Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

January 5, 2017
NOC-AE-16003429
10 CFR 54
File No. G25

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to Requests for Additional Information for the
Review of the South Texas Project, Units 1 and 2,
License Renewal Application – RAI B2.1.8-3 (TAC Nos. ME4936 and ME4937)

References:

1. Letter; G.T. Powell to the NRC Document Control Desk; "License Renewal Application", NOC-AE-10002607; dated October 25, 2010. (ML103010257)
2. Letter; from the NRC, L. M. James, to STPNOC, G.T. Powell; "Request for Additional Information for the Review of the South Texas Project, Units 1 and 2, License Renewal Application (TAC Nos. ME4936 and, ME4937)", dated December 8, 2016. (ML16343A042)

By Reference 1, STP Nuclear Operating Company (STPNOC) submitted a License Renewal Application (LRA). In Reference 2, the NRC requested additional information for the review of the South Texas Project LRA. Enclosure 1 to this letter provides STPNOC's response to the requests for additional information, and Enclosure 2 provides line in/line out revisions to the LRA.

A147
NRR

STI: 34421468

If there are any questions regarding this submittal, please contact Arden Aldridge, STP License Renewal Project Lead, at (361) 972-8243 or Rafael Gonzales, STP License Renewal Project regulatory point-of-contact, at (361) 972-4779.

Revised regulatory commitments are included in Enclosure 3 to this letter. There are no other regulatory commitments in this letter.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on January 5, 2017
Date

James Connolly
Site Vice President

rjg

Enclosures:

1) STPNOC Response to Request for Additional Information
2) STPNOC LRA Appendix A and B Line in/out Sections
3) STPNOC Regulatory Commitments - line in/out

cc:
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Enclosure 1

STPNOC Response to Request for Additional Information

SOUTH TEXAS PROJECT
LICENSE RENEWAL APPLICATION (LRA)
REQUEST FOR ADDITIONAL INFORMATION (RAI)

RAI B2.1.8-3

Background:

The staff issued License Renewal Interim Staff Guidance (LR-ISG) 2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components" (ADAMS Accession No. ML16237A383). LR ISG 2016 01 provides the following guidance for aging management:

- Visual inspections on steam generator head internal areas (head interior surfaces, divider plate assemblies, tubesheets (primary side) and tube-to-tubesheet welds) in order to identify signs of cracking or loss of material (e.g., rust stains and distortion of divider plates).
- Frequency of the visual inspections: at least every 72 effective full power months or every third refueling outage whichever results in more frequent inspections
- Implementation of the latest EPRI steam generator guidelines such as (a) EPRI Report 1022832 (primary-to-secondary leak guidelines); (b) EPRI Report 1025132 (in-situ pressure test guidelines); (c) EPRI Report 3002007571 (integrity assessment guidelines); and (d) EPRI Report 3002007572 (examination guidelines)

Issue:

The staff found a need to confirm whether the applicant's Steam Generator Tube Integrity Program is consistent with the guidance discussed above.

Request:

Clarify whether the Steam Generator Tube Integrity Program is consistent with the guidance discussed above (i.e., conduct of visual inspections, visual inspection frequency, and implementation or plans for implementation of the latest EPRI steam generator guidelines by the implementation dates provided by the industry). If not, provide justification of why the applicant's Steam Generator Tube Integrity Program is adequate for aging management. In addition, provide updated UFSAR supplement for this program as necessary.

STPNOC Response:

LRA Table 3.1.2-4, Appendix A1.8, Appendix B2.1.8, and LRA Basis Document AMP XI.M19, Steam Generator Tube Integrity, have been revised consistent with the guidance provided in LR ISG 2016-01, "Changes to Aging Management Guidance for Various Steam Generator Components":

- Perform visual inspections on steam generator head internal areas (head interior surfaces, divider plate assemblies, tubesheets (primary side) and tube-to-tubesheet welds) in order to identify signs of cracking or loss of material.
- Frequency of the visual inspections: at least every 72 effective full power months or every third refueling outage whichever results in more frequent inspections.
- Implementation of the latest (i.e. implemented within the approved implementation period) EPRI steam generator guidelines such as (a) EPRI Report PWR Primary-To-Secondary Leak Guidelines; (b) EPRI Report Steam Generator In-Situ Pressure Test Guidelines; (c) EPRI Report Steam Generator Program Integrity Assessment Guidelines; and (d) EPRI Report PWR Steam Generator Examination Guidelines.

Enclosure 2 provides the line-in/line-out revision to LRA Appendix A1.8, LRA Appendix B2.1.8, and Table 3.1.2-4.

