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

July 5, 2012
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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 Requests for Additional Information (RAI) B2.1.9-4b for the
South Texas Project License Renewal Application (TAC Nos. ME4936 and ME4937)

References: 1. STPNOC letter dated October 25, 2010, from G. T. Powell to NRC Document Control Desk, "License Renewal Application" (NOC-AE-10002607) (ML103010257)
2. NRC letter dated May 14, 2012, "Requests for Additional Information for the Review of the South Texas Project, Units 1 and 2, License Renewal Application – Aging Management, Set 18 (TAC Nos. ME4936 and ME4937)" (ML12124A094)

By Reference 1, STP Nuclear Operating Company (STPNOC) submitted a License Renewal Application (LRA) for South Texas Project (STP) Units 1 and 2. By Reference 2, STPNOC received RAI B2.1.9-4b. The response to Reference 2 is provided in Enclosure 1 to this letter. Changes to LRA pages described in Enclosure 1 are depicted as line-in/line-out pages provided in Enclosure 2.

One regulatory commitment in Table A4-1 of the LRA is revised and is provided in Enclosure 3 to this letter. There are no other regulatory commitments in this letter.

Should you have any questions regarding this letter, please contact either Arden Aldridge, STP License Renewal Project Lead, at (361) 972-8243 or Ken Taplett, STP License Renewal Project regulatory point-of-contact, at (361) 972-8416.

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NRR

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

Executed on July 5, 2012
Date

G. T. Powell
Vice President,
Generation

KJT

Enclosures:
1. STPNOC Response to RAI B2.1.9-4b
2. STPNOC LRA Changes with Line-in/Line-out Annotations
3. Revised Regulatory Commitment

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Enclosure 1

STPNOC Response to RAI B2.1.9-4b

SOUTH TEXAS PROJECT, UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
AGING MANAGEMENT, SET 18
(TAC NOS. ME4936 AND ME4937)

Open Cycle Cooling Water System (021)
RAI B2.1.9-4b

Background:

RAI B2.1.9-4 requested the technical basis to demonstrate that loss of material due to worst case erosion in the essential cooling water (ECW) system will be adequately managed without protective coatings. The staff noted that the aging management program (AMP) basis document stated that coatings are not credited to protect metal surfaces. The response to the RAI stated that it was acceptable if coatings erode away between inspections because the piping inspections ensure that the piping is repaired or replaced before it reaches the minimum allowable wall thickness. The response also stated that the "wear rate is calculated from the measurement of wear and the previous inspection results, which is then used with conservatisms to calculate the lifetime of the component."

RAI B2.1.9-4a requested information, for locations where coatings are used in the ECW system, relating to the conservatisms used in the calculations that establish the continued acceptability of components. The response to RAI B2.1.9-4a stated that the piping at the flange connections to the 30-inch ECW throttle valves is coated and is managed for cavitation erosion. The response also stated that the coating is used sacrificially, is considered a short-lived commodity, and is replaced, as needed, during the 5-year preventive maintenance inspection. The response further stated that the program inspects for erosion of the piping and that an engineering evaluation is performed to determine the extent and depth of the erosion and whether the affected areas are acceptable for continued operation during the following 5-year period. The staff noted that the response did not provide the information requested relative to (a) the conservatisms used in the calculations that establish the lifetime of the piping, and (b) demonstrate that the coating is not credited to protect the metal surface.

Issue:

Since the applicant states that it is acceptable for coatings to erode away between inspections, it is not clear to the staff how the acceptability of the component can be calculated because the amount of time that the coating has protected the component appears to be unknown. Because of the presence of a coating, the staff cannot evaluate how an accurate pipe material wear rate was determined. As a result, the staff would expect that the "conservatisms" noted above in the applicant's response would assume the worst case loss of material which could occur between inspections without any coating. The applicant neither defined the conservatisms used to calculate the lifetime of the component nor described how the conservatisms in the calculation were established.

Request:

For locations where coatings are used in the ECW system to sacrificially protect the pipe material, provide information to either (1) or (2) below, depending on the method used in the engineering evaluations which determine the acceptability of piping for continued operation until its next scheduled inspection.

