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SOUTHERN COMPANY
Energy to Serve Your World℠

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Vogtle Electric Generating Plant
Response to NRC Questions Regarding
Request to Revise Technical Specifications and
Pressure and Temperature Limits Report

Ladies and Gentlemen:

On February 26, 2004, Southern Nuclear Operating Company (SNC) submitted a proposed change to revise the Vogtle Electric Generating Plant (VEGP) Unit 1 and Unit 2 Technical Specifications (TS) related to the Pressure and Temperature Limits Report (PTLR). In conjunction with this change, SNC submitted revised PTLRs for Unit 1 and Unit 2 for review and approval by the NRC. In addition, SNC submitted TS Bases changes associated with the proposed changes to the TS for information.

On March 31 and April 12, 2004, SNC received facsimiles from the NRC regarding the VEGP February 26, 2004, submittal. These facsimiles contained 3 questions and 1 question, respectively. On July 8, 2004, SNC submitted a response to these NRC questions.

On August 23, 2004, SNC received another facsimile from the NRC containing 3 additional questions regarding the VEGP February 26, 2004 submittal. The SNC responses to these NRC questions are enclosed.

As stated in the initial SNC submittal of February 26, 2004, SNC requests approval of the proposed license amendment by February 15, 2005, so that the revised limits can be implemented for the start-up of Unit 1 following the refueling outage, currently scheduled for March 2005. The proposed changes will be implemented within 90 days of issuance of the amendment.

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Mr. J. T. Gasser states he is an Executive Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

This letter contains no NRC commitments. If you have any questions, please advise.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Jeffrey T. Gasser

Sworn to and subscribed before me this 22nd day of October, 2004.

Notary Public

My commission expires: 9-14-06

JTG/DRG/daj

Enclosure: SNC Response to NRC Questions Regarding Vogtle Electric Generating Plant Units 1 and 2 Technical Specification Revision and PTLR Submittal

cc: Southern Nuclear Operating Company
Mr. D. E. Grissette, Vice President – Plant Vogtle
Mr. W. F. Kitchens, General Manager – Plant Vogtle
RType: CVC7000

U. S. Nuclear Regulatory Commission
Dr. W. D. Travers, Regional Administrator
Mr. C. Gratton, NRR Project Manager – Vogtle
Mr. G. J. McCoy, Senior Resident Inspector – Vogtle

State of Georgia
Mr. L. C. Barrett, Commissioner – Department of Natural Resources

Enclosure

SNC Response to NRC Questions Regarding
Vogtle Electric Generating Plant Units 1 and 2
Technical Specification Revision and PTLR Submittal

SNC Response to NRC Questions Regarding
Vogtle Electric Generating Plant Units 1 and 2
Technical Specification Revision and PTLR Submittal

Pressure-Temperature (P-T) limits (TAC Nos. MC2225 and MC2226)

1.1 NRC Question

Figure 5-1 (for 26 EFPY) of WCAP-15068, Revision 3, "Vogtle Electric Generating Plant Unit 1 Heatup and Cooldown Limit Curves for Normal Operation," shows that the heatup curve for 100°F/hr maintains a constant pressure of 748 psig from 60°F to 90°F; instead of a smooth, pressure varying P-T limit curve derived directly from the American Society of Mechanical Engineers (ASME) Code, Section XI, Appendix G methodology as described in Section 3 of this WCAP. Provide the basis and detailed calculations for this part of the P-T limit curve. A similar concern applies to Figure 5-3 (for 36 EFPY) of WCAP-15068, Revision 3 and Figure 5-1 (for 26 EFPY) and Figure 5-3 (for 36 EFPY) of WCAP-15161, Revision 3, "Vogtle Electric Generating Plant Unit 2 Heatup and Cooldown Limit Curves for Normal Operation." No justification is required for these P-T limit curves if it is the same as that for Figure 5-1 of WCAP-15068, Revision 3. However, if this concern results in a revision of the proposed P-T limits, all four figures mentioned above should be revised.

