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Energy to Serve Your WorldSM

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50-425

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

Ladies and Gentlemen:

VOGTLE ELECTRIC GENERATING PLANT
10 CFR 50.46 ECCS EVALUATION MODELS SIGNIFICANT ERROR REPORT

Pursuant to the requirements of 10 CFR 50.46 (a)(3)(ii), Southern Nuclear Operating Company (SNC) is submitting a significant error report to report errors in the Small-Break Loss of Coolant Accident (SBLOCA) Emergency Core Cooling System (ECCS) model for Unit 2. Attached is a description of the errors along with a revised assessment of the SBLOCA peak clad temperature (PCT). The report also provides updated values of PCT for the Large-Break Loss of Coolant Accident (LBLOCA) ECCS model for Unit 1 and Unit 2 and for the SBLOCA ECCS model for Unit 1. The report is based on information provided by Westinghouse of changes and errors assessed against the Vogtle Electric Generating Plant (VEGP) ECCS Evaluation Model and has been prepared in accordance with the guidance in WCAP-13451.

The sum of the absolute magnitudes of additional assessments against the VEGP ECCS Evaluation Model for SBLOCA has resulted in a total error greater than 50 °F for Unit 2. This is considered to be significant per 10 CFR 50.46 (a)(3)(i). This report is being submitted pursuant to 10 CFR 50.46 (a)(3)(ii).

In the 1999 annual report (LCV-1436, April 4, 2000), SNC reported a LBLOCA PCT of 2169 °F for both Unit 1 and Unit 2. Subsequent to this report, Westinghouse notified SNC of an additional error in the LOCBART computer code that resulted in a 15 °F PCT benefit. The resultant LBLOCA PCT is 2154 °F for both Unit 1 and Unit 2. The cumulative LBLOCA PCT error for both Unit 1 and Unit 2 since the last LBLOCA significant error report (LCV-1388, October 19, 1999) is 15 °F. This is not considered to be significant per 10 CFR 50.46 (a)(3)(i).

In the 1999 annual report referenced above, SNC reported a SBLOCA PCT of 1876 °F for Unit 1 and 1872 °F for Unit 2. In that report, SNC reported a cumulative PCT error of 51 °F for Unit 1 and 49 °F for Unit 2. The error for Unit 1 was considered to be significant per

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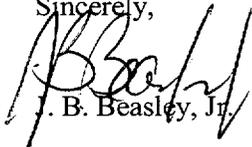
10 CFR 50.46 (a)(3)(i). The error for Unit 2 was not considered to be significant per 10 CFR 50.46 (a)(3)(i).

Subsequent to the 1999 annual report, on July 15, 2000, SNC received notification from Westinghouse of additional errors in the NOTRUMP code that resulted in a PCT penalty of 24 °F. The resultant SBLOCA PCT is 1900 °F for Unit 1 and 1896 °F for Unit 2. The cumulative SBLOCA PCT error for Unit 1 since the last Unit 1 significant error report (LCV-1436, April 4, 2000) is 24 °F and is not considered to be significant. The cumulative SBLOCA PCT error for Unit 2 since the last Unit 2 significant error report (LCV-0327-B, December 8, 1994) is 73 °F and is considered to be significant per 10 CFR 50.46 (a)(3)(i). Reporting of this error has exceeded 30 days, as specified in 10 CFR 50.46 (a)(3)(ii), because the previous SBLOCA cumulative error of 49 °F for Unit 2 was considered as having been reported in the 1999 annual report (LCV-1436, April 4, 2000). Upon further review of the requirements of 10 CFR 50.46 (a)(3)(ii), it was determined that this should be reported with the recently identified error of 24 °F.

The resultant LBLOCA and SBLOCA PCT for each unit remains in compliance with the criterion set forth in 10 CFR 50.46 (b)(1). The criterion requires that the PCT does not exceed 2200 °F.

Per 10 CFR 50.46 (a)(3)(ii), reanalysis or taking other action is not required because compliance with 10 CFR 50.46 (b)(1) has been demonstrated for both LBLOCA and SBLOCA. The results of this report will be incorporated in a future Final Safety Analysis Report (FSAR) update.

