Nuclear Operating Company

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

March 10, 2016
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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 – Request for Additional Information
B2.1.8-2: LR-ISG-2011-02, and Clarification of
License Renewal Application 2014 Annual Update (TAC. Nos. ME4936 and ME4937)

References:

1. Letter, G. T. Powell to USNRC Document Control Desk; "License Renewal Application;" NOC-AE-10002607; dated October 25, 2010 (ML103010257)
2. Letter, from NRC, Lois James to STP Arden Aldridge; Request for Additional Information STP LRA Safety Review, dated February 29, 2016. (ML16060A287)
3. Letter from NRC, Lois James to STP Nuclear Operating Company, "Summary of Conference Calls Held on February 23, 2016, Between the U.S. Nuclear Regulatory Commission and STP Nuclear Operating Company, Concerning the Staff's Review of the Submerged Closure Bolting Portion of the 2014 Annual update for the South Texas Project, License Renewal Application", dated March 7, 2016 (TAC. Nos. ME4936 and ME4937) (ML16060A127)

By Reference 1, STP Nuclear Operating Company (STP) submitted a License Renewal Application (LRA). By Reference 2, the NRC staff requested additional information (RAI) for their review of the STP LRA. The RAI is related to South Texas Project's (STP) Aging Management Program for Steam Generators. By Reference 3, STP is providing information to clarify information located in Table 3.3.2-4 of the LRA.

STP's responses to the RAI and Telephone conference call are provided in Enclosure 1 of this letter. Changes to the LRA pages described in the body are depicted as line-in/line-out pages provided in Enclosure 2.

There are no commitments in this letter.

A147
NRR

STI: 34286599

If there are any questions, 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.

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

Executed on March 10, 2016
Date

Peter Nemeth
Secretary and General Counsel

rjg

Enclosures:

1. STP's Responses to the RAI and Telephone Conference Call
2. STP LRA Changes with Line-in/Line-out Annotations

cc:
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Enclosure 1

STP's Responses to the RAI and Telephone Conference Call

Request for Additional Information (RAI) B2.1.8-2: LR-ISG-2011-02

Background
The staff issued License Renewal Interim Staff Guidance 2011-02 (LR-ISG-2011-02), "Aging Management Program for Steam Generators." LR-ISG-2011-02 indicates that Revision 3 of NEI 97-06 updates Revision 2 of the NEI guidance and is suitable to manage aging effects of steam generators. LR-ISG-2011-02 also provides a correct reference to the steam generator integrity assessment guidelines for GALL Report, Revision 2. The correct reference is EPRI 1019038, "Steam Generator Integrity Assessment Guidelines," Revision 3, November 2009.

Issue
The applicant submitted its annual updates to the LRA by letters dated October 28, 2013; October 22, 2014; and October 22, 2015. The staff noted that these annual updates do not address whether applicant incorporated the guidance of LR-ISG-2011-02 into its Steam Generator Tube Integrity Program.

Request
Clarify whether the applicant incorporated the guidance of LR-ISG-2011-02 into its Steam Generator Tube Integrity Program. As part of the response, confirm whether the applicant's program is consistent with the guidance in NEI-97-06, Revision 3 and EPRI 1019038. If not, provide justification.

STP Response:
STP Steam Generator Tube Integrity Program includes the guidance provided in NEI-97-06, Revision 3 and EPRI 1019038 as prescribed in LR-ISG-2011-02. LRA Appendix A1.8, Appendix B2.1.8 and LRA Basis Document AMP X.M19, Steam Generator Tubing Integrity are revised.