Enclosure 3 provides the line-in/line-out revision to LRA Table A4-1 adding LRA Commitment item #48.

Enclosure 2

STPNOC LRA Appendix A and B Line in/out Sections

Affected LRA Section
Table 3.1.2-4
A1.8
B2.1.8

Table 3.1.2-4 Reactor Vessel, Internals, and Reactor Coolant System – Summary of Aging Management Evaluation – Steam Generators

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
SG Divider Plate	DF	Nickel Alloys	Reactor Coolant (Ext)	Cracking	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	IV.D1-6	3.1.1.81	E ~~A~~, 4
SG Divider Plate	DF	Nickel Alloys	Reactor Coolant (Ext)	Loss of Material	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	None	None	H, 4
Space between changes – For clarity, only the line items with changes haven provided in this submittal								
SG Tube-to-tubesheet Welds	PB	Nickel Alloys	Reactor Coolant (Ext)	Cracking	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	None	None	H
SG Tube-to-tubesheet Welds	PB	Nickel Alloys	Reactor Coolant (Ext)	Loss of Material	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	None	None	H
Space between changes – For clarity, only the line items with changes haven provided in this submittal								
SG Primary Head	PB	Carbon Steel with Stainless Steel Cladding	Reactor Coolant (Int)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD for Class 1 components (B2.1.1), ~~and~~ Water Chemistry (B2.1.2) and Steam Generator Tubing Integrity (B2.1.8)	IV.D1-1	3.1.1.68	E ~~A~~
SG Primary Head	PB	Carbon Steel with Stainless Steel Cladding	Reactor Coolant (Ext)	Loss of Material	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	None	None	H

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Space between changes – For clarity, only the line items with changes haven provided in this submittal								
SG Tubesheet	PB	Carbon Steel Cladded with Nickel Alloys	Reactor Coolant (Ext)	Cracking	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	IV.D1-18	3.1.1.73	C, 2
SG Tubesheet	PB	Carbon Steel Cladded with Nickel Alloys	Reactor Coolant (Ext)	Loss of Material	Steam Generator Tubing Integrity (B2.1.8) and Water Chemistry (B2.1.2)	None	None	H

Notes for Table 3.1.2-4:

Standard Notes:

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

E Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

G Environment not in NUREG-1801 for this component and material.

H Aging effect not in NUREG-1801 for this component, material and environment combination.

Plant Specific Notes:

1 The inspection requirements of ASME Code Case N-722 do not apply to components with pressure retaining welds fabricated with Alloy 600/82/182 that have been mitigated by weld overlay.

2 The tubesheets in the replacement steam generators installed at STP are made of carbon steel cladded with the Alloy 690.The tube-tubesheet welds are flush fusion welds with cladding.

3 The replacement steam generator primary manway is equipped with stainless steel gasket insert.

4 The divider plates in the replacement steam generators installed at STP are made of Alloy 690 with the associated Alloy 52/152 weld materials.

5 The replacement steam generator secondary manway, handhole and inspection ports are equipped with nickel alloy gasket inserts.

A1.8 STEAM GENERATOR TUBE INTEGRITY

The Steam Generator Tube Integrity program is applicable to managing the aging of steam generator tubes, plugs, sleeves, divider plate assemblies, tube-to-tubesheet welds, primary head (interior surfaces), tubesheet(s) (primary side), and secondary side components that are contained within the steam generator. ~~The Steam Generator Tube Integrity program manages cracking and loss of material of the following component types: steam generator tubes, tube support plates, secondary side access covers, secondary nozzles, moisture separators, primary head and divider plates, internal structures, flow distribution baffles, feedwater rings, and auxiliary feedwater (AFW) spray pipes. The program manages the cracking of plugs.~~ The program also manages the wall thinning of the following component types: upper steam drum internals, moisture separators, feedwater rings, and AFW spray pipes.

The program ensures the integrity of the primary to secondary pressure boundary through preventive measures, inspections, degradation assessments, condition monitoring, operational assessments, tube plugging, and leakage monitoring activities necessary to manage potential steam generator tube degradation, including mechanically induced phenomena, such as wear and impingement damage.

The aging management measures employed includes nondestructive examinations, visual inspection, sludge removal, tube plugging, in-situ pressure testing and maintaining the chemistry environment by removal of impurities and addition of chemicals to control pH and oxygen. NDE inspection and primary to secondary leak rate monitoring are conducted consistent with the requirements of STP Units 1 and 2 Technical Specifications, NEI 97-06, Steam Generator Program Guidelines and the latest (i.e. implemented within the approved implementation period) EPRI Steam Generator Integrity Assessment Guidelines, EPRI PWR Primary-to-Secondary Leak Guidelines, EPRI Steam Generator In-Situ Pressure Test Guidelines, and EPRI PWR Steam Generator Examination Guidelines.