SNC Response

Table 1 below shows the actual pressure data for the 1/4T, 3/4T and Steady State PT Curves generated by Westinghouse for the Vogtle Unit 1 26 EFPY PT curves (100°F/hr and Steady State). Figure 1 is a graphical representation of that data. The Westinghouse computer program compares the pressure from each column and takes the minimum data point at each given temperature. Additionally, if the curve drops to a minimum pressure point after Temp = 60°F, then the preceding pressures are also set to that minimum pressure point. As can be seen below, the minimum pressure from 60°F to 95°F is 748 psig. Therefore the curve is conservatively set to this minimum pressure point from Temp = 60°F to 95°F. This occurs similarly for all of the Vogtle Unit 1 and Unit 2 PT Curves.

Table 1: Raw Data Comparison for Vogtle Unit 1: 26 EFPY

Temp. (°F)	100°F/hr 1/4T Press. (psig)	100°F/hr 3/4T Press. (psig)	SS Press. (psig)
60	765	813	**759**
65	799	795	**775**
70	832	**779**	792
75	864	**766**	812
80	895	**756**	833
85	926	**750**	857
90	957	**748**	883
95	987	**748**	912
100	1019	**752**	944
105	1051	**759**	979
110	1084	**769**	1018
115	1119	**782**	1062
120	1156	**799**	1109
125	1195	**818**	1162
130	1237	**842**	1221
135	1282	**868**	1285
140	1331	**899**	1356
145	1384	**934**	1435
150	1441	**974**	1522
155	1504	**1018**	1618
160	1572	**1068**	1725
165	1647	**1124**	1842
170	1730	**1186**	1972
175	1820	**1254**	2116
180	1919	**1331**	2274
185	2028	**1415**	2449

Bolded values are the minimum calculated between the 3 curves at each temperature

