



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

July 17, 2012  
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10 CFR 54  
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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 for the  
South Texas Project License Renewal Application  
Aging Management Program, Set 20 (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 June 25, 2012, "Requests for Additional Information for the Review of the South Texas Project, Units 1 and 2, License Renewal Application – Aging Management, Set 20 (TAC Nos. ME4936 and ME4937)" (ML12144A443)

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, the NRC staff requests additional information for review of the STP LRA. STPNOC's response to the requests for additional information 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.

There are no 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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NRK

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

Executed on 7/17/2012  
Date



D. W. Rencurrel  
Chief Nuclear Officer

KJT

Enclosures: 1. STPNOC Response to Requests for Additional Information  
2. STPNOC LRA Changes with Line-in/Line-out Annotations

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**Enclosure 1**

**STPNOC Response to Requests for Additional Information**

#### **RAI 4.2.2.4-1, Pressure-Temperature Limits TLAA (059)**

##### Background:

10 CFR Part 50, Appendix G, Paragraph IV.A states that, "*the pressure-retaining components of the reactor coolant pressure boundary [RCPB] that are made of ferritic materials must meet the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code [ASME Code, Section III], supplemented by the additional requirements set forth in [paragraph IV.A.2, "Pressure-Temperature (P-T) Limits and Minimum Temperature Requirements"] ...*" Therefore, 10 CFR Part 50, Appendix G requires that P-T limits be developed for the ferritic materials in the reactor vessel (RV) beltline (neutron fluence  $\geq 1 \times 10^{17}$  n/cm<sup>2</sup>, E > 1 MeV), as well as ferritic materials not in the RV beltline (neutron fluence  $< 1 \times 10^{17}$  n/cm<sup>2</sup>, E > 1 MeV). Further, 10 CFR Part 50, Appendix G requires that all RCPB components must meet the ASME Code, Section III requirements. The relevant ASME Code, Section III requirement that will affect the P-T limits is the lowest service temperature requirement for all RCPB components specified in Section III, NB-2332(b).

##### Issue:

P-T limit calculations for ferritic RCPB components that are not RV beltline shell materials (neutron fluence  $< 1 \times 10^{17}$  n/cm<sup>2</sup>, E > 1 MeV) may define P-T curves that are more limiting than those calculated for the RV beltline shell materials (neutron fluence  $\geq 1 \times 10^{17}$  n/cm<sup>2</sup>, E > 1 MeV). This may be due to the following factors:

1. RV nozzles, penetrations, and other discontinuities have complex geometries that may exhibit significantly higher stresses than those for the RV beltline shell region. These higher stresses can potentially result in more restrictive P-T limits, even if the reference temperature (RT<sub>NDT</sub>) for these components is not as high as that of RV beltline shell materials that have simpler geometries.
2. Ferritic RCPB components that are not part of the RV may have initial RT<sub>NDT</sub> values, which may define a more restrictive lowest operating temperature in the P-T limits than those for the RV beltline shell materials.

Section 4.2.4 (*P-T Limits*) of the license renewal application (LRA) states in part, "The current P-T limit curves and the assumed Adjusted Reference Temperature (ART) values are valid up to 32 EFPY. The effects of extended beltline materials on the P-T curves were also evaluated. The RT<sub>PTS</sub> of inlet/outlet nozzles for both units were calculated using conservative assumptions for fluence and material properties, and the results could not demonstrate that these nozzles would not be limiting. Therefore the revision to the P-T curves necessary to extend the P-T curves beyond 32 EFPY and into the period of extended operation will need to demonstrate the nozzles will receive a fluence of less than  $1 \times 10^{17}$  n/cm<sup>2</sup> (E > 1.0 MeV) or will need to consider the ART of inlet/outlet nozzles. For Unit 2, the extended beltline material for the bottom head torus, R3020-1, was shown to be the limiting material. Therefore the revision to the P-T curves will need to consider the ART of the bottom head torus."

Request:

Revise LRA Section 4.2.4 to describe how the P-T limit curves, and the methodology used to develop these curves, will consider all RV materials (beltline and non-beltline) and the lowest service temperature of all ferritic RCPB materials, consistent with the requirements of 10 CFR Part 50, Appendix G, during the period of extended operation, or provide a justification for how the current LRA Section 4.2.4 will satisfy the requirements of 10 CFR Part 50, Appendix G, during the period of extended operation.