1. If the method calculates a wear rate using the previously measured wall thickness value in combination with the currently measured wall thickness value, and the coating was present at any point between the times that the two measurements were taken, then explain precisely how the time period that was used to calculate the wear rate was adjusted to account for the amount of time that the coating protected the underlying material. In addition, quantify the conservatisms in the method that address thickness measurement uncertainties, the effects of flow rate variations, and any non-linear behavior in the phenomena causing the wall loss.

2. If the method uses a previously established wear rate which is not based on the difference between the current and prior wall thickness values, provide the details concerning how this previously established wear rate was determined. Include details regarding the conservatisms that address measurement uncertainties, the effects of flow rate variations, and any non-linear behavior in the phenomena causing the pipe material loss.

STPNOC Response:

This response addresses request (1) above.

The aluminum-bronze piping inserted inside the slip-on flange downstream of the Component Cooling Water (CCW) heat exchanger thinned and cracked due to cavitation erosion. Loss of material in this area was first discovered in 2005 following approximately 19 years of plant operation. The in-service time and the thinning were similar for all six Essential Cooling Water (ECW) trains.

In response to the identification of through-wall leakage in the ECW system piping in 2005, South Texas Project (STP) applied coatings to the internal surfaces of piping downstream of the CCW heat exchanger outlet valve (one location per train) and implemented periodic inspections of the applied coating because:

1) the longevity of the coatings were unproven for the STP in-service conditions,

2) it could not be determined how long the pre-2005 uncoated design provided satisfactory service before through-wall damage occurred, and

3) if replacement of components is required due to pipe wear, replacement would occur prior to loss of system functionality.

An inspection program was established to inspect the inside of the pipe when the flange joint is disassembled because it is not practical to measure pipe wall thickness inside the slip-on flange during normal plant operations. The intent of the inspection is to remove and inspect the valve, inspect the downstream piping flange, and inspect the upstream piping in the spool for coating degradation and potential piping erosion. Inspections to date have revealed that sections of the coating wear away exposing bare pipe to erosion. In order to evaluate the condition, the reduction in wall thickness is measured from inside where the erosion is observed. The wear rate is estimated using these measurements.

Six locations are monitored by the preventive maintenance program. The open pipe inspections are performed at a nominal 216 week interval (plus an additional 25 percent grace period allowance.) The results of inspections are summarized below:

Location	Installation date	Inspection date (See Notes 2 & 3)	Nominal Reduction in wall thickness
1A	3/17/2006	6/8/08	~.010"
1A		4/30/2012	~.030"
1B	10/24/06	5/14/08	No perceptible wear noted
1B		1/14/2013	Note 3
1C	3/3/06	5/21/08	~.010"
1C		1/21/2013	Note 3
2A	7/11/05	5/16/07	~.020"
2A		1/26/12	~0.034" (See Note 1)
2B	8/18/2005	12/5/07	~.030"
2B		5/15/2012	~.019"
2C	7/29/05	10/25/07	~.010"
2C		2/25/2013	Note 3

Note 1 – A new pipe with carbon steel flange was replaced due to corrosion of the carbon steel hub at the gasket seating area. This condition was attributed to the lack of aluminum bronze overlay in the seating area. Future replaced hub to have overlay.

Note 2 – Initial performance dates were adjusted as necessary to facilitate available scheduled maintenance windows.

Note 3 – The second inspection for remaining trains are scheduled as follows:

Train 1B – January 14, 2013
Train 1C – January 21, 2013
Train 2C – February 25, 2013

Although coating is applied downstream the CCW heat exchanger outlet valves, inspection results indicate that the coating wears away in localized areas. The coating is credited in the sense that the current inspection interval assumes that the metal surface coating will be

reapplied, as required, following each inspection. However, the amount of time that the coating protected the underlying material does not need to be known as long as the coating is consistently reapplied, when required, in accordance with vendor instructions. The preventive maintenance inspection interval is based on engineering judgment that has been confirmed through inspection results.