Summary of Conference Calls Held on February 23, 2016, Between the U.S. Nuclear Regulatory Commission and STP Nuclear Operating Company, Concerning the Staff's Review of the Submerged Closure Bolting Portion of the 2014 Annual update for the South Texas Project, License Renewal Application

Background

The U.S. Nuclear Regulatory Commission (NRC or the staff) and representatives of STP Nuclear Operating Company (STPNOC or the applicant) held a telephone conference call on February 23, 2016, to discuss and clarify information in the 2014 Annual Update, dated October 22, 2014, for the STP License Renewal Application, specifically two additions to Table 3.3.2-4, "Auxiliary Systems - Summary of Aging Management Evaluation - Essential Cooling Water and ECW Screen Wash System." The table was revised to add two new aging management review (AMR) items. The new AMR items address copper alloy closure bolting exposed to a submerged environment of raw water for which the aging effect of loss of material and loss of preload will be managed by the Open Cycle Cooling Water System and Bolting Integrity Programs respectively.

The staff stated that the GALL Report recommends the Bolting Integrity Program to manage the aging effects of both loss of material and loss of preload of closure bolting. The Bolting Integrity Program relies on periodic inspections of closure bolting for indication of leakage to detect the effects of aging for loss of material and loss of preload. The staff also stated that neither the LRA nor the 2014 LRA annual update describes the frequency of inspections how closure bolting in a submerged environment will be inspected under the Bolting Integrity and Open Cycle Cooling Water System. The LRA and 2014 LRA annual update also doesn't provide the frequency of inspections and a justification for such frequency. Considering that the closure bolts are in a submerged environment that prevents the identification of leakage and based on the information in the LRA and the 2014 LRA annual update, it is not clear what frequency of inspections and what inspections methods would be employed by the applicant such that it can adequately manage the aging effects of loss of material and loss of preload of these components under the proposed programs. The applicant stated that it will provide information on the docket describing how the submerged closure bolting will be inspected including the frequency of inspections and its justification for it.

STP LRA Update:

LRA Table 3.3.2-4 identifies copper alloy closure bolting exposed to raw water. These submerged closure bolts on the Essential Cooling Water (ECW) Pump columns are managed for loss of preload using the Bolting Integrity Program, B2.1.7 and for loss of material using the Open-Cycle Cooling Water Program, B2.1.9.

Loss of preload for the ECW Pump column bolts is managed using preventive actions consistent with the Bolting Integrity Program, B2.1.7. The preventive actions include proper selection of bolting material, the use of appropriate lubricants and sealants in accordance with the guidelines of EPRI NP-5769, EPRI TR-104213, and NUREG-1339, consideration of yield strength when procuring bolting material, proper torqueing of bolts, checking for uniformity of gasket compression after assembly, and application of an appropriate preload based on guidance in EPRI documents, manufacturers recommendations, and plant procedures.

Loss of material for the ECW Pump column bolts is managed consistent with the Open-Cycle Cooling Water System Program, B2.1.9 using visual inspections during the ECW pump refurbishment as scheduled by the Pump and Motor Plan nominally every 10 years. The Work Order and maintenance instructions document as-found conditions. Unexpected conditions are evaluated using the STP condition reporting program.

The ECW pump column bolts are inspected during ECW Pump refurbishment nominally every 10 years. The ECW pumps are performance tested quarterly, pump parameters such as pressure and flow are trended to identify any potential leakage caused by loss of preload before the leakage that could affect the ECW system from performing its intended functions.

There is no operating experience (OE) documenting loss of preload or loss of bolting material of the column joint integrity during the performance of the ECW pumps periodic refurbishments. This demonstrates that the Bolting Integrity and Open-Cycle Cooling Programs are effective in managing loss of preload and loss of material of these bolted connections. Therefore, continued implementation of the program provides reasonable assurance that the effects of aging will be managed so that components crediting this program can perform their intended functions consistent with the current licensing basis during the period of extended operation.

LRA Appendix A1.7, Appendix B2.1.7 and LRA Basis Document AMP X.M18, Bolting Integrity are revised to discuss loss of preload aging management of the Essential Cooling Water (ECW) Pump column bolts.