Sincerely,



J. B. Beasley, Jr.

JBB/RJF

Attachment

cc: Southern Nuclear Operating Company
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SNC Document Management

U. S. Nuclear Regulatory Commission
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Mr. J. Zeiler, Senior Resident Inspector, Vogtle

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

ATTACHMENT
VOGTLE ELECTRIC GENERATING PLANT
10 CFR 50.46 ECCS EVALUATION MODELS SIGNIFICANT ERROR REPORT

BACKGROUND

Provisions in 10 CFR 50.46 require applicants and holders of operating licenses or construction permits to notify the Nuclear Regulatory Commission (NRC) of errors and changes in the Emergency Core Cooling System (ECCS) Evaluation Models on an annual basis when the errors and changes are not significant, and within 30 days of discovery when the errors and changes are significant. A significant error or change, as defined by 10 CFR 50.46, is one which results in a calculated fuel peak cladding temperature (PCT) different by more than 50 °F from the temperature calculated for the limiting transient using the last acceptable model, or a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50 °F.

The following presents a summary of the effects of errors and changes to the Westinghouse ECCS Evaluation Models on the Vogtle Electric Generating Plant (VEGP) Units 1 and 2 loss of coolant accident (LOCA) analyses since the 1999 annual report (Reference 1). This report has been prepared in accordance with the methodology presented in WCAP-13451 (Reference 3). The LBLOCA and SBLOCA analyses, Evaluation Model assessments, and safety evaluation results reported herein will be included in a future VEGP Final Safety Analysis Report (FSAR) update.

LARGE-BREAK LOCA

ECCS Evaluation Model

Since the 1999 annual report (Reference 1), an additional error in the LOCBART computer code has resulted in a 15 °F LBLOCA PCT benefit for both Unit 1 and Unit 2. The cumulative LBLOCA PCT error for both Unit 1 and Unit 2 since the last significant error report for both units (Reference 10) is 15 °F. This is not considered to be significant per 10 CFR 50.46 (a)(3)(i).

The LBLOCA analysis results are based on the Westinghouse BASH large-break ECCS Evaluation Model (Reference 4), as approved by the NRC for VEGP-specific application (References 5 and 6), and the latest acceptable LOCBART model. The limiting size break analysis continues to assume the following information important to the LBLOCA analyses:

- o 17x17 VANTAGE-5 Fuel Assembly
- o Core Power = 1.02 * 3565 MWT
- o Vessel Average Temperature = 571.9 °F
- o Steam Generator Plugging Level = 10%
- o $F_Q = 2.50$
- o $F_{\Delta H} = 1.65$

Attachment
Page 2

For VEGP Units 1 and 2, the limiting size break continues to be the double-ended guillotine rupture of the cold leg piping with a discharge coefficient of $C_D = 0.6$. The LBLOCA LOCBART analysis-of-record calculated PCT value is 1915 °F.

The Analysis-of-Record category continues to include an assessment of - 4 °F for the LOCBART clad creep and burst error.

The containment purge, T_{avg} uncertainty, and transition core penalty items continue to be listed separately. The items are listed separately because these items are not explicitly modeled. The PCT assessment values of the containment purge and T_{avg} penalties remain at 10 and 11 °F, respectively. The cycle-specific transition core penalty may be used in subsequent cycles, depending on core design, so it remains a line item but is reported as having a value of 0 °F.

VEGP cores contain ZIRLO clad IFBA fuel rods with a backfill pressure of 100 psig. The ZIRLO clad IFBA rods result in a penalty of 21 °F PCT as calculated by the latest acceptable LOCBART model.

The use of ZIRLO clad fuel rods results in a penalty of 5 °F PCT as calculated by the latest acceptable LOCBART model.

Prior 10CFR50.46 BASH Large-Break ECCS Evaluation Model Assessments

As reported in the significant error report in Reference 2, four prior model assessments have been combined into a single assessment of - 6 °F. These assessments are: (1) Steam Generator Flow Area Application, (2) Structural Metal Heat Modeling, (3) LUCIFER Error Correction, and (4) Translation of Fluid Conditions from SATAN to LOCTA.

In the significant error report in Reference 10, three model assessments were reported. Their combined assessment is 206 °F. These assessments are: (1) Increased Accumulator Line Resistances, (2) LOCBART Spacer Grid Single-Phase Heat Transfer Error, and (3) LOCBART Zirc-Water Oxidation Error.

Because these two sets of assessments have been previously reported in significant error reports, they have been combined into a single assessment of 200 °F.

Current 10CFR50.46 BASH Large-Break ECCS Evaluation Model Assessments

Since the significant error report in Reference 10, an additional error in the LOCBART computer code resulted in a 15 °F LBLOCA PCT benefit. The model for film boiling used in LOCBART computes the cladding-to-fluid heat transfer coefficient for heat transfer across the vapor film. An error was discovered in LOCBART resulting in an underprediction of the heat transfer coefficient. The correction of the error resulted in a PCT benefit, i.e., reduction in PCT.