STPNOC Response:

The development of the revised P-T limit curves to extend the curves beyond 32 EFY and into the period of extended operation will be in accordance with 10 CFR 50 Appendix G. The revised P-T limit curves will consider the effects of neutron embrittlement in the adjusted reference temperature for RV beltline and extended-beltline locations and the higher stresses in the inlet/outlet nozzle corner region. The revised P-T limit curves also will consider the ferritic RCPB components outside the beltline and extended-beltline locations when determining the lowest service temperature.

LRA Section 4.2.4 and Appendix A3.1.4 "Pressure–Temperature (P-T) Limits" are revised to describe how the P-T limit curves will be revised to be consistent with the requirements of 10 CFR Part 50, Appendix G, during the period of extended operation.

Enclosure 2 provides the line-in/line-out changes to LRA Section 4.2.4 and Appendix A3.1.4.

**Enclosure 2**

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

**List of Revised LRA Sections**

<b>RAI</b>	<b>Affected LRA Section</b>
RAI 4.2.2.4-1	4.2.4
	A3.1.4



#### 4.2.4 Pressure-Temperature (P-T) Limits

##### Summary Description

Appendix G of 10 CFR 50 requires that reactor vessel boltup, hydrotest, pressure tests, normal operation, and anticipated operational occurrences be accomplished within established pressure-temperature (P-T) limits. These limits are established by calculations that utilize the material properties (adjusted reference temperature, ART), effects of fluence on material properties obtained from the reactor surveillance capsules, and methodology of Appendix G of ASME, Section III.

These methods depend on the limiting ART of the beltline material and cause the calculation of the P-T limit curves to be a TLAA. Withdrawal and testing of the surveillance coupons verifies that the limiting ART value used in the P-T limit curves bounds the aging of the reactor vessel material as required by Technical Specification 4.4.9.1.2.

##### Analysis

The current P-T limit curves and the assumed ART value are valid up to 32 EFPY. The current Technical Specification curves assume a  $\frac{1}{4}T$   $RT_{NDT}$  of 91°F and a  $\frac{3}{4}T$   $RT_{NDT}$  of 64°F. These reference temperatures are based on an initial projection of the aging of intermediate shell R1606-3 to 32 EFPY.

The effects of extended beltline materials on the P-T curves were also evaluated. The  $RT_{PTS}$  of inlet/outlet nozzles for both units were calculated using conservative assumption for fluence and material properties, and the results could not demonstrate that these nozzles would not be limiting. Therefore, the revision to the P-T curves necessary to extend the P-T curves beyond 32 EFPY and into the period of extended operation will be in accordance with the requirements of 10 CFR 50, Appendix G, need to demonstrate the nozzles will receive a fluence of less than  $1 \times 10^{17}$  n/cm<sup>2</sup> (E>1.0 MeV) or will need to The revised curves will consider the ART of inlet/outlet nozzles and the higher stresses in the nozzle corner region. For Unit 2, the extended beltline material for the bottom head torus, R3020-1, was shown to be the limiting material. Therefore, the revision to the P-T curves will ~~need to~~ consider the ART of the bottom head torus and ensure the use of the appropriate methodology in the development of the P-T curves. Additionally, the ferritic reactor coolant pressure boundary (RCPB) components outside the beltline and extended-beltline locations will be considered in the development of the revised P-T limit curves when determining the lowest service temperature.

The current P-T curves satisfactorily account for the extended beltline materials to 32 EFPY.

##### Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The STP P-T limits curves are required to be maintained and updated as necessary to maintain plant operation consistent with 10 CFR 50. The P-T limit curves will be managed, as required by the STP license. Therefore, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).

#### A3.1.4 Pressure-Temperature (P-T) Limits

Appendix G of 10 CFR 50 requires that reactor vessel boltup, hydrotest, pressure tests, normal operation, and anticipated operational occurrences be accomplished within established pressure-temperature (P-T) limits. These limits are established by calculations that utilize the material properties (adjusted reference temperature, ART), effects of fluence on material properties obtained from the reactor surveillance capsules, and methodology of Appendix G of ASME, Section III.

The current P-T limit curves and the assumed adjusted reference temperature (ART) values are valid up to 32 EFPY. The revision necessary to extend the P-T curves beyond 32 EFPY and into the period of extended operation will consider the following in accordance with the requirements of 10 CFR 50 Appendix G.

- effects of neutron embrittlement in the ART for the reactor vessel beltline and extended-beltline locations
- the higher stresses in the inlet/outlet nozzle corner region
- the ferritic reactor coolant pressure boundary components outside the beltline and extended-beltline locations when determining the lowest service temperature

These STP P-T limits curves are required to be maintained and updated as necessary to maintain plant operation consistent with 10 CFR 50. The P-T limit curves will be managed, as required by the STP license. Therefore, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(iii).