Data obtained thus far have not indicated any adverse behavior (e.g. non-linear wear rate) that warrants an adjustment in the inspection interval. Inspection results in the future will be used to continue to justify the current inspection interval or make adjustments, as necessary.

STP will use a conservative margin of four years of wear at the actual yearly wear rate in future engineering evaluations. If the calculated wear over the next inspection interval indicates that the wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate), then the pipe will be repaired or replaced in accordance with the corrective action program. The margin of the four years of wear at the actual yearly wear rate is conservative base on the following;

1) The system flow rate variability is minimal and has been shown not to adversely affect the predictability of wear rate, and

2) The structural integrity of the system is dependent on the carbon steel slip-on flange, and not the aluminum-bronze piping inserted inside the slip-on flange.

LRA Appendices A1.9 and B2.1.9, LRA Bases Document XI.M20 (B2.1.9) "Open-Cycle Cooling Water System" are revised to use a conservative margin of four years of wear at the actual yearly wear rate in future engineering evaluations. If the evaluated wear over the next inspection interval indicates that the wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate), then the pipe will be repaired or replaced.in accordance with the corrective action program.

Enclosure 2 provides the line-in/line-out revision to LRA Appendices A1.9 and B2.1.9. Enclosure 3 provides a revised commitment Item 4 to Table A4-1 of the LRA.

Further conservatism is provided by the structural integrity of the system, which is assured by the large available cross-section of the carbon steel flange. For the worst-case damaged flange area identified in 2005, the structural integrity of the system was verified by engineering evaluation. This evaluation, using design load (i.e. seismic) and combined load analysis, concluded the structural integrity of the ECW system pipe-to-flange assembly was not degraded to a condition where catastrophic failure would occur during a seismic event. The structural integrity of pipe-to-flange hub weld was not compromised. The calculated stresses in this weld were within the ASME Code allowable limits and below the material yield strength.

The quarterly ECW system pump surveillances are performed per ASME Section XI to assure that ECW system flow through the CCW heat exchanger is maintained within operating limits and to minimize wear by maintaining established flow conditions. The ECW system independent train design facilitates minimum flow condition variability during all modes of

operation such that flow rate does not adversely impact the predictability of wear rate. In addition, the CCW heat exchanger outlet valve is maintained in an intermediate position which ensures overall system flow remains balanced throughout the ECW train operation.

The verifiable inspection program for the known erosion phenomenon is part of the Open-Cycle Cooling Water System aging management program (B2.1.9) and ensures that corrective actions are taken to maintain ECW system integrity. The program is based on a defined wear rate and provides for an adequate margin to ensure the pipe is repaired or replaced prior to wearing below minimum wall thickness. STP will continue the current inspection program and take corrective action to repair or replace the pipe when the margin to maintain minimum wall thickness can no longer be assured. Further operating experience will be evaluated for any enhancements to this program to ensure that the aging mechanism does not compromise the ECW system from meeting its intended function.

Enclosure 2

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

List of Revised LRA Sections

RAI	Affected LRA Section
B2.1.9-4b	A1.9
B2.1.9-4b	B2.1.9

A1.9 OPEN-CYCLE COOLING WATER SYSTEM

The Open-Cycle Cooling Water System program manages loss of material and reduction of heat transfer for components within the scope of license renewal and exposed to the raw water of the essential cooling water system. Included are components of the essential cooling water (ECW) system that are within the scope of license renewal, the component cooling water heat exchangers and the other safety related heat exchangers cooled by the essential cooling water system. The program includes chemical treatment and control of biofouling, periodic inspections, flushes and physical and chemical cleaning, and heat exchanger performance testing/ inspections to ensure that the effects of aging will be managed during the period of extended operation. The program also includes inspections of a sample of ECW piping for wall thickness prior to the period of extended operation. Subsequent inspections will be scheduled based on the results of the initial inspections. The plant specific configuration of the aluminum-bronze piping inserted inside the slip-on flange downstream of the Component Cooling Water (CCW) heat exchanger is inspected at a nominal 216 week interval. An engineering evaluation is performed after each inspection. Corrective action in accordance with the corrective action program will be initiated if the calculated wear over the next inspection interval indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate). The program is consistent with STP commitments as established in responses to NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Components*.