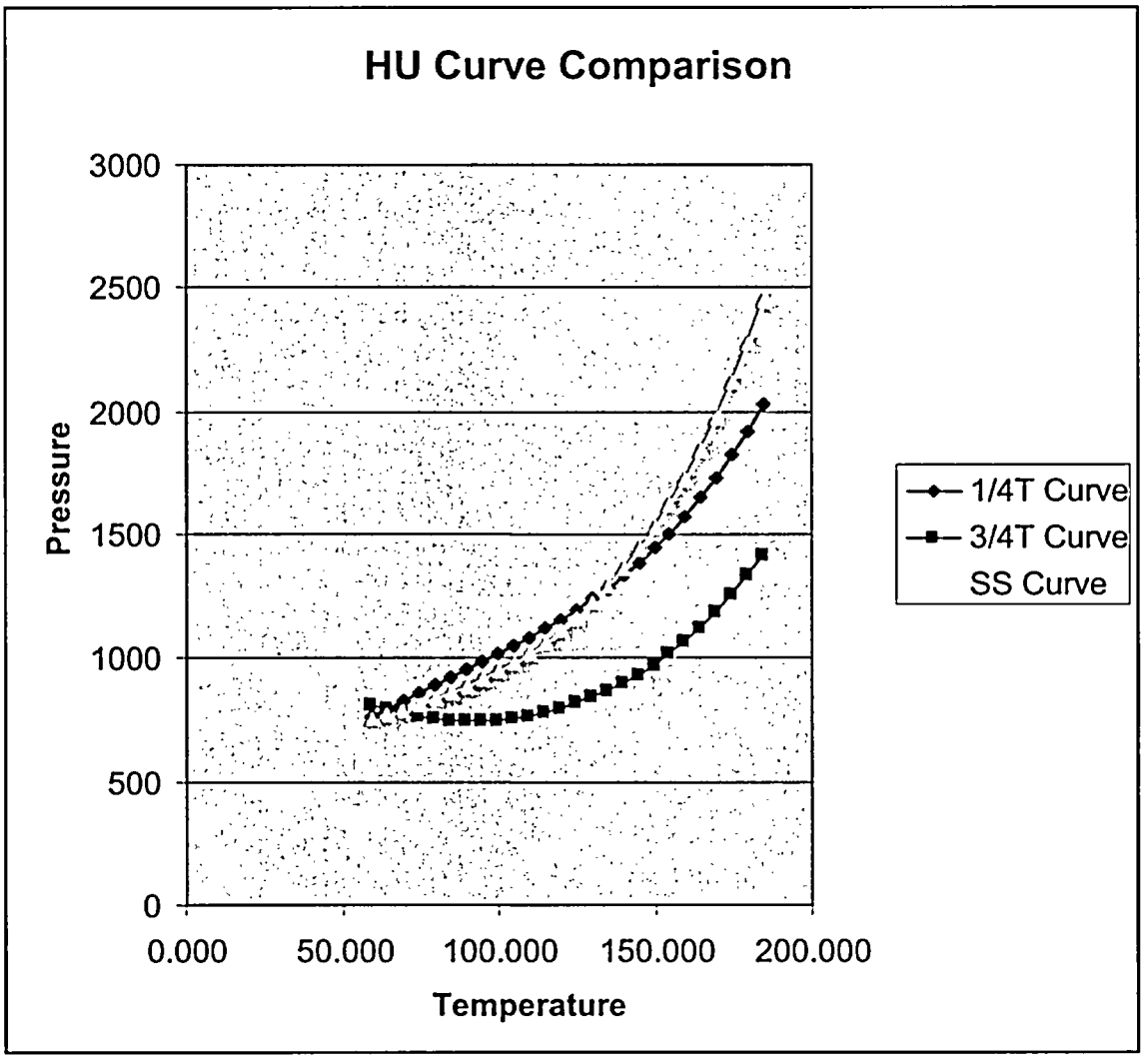

Figure 1: Graphical Representation of the Data Comparison from Table 1

1.2 NRC Question

There are moderate discrepancies between your P-T limits and those calculated by the staff using the formulas (not the alternative K_{It} formula) in Section 3 of this WCAP. For the 100°F/hr cooldown curve, please provide RPV bulk water temperature, 1/4T metal temperature, K_{Im}, and K_{It} for P-T pairs (582 psi, 65°F) and (948 psi, 110°F); for the 100°F/hr heatup curve, provide reactor pressure vessel (RPV) bulk water temperature, 3/4T metal temperature, K_{Im}, and K_{It} for P-T pairs (733 psi, 100°F) and (2344 psi, 225°F). Further, provide the thermal diffusivity that you used in your thermal calculations.

SNC Response

The parameters requested above (RPV bulk water temperature, 1/4T metal temperature, 3/4T metal temperature and the corresponding K_{It} values) that are contained in WCAP-15068 Rev. 3 are identified below and indicated as such. The parameters requested above, including the thermal stresses that are not contained in WCAP-15068, Rev. 3 are also provided below.

36 EFPY Heatup (100°F/hr) at an RPV bulk water temperature of 100°F:

- 1/4T metal temperature = 83.97°F **(WCAP-15068, Rev. 3 Table A3)**
- 1/4T K_{IT} = -9.1227 KSI Sq. Rt. In **(WCAP-15068, Rev. 3 Table A3)**
- Thermal Stress = -1825.45 psi
- 1/4T K_{IP} = 27.3182 KSI Sq. Rt. In

- 3/4T metal temperature = 68.28°F **(WCAP-15068, Rev. 3 Table A3)**
- 3/4T K_{IT} = 6.7187 KSI Sq. Rt. In **(WCAP-15068, Rev. 3 Table A3)**
- Thermal Stress = 2248.60 psi
- 3/4T K_{IP} = 19.3129 KSI Sq Rt. In

36 EFPY Heatup (100°F/hr) at an RPV bulk water temperature of 225°F:

- 1/4T metal temperature = 200.73°F
- 1/4T K_{IT} = -15.09 KSI Sq. Rt. In
- Thermal Stress = -3147.89 psi
- 1/4T K_{IP} = 87.7759 KSI Sq. Rt. In

- 3/4T metal temperature = 174.54°F
- 3/4T K_{IT} = 11.41 KSI Sq. Rt. In
- Thermal Stress = 3786.72 psi
- 3/4T K_{IP} = 61.7711 KSI Sq. Rt. In

36 EFPY Cooldown (100°F/hr) at an RPV bulk water temperature of 65°F:

- 1/4T metal temperature = 89.52°F **(WCAP-15068, Rev. 3 Table A4)**
- 1/4T K_{IT} = 15.1398 KSI Sq. Rt. In **(WCAP-15068, Rev. 3 Table A4)**
- Thermal Stress = 3250.63 psi
- 1/4T K_{IP} = 15.9099 KSI Sq. Rt. In

36 EFPY Cooldown (100°F/hr) at an RPV bulk water temperature of 110°F:

- 1/4T metal temperature = 135.30°F **(WCAP-15068, Rev. 3 Table A4)**
- 1/4T K_{IT} = 15.7553 KSI Sq. Rt. In **(WCAP-15068, Rev. 3 Table A4)**
- Thermal Stress = 3383.14 psi
- 1/4T K_{IP} = 25.9151 KSI Sq. Rt. In

The thermal stress and stress intensity calculation is performed internally by the computer program, and is not an external input.