Performance criteria are maintained for operational leakage, accident induced leakage and structural integrity as prescribed in the Technical Specifications. Tube structural integrity limits consistent with Regulatory Guide 1.121 are applied.

Visual inspection are performed of the divider plates assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) for signs of cracking and loss of material are performed at least every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections.

B2.1.8 Steam Generator Tube Integrity

Program Description

The Steam Generator Tube Integrity program is applicable to managing the aging of steam generator tubes, plugs, sleeves, divider plate assemblies, tube-to-tubesheet welds, primary head (interior surfaces), tubesheet(s) (primary side), and secondary side components that are contained within the steam generator. ~~The Steam Generator Tube Integrity program manages the loss of material of the following component types: steam generator tubes, tube support plates, secondary side access covers, secondary nozzles, moisture separators, internal structures, flow distribution baffles, feedwater rings, auxiliary feedwater (AFW) spray pipes, primary head and divider plates. The program manages the cracking of the following component types: steam generator tubes, plugs, tube support plates, secondary side access covers, secondary nozzles, primary head and divider plates, internal structures, flow distribution baffles, feedwater rings, and AFW spray pipes.~~ The program also manages wall thinning of the following component types: moisture separators, feedwater rings, and AFW spray pipes.

The program ensures the integrity of the primary to secondary pressure boundary through assessments of potential degradation mechanisms, inspections, tube integrity assessments, maintenance plugging and repairs, primary to secondary leakage monitoring, maintenance of the secondary-side integrity, primary side and secondary side water chemistry, and foreign material exclusion. STP procedural guidance ensures performance criteria for tube structural integrity, operational leakage and accident induced leakage.

Reporting criteria, inspection scope and frequency, assessments, plugging criteria, and primary to secondary leak rate monitoring, monitoring and controlling primary and secondary side water chemistry are consistent with the requirements of STP Units 1 and 2 Technical Specifications, the Maintenance Rule (10 CFR 50.65), NEI 97-06, Steam Generator Program Guidelines, ~~Revision 3~~ and the latest (i.e. implemented within the approved implementation period) EPRI ~~1019038,~~Steam Generator Integrity Assessment Guidelines, EPRI PWR Primary-to-Secondary Leak Guidelines, EPRI Steam Generator In-Situ Pressure Test Guidelines, and EPRI PWR Steam Generator Examination Guidelines. Tube structural integrity limits consistent with Regulatory Guide 1.121, Bases for Plugging Degraded PWR Steam Generator Tubes are applied as detailed in UFSAR Section 3.12.1.

Visual inspection of the divider plates assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) for signs of cracking and loss of material are performed at least every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections.

The training and qualification standards for personnel engaged in the acquisition and/or evaluation of steam generator non-destructive examination (NDE) activities are specified in a station administrative procedure, and inspection practices are consistent with the EPRI PWR Steam Generator Examination Guidelines. STP programmatic guidance also requires that each inspection be based on a degradation assessment created for each refueling outage that considers existing and potential degradation mechanisms.

The STP steam generators were replaced with Westinghouse Delta 94 Steam Generators in 2000 and 2002 for Units 1 and 2, respectively. The STP replacement steam generators are equipped with Alloy 690TT tubes. The tube support plates are fabricated from type 405 stainless steel and the tube holes are trefoil-broached. ~~Due to the advanced design and~~

~~features, and material selection of the replacement steam generators, the previously significant degradation mechanisms of tube support plate erosion/corrosion and corrosion-induced denting, divider plate cracking, and wrapper drop have insignificant potential of occurring. Since the STP replacement steam generators are not susceptible to the modes of degradation defined in Generic Letter 97-06, the STP response to NRC Generic Letter 97-06 is no longer applicable.~~ STP has observed minor tube to support plate wear on the replacement steam generators. To date STP has observed six tube to support plate wear indications, three in each unit, with the largest being 10% thru wall. STP has also observed one potential under deposit pitting corrosion indication in SG 1D during 1RE19. Anti-vibration bar (AVB) wear in the STP steam generators is unlikely, since the STP replacement steam generators have a U-bend region designed to prevent the potential mechanical wear seen in the first generation steam generators.

NUREG-1801 Consistency

The Steam Generator Tube Integrity program is an existing program that, following enhancement, will be ~~is~~ consistent with NUREG-1801, Section XI.M19, Steam Generator Tube Integrity.