Enclosure 2

STP LRA Changes with Line-in/Line-out Annotations

List of Revised LRA Sections

Affected LRA Section
A1.7
B2.1.7
A1.8
B2.1.8

A1.7 BOLTING INTEGRITY

The Bolting Integrity program manages cracking, loss of material, and loss of preload for pressure retaining bolting and ASME component support bolting. The program includes preload control, selection of bolting material, use of lubricants/sealants consistent with EPRI NP-5067, *Good Bolting Practices*, and performance of periodic inspections for indication of aging effects. The program also includes inservice inspection requirements established in accordance with ASME Section XI, Subsections IWB, IWC, IWD, and IWF for ASME Class bolting.

STP good bolting practices are established in accordance with plant procedures. These procedures include requirements for proper disassembling, inspecting, and assembling of connections with threaded fasteners. In addition to the inspection activities noted above, the Bolting Integrity program includes activities for preload control, material selection and control, and use of lubricants/sealants. The general practices that are established in this program are consistent with EPRI TR-104213, *Bolted Joint Maintenance and Applications Guide*, EPRI NP-5769, *Degradation and Failure of Bolting in Nuclear Power Plants*, Volume 1 and 2, and the recommendations delineated in NUREG-1339.

The Essential Cooling Water (ECW) Pump column closure bolts, submerged in raw water, are managed for loss of preload using good bolting practices in accordance with plant procedures. The ECW pump column closure bolts are inspected during ECW pump refurbishment nominally every 10 years. The ECW pumps are performance tested quarterly, pump parameters such as pressure and flow are trended to identify any potential leakage before the leakage could affect the ECW system from performing its intended functions.

B2.1.7 Bolting Integrity

Program Description

The Bolting Integrity program manages cracking, loss of material, and loss of preload for pressure retaining bolting and ASME component support bolting. The program includes preload control, selection of bolting material, use of lubricants/sealants consistent with EPRI NP-5067, *Good Bolting Practices*, and performance of periodic inspections for indication of aging effects. The program also includes inservice inspection requirements established in accordance with ASME Section XI, Subsections IWB, IWC, IWD, and IWF for ASME Class bolting.

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The Essential Cooling Water (ECW) Pump column closure bolts, submerged in raw water, are managed for loss of preload using good bolting practices in accordance with plant procedures. The ECW pump column closure bolts are inspected during ECW pump refurbishment nominally every 10 years. The ECW pumps are performance tested quarterly, pump parameters such as pressure and flow are trended to identify any potential leakage before the leakage could affect the ECW system from performing its intended functions.

The following STP aging management programs supplement the Bolting Integrity program with management of loss of preload, cracking, and loss of material:

(a) ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD (B2.1.1) provides the requirements for inservice inspection of ASME Class 1, 2, and 3 safety-related pressure retaining bolting.

(b) ASME Section XI, Subsection IWF (B2.1.29) provides the requirements for inservice inspection of safety-related component support bolting.

(c) External Surfaces Monitoring Program (B2.1.20) provides the requirements for inspection of pressure boundary closure bolting within the scope of license renewal.

(d) Structures Monitoring Program (B2.1.32) provides the requirements for inspection of structural bolting.

(e) Open-Cycle Cooling Water Program (B2.1.9) manages the loss of material for the Essential Cooling Water (ECW) Pump column closure bolts.

NUREG-1801 Consistency

The Bolting Integrity program is an existing program, that following enhancement, will be consistent, with exception to NUREG-1801, Section XI.M18, Bolting Integrity.

Exceptions to NUREG-1801

Program Elements Affected:

Parameters Monitored or Inspected (Element 3)

NUREG-1801 states that bolting for safety-related pressure retaining components is inspected for loss of preload/loss of prestress. Loss of preload is not a parameter of inspection for the STP Bolting Integrity program. AT STP the application of good bolting techniques provided in plant procedures and vendor instructions during assembly of bolted joints minimizes the possibility for a loss of preload/loss of prestress. The discussion of bolt preload in EPRI NP-5769, Vol. 2, Section 10, indicates that job inspection torque is non-conservative since for a given fastener tension more torque is required to restart the installed bolts. The techniques for measuring the amount of bolt tension in an assembled joint are both difficult and unreliable. Inspection of preload is usually unnecessary if the installation method has been carefully followed. Torque values are provided in plant procedure if not provided by the vendor instructions, design documents or specifications. These torque values are based on the industrial experience that includes the consideration of the expected relaxation of the fasteners over the life of the joint and gasket stress in the application of pressure closure bolting. Additionally visual inspections for leakage would detect a loss of preload/loss of prestress in the connection prior to a loss of intended function.