As discussed in the first paragraph after Equation 6 on page 3-3 of WCAP-15068, Rev. 3, the OPERLIM computer code uses the alternative methods for calculating K_{IT}, i.e., Equations 4 and 5 on pages 3-2 and 3-3 of WCAP-15068, Rev. 3.

The Westinghouse computer program manual does not have an input term called "Thermal Convection," however, it does contains an input term called "Film Coefficient," and that value is 7,000 BTU/hr ft^2 °F for all RPV bulk water temperatures. The thermal calculation uses other material properties (e.g., thermal conductivity, etc.) at the initial temperature and final temperature. The computer program then interpolates between the initial and final temperature values and does not provide values at any temperatures as an output. Therefore, the requested values cannot be obtained or provided at the specified temperatures. This is why the K_{IT} and thermal stress values, along with the specific wall temperatures are provided.

Exemption to eliminate the RPV closure head and vessel flange requirements (TAC Nos. MC2227 and MC2228)

2.1 NRC Question

Confirm that the results plotted in Figure 4-1 and 4-2 of WCAP-16142-P, Revision 1, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Vogtle Units 1 and 2," are based on a heatup rate of 100°F/hr and the operating RPV pressure. In addition, the submitted information is not enough for the staff to assess the changing margin during the heatup or cooldown. Please revise Figures 4-1 and 4-2 by applying the ASME Code, Section XI, Appendix G structural factor of 2 to the applied stress intensity factors due to pressure and boltup loading and the ASME Code, Section XI, Appendix G structural factor of 1 to the applied stress intensity factor due to thermal loading. For both torus to flange region weld (Cut 3) and dome to torus region weld (Cut 2), provide the RPV temperatures at a/t ratios of 0.1 and 0.25 at the following specific moments of time after heatup or cooldown: 82, 207.4, 344.2, 355, 375, and 405 minutes after heatup; 421 minutes after cooldown; and the steady state condition at 406 minutes). The staff needs these crack-tip temperature values to calculate the appropriate K_{Ic} values.

SNC Response

The results plotted in Figure 4-1 and 4-2 of WCAP-16142-P, Revision 1, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Vogtle Units 1 and 2," are based on a heatup rate of 100°F/hr and the operating RPV pressure.

The key margins in WCAP-16142-P, Revision 1 are discussed in Section 4, Flange Integrity. The results for the applied stress intensity factors are given in Figure 4-1 for Cut 3 and in Figure 4-2 for Cut 2, as stated in the fourth paragraph on Page 4-1. As can be seen in the two figures, the limiting condition for the end of heatup occurs at Cut 2, in Figure 4-2. At 344.2 minutes, near the end of heatup, the value for a flaw at 10 percent of the wall is 49.21, as stated on Page 4-1. The Boltup is actually more severe for Cut 3 in Figure 4-1, and gives a value of 24.84, which is also stated on Page 4-1. This was why the results for both locations were included in WCAP-16142-P, Revision 1.

The calculations were done for the most limiting material in the flange area, RT_{NDT} = 20 °F, as shown in Table 3-1. Calculations were done for the two most limiting conditions, the end of heatup, and boltup alone. The margin results shown below are a ratio of the fracture toughness to the applied K.

- Boltup: $K_{IC}/K_I = 79.3/24.84 = 3.19$, $K_{IA}/K_I = 49.0/24.84 = 1.97$
- Heatup: $K_{IC}/K_I = 200/49.21 = 4.06$, $K_{IA}/K_I = 200/49.21 = 4.06$

These results are for the most limiting location and the most limiting material properties, for a postulated flaw depth of 10 percent of the flange thickness. Margins calculated for any other locations would be higher.

Margins are also discussed in Section 5 of WCAP-16142-P, Revision 1. In Section 5, a calculation was performed to determine the boltup temperature needed to maintain a safety factor of 2 on stress, and a postulated flaw size of 10% of the flange wall thickness, using K_{IC} toughness. The boltup temperature was determined to be 20 °F, and therefore a room (ambient) boltup temperature is easily justified.