B2.1.9 Open-Cycle Cooling Water System

Program Description

The Open-Cycle Cooling Water (OCCW) System program manages loss of material and reduction of heat transfer for components in scope of license renewal and exposed to the raw water of the essential cooling water (ECW) and essential cooling water screen wash system. The program includes surveillance techniques and control techniques to manage aging effects caused by biofouling, corrosion, erosion, cavitation erosion, protective coating failures and silting in components of the ECW system, and structures and components serviced by the ECW system, that are in scope of license renewal. The program also includes periodic inspections to monitor aging effects on the OCCW structures, systems and components, component cooling water heat exchanger performance testing, and inspections of the other safety related heat exchangers cooled by the ECW System, to ensure that the effects of aging on OCCW components are adequately managed for the period of extended operation. The program also includes inspections of a sample of ECW piping for wall thickness prior to the period of extended operation. Subsequent inspections will be scheduled based on the results of the initial inspections. The plant specific configuration of the aluminum-bronze piping inserted inside the slip-on flange downstream of the CCW heat exchanger is inspected at a nominal 216 week interval. An engineering evaluation is performed after each inspection. If the calculated wear over the next inspection interval indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate), then the pipe will be repaired or replaced in accordance with the corrective action program. Components within the scope of the OCCW System program are: 1) components of the ECW system that are in scope of license renewal and 2) the safety-related heat exchangers cooled by the ECW system: component cooling water heat exchangers, diesel generator jacket water heat exchangers, diesel generator lube oil coolers, diesel generator intercoolers, essential chiller condensers, and component cooling water pump supplementary coolers. The program is consistent with STPNOC commitments established in responses to NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Components*.

The surveillance techniques utilized in the Open-Cycle Cooling Water System program include visual inspection, volumetric inspection, and thermal and hydraulic performance monitoring of heat exchangers. The control techniques utilized in the Open-Cycle Cooling Water System program include (1) water chemistry controls to mitigate the potential for the development of aggressive cooling water conditions, (2) flushes and (3) physical and/or chemical cleaning of heat exchangers and of the ECW pump suction bay to remove fouling and to reduce the potential sources of fouling.

Additional measures used to manage loss of material due to selective leaching for aluminum bronze components in the ECW system are detailed in the plant-specific aging management program Selective Leaching of Aluminum Bronze (B2.1.37).

NUREG-1801 Consistency

The Open-Cycle Cooling Water System program is an existing program that, following enhancement, will be consistent with exception to NUREG-1801, Section XI.M20, Open-Cycle Cooling Water System.

Exceptions to NUREG-1801

Program Elements Affected:

Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)

NUREG-1801, Section XI.M20, Elements 2, 3 and 4, provide for a program of flushing and inspection to confirm that fouling and degradation of surfaces is not occurring. An exception is taken to flushing the ECW train cross-tie dead legs and inspecting the interior of these lines. Instead, the external surfaces of the cross-tie lines are included in the six month dealloying visual external inspection walkdowns. The cross-tie valves and piping are also included in the essential cooling water system inservice pressure test, which includes VT-2 inspections of these components. Measures used to manage loss of material due to selective leaching are detailed in the Selective Leaching of Aluminum Bronze program (B2.1.37). These inspections and tests provide confidence in the ability to detect leakage in the piping and valves. The cross-tie lines do not have an intended function and are not required for any accident scenario within the design basis of the plant. The cross-tie valves are maintained locked closed.

Enhancements

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

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

Procedures will be enhanced to include visual inspection of the strainer inlet area and the interior surfaces of the adjacent upstream and downstream piping. Material wastage, dimensional change, discoloration, and discontinuities in surface texture will be identified. These inspections will provide visual evidence of loss of material and fouling in the ECW system and serve as an indicator of the condition of the interior of ECW system piping components otherwise inaccessible for visual inspection. Procedures will also be enhanced to include the acceptance criteria for this visual inspection.