Monitoring and Trending (Element 5)

NUREG-1801, Section XI.M18 specifies that if bolting connections for pressure retaining components (not covered by ASME Section XI) are reported to be leaking, then they may be inspected daily. If the leak rate does not increase, the inspection frequency may be decreased to biweekly or weekly. STP procedures require the inspection frequency be adjusted as necessary based on the trending of inspection results to ensure there is not a loss of intended function between inspection intervals. For pressure retaining components reported to be leaking, STP procedures initiate the site corrective action process. Consideration is also given to adequate frequency of subsequent inspections to ensure the inspection interval is adequate to detect further aging degradation so that a loss of intended function is avoided.

Enhancements

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

Scope (Element 1)

Procedures will be enhanced to conform to the guidance contained in EPRI TR-104213.

Corrective Actions (Element 7)

Procedures will be enhanced to evaluate loss of preload of the joint connection, including bolt stress, gasket stress, flange alignment, and operating condition to determine the corrective actions consistent with EPRI TR-104213.

Operating Experience

Both the industry and NRC have revealed a number of instances of bolting concerns from material control and certification (e.g. NRC Bulletin 87-02) to bolting practices, use of lubrication and injection sealants and its effect on SCC (e.g., NRC Bulletin 82-02, and INPO SOER 84-05). The Bolting Integrity program incorporates the applicable industry experience on bolting issues into the program. Actions taken include confirmatory testing/analysis or inspections. Also included are the addition of procedures of inspection, material procurement and verification processes. NRC Information Notices, Bulletins, Circulars, and Generic Letters listed in Section 3 of NUREG-1339 were evaluated for applicability to the STP Bolting Integrity program to ensure conformance with the recommendations of NUREG-1339.

There is no reported case of cracking of bolting due to stress corrosion cracking.

A review of operating experience contained in STP condition reports (CRs) were evaluated for aging effects associated with the Bolting Integrity program. Of these CRs only 19 were determined to have applicable aging effects associated with the Bolting Integrity program. The following is a summary of the aging effects reported in these CRs.

Condensation has been observed to cause surface corrosion of bolting associated with chilled water bolted connections. The instances were evaluated and it was determined that the corrosion was limited to the surface and did not affect the integrity of the bolted joint. To prevent this corrosion from reoccurring the bolting was either painted to prevent water droplets coming in direct contact with carbon steel bolting or insulation was installed to prevent the cool surface temperatures from creating the condensation.

Leakage from fittings and pump mechanical seals has also caused corrosion of bolting when the leaking system fluid came in contact with bolting. The bolting was evaluated for each joint and replaced where required.

Boric acid accumulations have been observed on bolting. After the boric acid accumulations were removed the bolting was evaluated. The bolting was determined to be acceptable as found or replaced if the bolting material was degraded by boric acid corrosion.

Incorrect materials have been found in bolting connections during system walkdowns and inspections. The bolting was replaced with the correct material.

Conclusion

The continued implementation of the Bolting 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.

A1.8 STEAM GENERATOR TUBE INTEGRITY

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, ~~and~~ NEI 97-06, ~~Revision 2,~~ *Steam Generator Program Guidelines* and EPRI Steam Generator Integrity Assessment 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.

B2.1.8STEAM GENERATOR TUBE INTEGRITY

Program Description

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), ~~and~~ NEI 97-06, *Steam Generator Program Guidelines,* Revision 3 and EPRI 1019038, Steam Generator Integrity Assessment 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.

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. 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 is consistent with NUREG-1801, Section XI.M19, Steam Generator Tube Integrity.

Exceptions to NUREG-1801

None

Enhancements

None

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.

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. 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.