Exceptions to NUREG-1801

None

Enhancements

~~None~~

Prior to the period of extended operation, the following enhancement will be implemented in the following program elements:

Scoping (Element 1)

Procedures will be revised to specify visual inspection of the divider plates assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) for signs of cracking and loss of material.

Parameters of Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)

Procedures will be revised to specify visual inspection of the divider plates assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) for signs of cracking and loss of material are performed at least every 72 effective full power months or every third refueling outage, whichever results in more frequent inspections.

Acceptance Criteria (Element 6)

Procedures will be revised to evaluate the acceptability of any degraded conditions of the divider plate assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) on a case-by-case basis.

Operating Experience

The Degradation Assessment for STP examines industry experience for Westinghouse advanced-design steam generators to determine the potential degradation mechanisms for STP steam generators. To date, the dominant degradation mechanism detected in U.S. replacement steam generators equipped with Alloy 690TT tubing has been mechanical wear, primarily from foreign objects and a few cases of anti-vibration bar (AVB) wear as well as support plate wear.

Based on industry operating experience and the loose parts wear experienced in STP steam generator 1D, tube wear at AVB intersections and loose parts wear are considered potential degradation mechanisms. Minor support plate wear and potential under deposit pitting corrosion have been observed at STP. Other degradation mechanisms have a very low likelihood of occurrence. STP has experienced chemistry events with chloride, hydrazine and sodium, where inspected parameters have been found at concentrations outside the specified operating range. All conditions were evaluated and corrective actions were instituted, when appropriate, to prevent reoccurrence.

Pre-service Non-Destructive Examination inspections of the new STP steam generators were performed at the manufacturing site. These included 100 percent full length bobbin coil examinations, and additional tests on select areas of interest. As a result of this preservice inspection, a total of six tubes in the Unit 2 steam generators and 108 tubes in the Unit 1 steam generators were plugged. There are 7585 tubes in each of the four steam generators at STP. Unit 1 SG B had the most tubes plugged (40) as a result of this pre-service inspection. This pre-service inspection also established the baseline for future eddy current testing of the STP steam generators.

Unit 1 steam generators were replaced in 1RE09 (March 2000). Unit 1 refueling outage 1RE11 occurred in April of 2003. In Unit 1, during operating cycle 11, a feed water heater event released foreign materials into steam generator 1D. Four tubes in the steam generator 1D cold leg were identified with wear due to wire from the feedwater heater event of operating cycle 11. One tube required plugging due to a wear depth of 44 percent and the remaining tubes had wear depths of less than 20 percent and remained in service. Two tubes with volumetric indications greater than 20 percent were plugged. The Condition Monitoring limits were met and an Operation Assessment showed no challenge to tube integrity for the next cycle for steam generator 1D. Steam generators 1A/B/C were approved for the next 3 cycles of operation.

During 1RE14 (April 2008), 220 foreign objects from the feedwater event of operating cycle 11 were identified during the secondary side visual inspections. No wear was found due to the stabilizer wire that was the most common of the foreign objects. Foreign object retrieval removed 150 of the foreign objects during the 1RE14 (April 2008) outage. For the items remaining, an engineering evaluation supported by detailed wear calculations provided the conclusion that no tube in steam generator 1D would experience wear exceeding the plugging limit during the next two cycles of operation. Additional detailed wear calculations will be required before operation beyond the next two cycles and are included in the SG Degradation Assessment.

Based on a review of operating experience, degradation has been consistent with industry experience, including the operating experience identified in NUREG-1801. STP has effectively monitored and trended abnormal conditions. Appropriate corrective actions have been taken, including increasing sampling frequencies, physical inspections, and repair. As additional industry and plant-specific applicable operating experience becomes available, it will be

evaluated and incorporated into the program through the Condition Reporting Process or the Operating Experience program.

Conclusion

The continued implementation of the Steam Generator Tube Integrity program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Enclosure 3

STPNOC Regulatory Commitments - line in/out

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
48	Enhance the Steam Generator Tube Integrity program procedures to: • Specify perform visual inspections of the steam generator head internal areas (head interior surfaces, divider plate assemblies, tubesheets (primary side) and tube-to-tubesheet welds) for signs of cracking or loss of material. • Specify the frequency of the visual inspections be at least every 72 effective full power months or every third refueling outage whichever results in more frequent inspections. • Procedures will be revised to evaluate the acceptability of any degraded conditions of the divider plate assemblies, tubesheets (primary side), tube to tubesheet welds, and primary head (interior surfaces) on a case-by-case basis.	B2.1.8	Complete no later than six months prior to the period of extended operation CR 16-15866