluations and circumstances associated with the condition evaluated, and verified that corrective actions were planned and/or implemented that are commensurate with the significance of the identified issue.

The largest magnitude transient possible is from an automatic initiation of the auxiliary feedwater actuation system (AFAS) when SG level is below the discharge point of the j-tubes. This type of transient was experienced during the water hammer events of Cycles 21 and 23, and no loose parts

were generated from these events based on secondary-side visual inspections in RFO 22 and RFO 24, respectively. If more than one pressure transient is experienced in the SG feedwater ring of St. Lucie Unit 2 during a cycle, a visual inspection of the feedwater ring and supports (of the affected SG) is required by procedure prior to unit startup to assess potential damage. No loose parts have ever been generated in the current feedwater ring support design. The restrictions placed on unit operation with multiple transients, and the presence of the debris screens provide reasonable assurance that the integrity of the SG tubes is maintained.

References:

1. Review of the Spring 2014 Steam Generator Tube Inservice Inspection Report for Refueling Outage 21 (Accession No. ML15209A646).
2. St. Lucie Plant - NRC Integrated Inspection Report 05000389/2015001 (Accession No. ML15126A323)
3. St. Lucie Plant - NRC Integrated Inspection Report 05000389/2015002 (Accession No. ML15216A565)
4. St. Lucie Plant - NRC Integrated Inspection Report 05000389/2017001 (Accession No. ML17129A510)