Scope (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)

Procedures will be enhanced to require a minimum of 25 ECW piping locations be measured for wall thickness. Selected areas will include locations that are considered to have the highest corrosion rates, such as areas with stagnant flow.

Procedures will be enhanced to require an engineering evaluation after each inspection of the aluminum-bronze piping inserted inside the slip-on flange downstream of the CCW heat exchanger. The engineering evaluation will calculate wear over the next inspection interval using a margin of four years of wear at the actual yearly wear rate. Corrective action in accordance with the corrective action program will be initiated if the calculated wear indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate).

Corrective Actions (Element 7)

Procedures will be enhanced to require loss of material in piping and protective coating failures be documented in the corrective action program. The resolution will include an engineering evaluation of the condition.

Operating Experience

Industry operating experience evaluations, Maintenance Rule Periodic Assessments, and OCCW component performance testing results have shown that the effects of aging are being adequately managed.

A review of the STP plant specific operating experience indicates that macrofouling, general corrosion, erosion corrosion, and cavitation erosion have been observed in aluminum bronze components.

In 2001 plant inspections of the ECW pumps revealed signs of flow erosion and corrosion on the pump internal and external surfaces. The pump vendor recommended application of Belzona coating to provide protection against erosion and corrosion and the coating was applied to the internal wetted surfaces of all ECW pumps. Use of Belzona has improved pump performance and service life of the components.

In May 2005, damage was discovered in the slip-on flange immediately downstream of the component cooling water heat exchanger 1B ECW return throttle valve. The damage was due to cavitation erosion. The corresponding locations in the other ECW trains were inspected. The damaged areas of all six trains were replaced or reworked in accordance with the applicable codes and piping specifications. A design modification was performed to coat the affected areas with Belzona, and PMs were generated to perform regular inspections. The use of Belzona for mitigating cavitation erosion has been successful in prolonging service life of the components.

The OCCW System program operating experience information provides objective evidence to support the conclusion that the effects of aging are adequately managed so that the structure and component intended functions are maintained during the period of extended operation.

NRC Generic Letter 89-13 was based on industry operating experience and forms the basis for the STP OCCW System program.

Conclusion

The continued implementation of the Open-Cycle Cooling Water System program will provide 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

Revised Regulatory Commitment

A4 LICENCE RENEWAL COMMITMENTS

Table A4-1 identifies proposed actions committed to by STPNOC for STP Units 1 and 2 in its License Renewal Application. These and other actions are proposed regulatory commitments. This list will be revised, as necessary, in subsequent amendments to reflect changes resulting from NRC questions and STPNOC responses. STPNOC will utilize the STP commitment tracking system to track regulatory commitments. The Condition Report (CR) number in the Implementation Schedule column of the table is for STPNOC tracking purposes and is not part of the amended LRA.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
4	Enhance the Open-Cycle Cooling Water System program procedures to: • include visual inspection of the strainer inlet area and the interior surfaces of the adjacent upstream and downstream piping. Material wastage, dimensional change, discoloration, and discontinuities in surface texture will be identified. These inspections will provide visual evidence of loss of material and fouling in the ECW system and serve as an indicator of the condition of the interior of ECW system piping components otherwise inaccessible for visual inspection. • include the acceptance criteria for this visual inspection. • require a minimum of 25 ECW piping locations be measured for wall thickness prior to the period of extended operation. Selected areas will include locations considered to have the highest corrosion rates, such as areas with stagnant flow. • require an engineering evaluation after each inspection of the aluminum-bronze piping inserted inside the slip-on flange downstream of the CCW heat exchanger, o require the engineering evaluation calculated wear over the next inspection interval using a margin of four years of wear at the actual yearly wear rate, o require corrective action in accordance with the corrective action program be initiated If the calculated wear indicates that the aluminum-bronze piping wall will reduce to a thickness of less than minimum wall thickness plus margin (four years of wear at the actual yearly wear rate), • require loss of material in piping and protective coating failures be documented in the	B2.1.9	Prior to the period of extended operation CR 10-23256

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	corrective action program, and • require an engineering evaluation be performed when loss of material in piping or protective coating failures is identified.		