Attachment
Page 3

LBLOCA 10CFR50.46 ECCS Evaluation Model Assessment Summary

The absolute sum of the LBLOCA PCT assessments since the last LBLOCA significant error report for both Unit 1 and Unit 2 (Reference 10) is 15 °F. This is not considered to be significant per 10 CFR 50.46 (a)(3)(i).

10 CFR 50.59 Evaluation Assessments

There are three plant modifications pursuant to 10 CFR 50.59 which affect the LBLOCA analysis results. The combined PCT effects from the two evaluations for the permanent radiation shield and for the trisodium phosphate baskets result in only a 1 °F PCT assessment. The third plant modification is the addition of metal mass in containment. An allowance of 10 °F has been made for both units for future additions of metal mass.

Attachment
Page 4

Unit 1 Licensing Basis LBLOCA PCT

Based on the above discussions concerning the VEGP-specific application of the Westinghouse BASH large-break ECCS Evaluation Model, the licensing basis LBLOCA PCT is as follows:

A.	LBLOCA BASH ECCS Model Analysis-of-Record	
	1. LOCBART Analysis Result	1915 °F
	2. LOCBART Clad Creep and Burst Error	- 4 °F
	3. Evaluation for Containment Purging	+ 10 °F
	4. Evaluation for +/- 6 °F Uncertainty Band	+ 11 °F
	5. Evaluation for Transition Cycle Penalty	+ 0 °F
	6. 100 psig Backfill Pressure IFBA with ZIRLO Clad	+ 21 °F
	7. ZIRLO Clad Fuel Rods	+ 5 °F
B.	Prior 10CFR50.46 BASH Large-Break ECCS Model Assessments	
	Combined assessments previously reported as significant in References 2 and 10	+ 200 °F
C.	Current 10CFR50.46 BASH Large-Break ECCS Model Assessments	
	LOCBART Vapor Film Flow Regime Heat Transfer Error	- 15 °F
D.	10 CFR 50.59 Evaluations	
	1. Permanent Radiation Shield/TSP Baskets	+ 1 °F
	2. Addition of Metal Mass in Containment	+ 10 °F
	Licensing Basis LBLOCA PCT	= <u>2154 °F</u>

Conclusion

When the effects of assessments to the BASH ECCS Evaluation Model and of safety evaluations were combined with the VEGP LBLOCA analysis results, it was determined that compliance with the requirements of 10 CFR 50.46 is being maintained for Unit 1.

Attachment
Page 5

Unit 2 Licensing Basis LBLOCA PCT

Based on the above discussions concerning the VEGP-specific application of the Westinghouse BASH large-break ECCS Evaluation Model, the licensing basis LBLOCA PCT is as follows:

A.	LBLOCA BASH ECCS Model Analysis-of-Record	
	1. LOCBART Analysis Result	1915 °F
	2. LOCBART Clad Creep and Burst Error	- 4 °F
	3. Evaluation for Containment Purging	+ 10 °F
	4. Evaluation for +/- 6 °F Uncertainty Band	+ 11 °F
	5. Evaluation for Transition Cycle Penalty	+ 0 °F
	6. 100 psig Backfill Pressure IFBA with ZIRLO Clad	+ 21 °F
	7. ZIRLO Clad Fuel Rods	+ 5 °F
B.	Prior 10CFR50.46 BASH Large-Break ECCS Model Assessments	
	Combined assessments previously reported as significant in References 2 and 10	+ 200 °F
C.	Current 10CFR50.46 BASH Large-Break ECCS Model Assessments	
	LOCBART Vapor Film Flow Regime Heat Transfer Error	- 15 °F
D.	10 CFR 50.59 Evaluations	
	1. Permanent Radiation Shield/TSP Baskets	+ 1 °F
	2. Addition of Metal Mass in Containment	+ 10 °F
	Licensing Basis LBLOCA PCT	= <u>2154 °F</u>

Conclusion

When the effects of assessments to the BASH ECCS Evaluation Model and of safety evaluations were combined with the VEGP LBLOCA analysis results, it was determined that compliance with the requirements of 10 CFR 50.46 is being maintained for Unit 2.

SMALL-BREAK LOCA

ECCS Evaluation Model

Since the 1999 annual report (Reference 1), additional errors in the NOTRUMP computer code have resulted in a SBLOCA PCT penalty of 24 °F for both Unit 1 and Unit 2. The cumulative SBLOCA PCT error for Unit 1 since the last significant error report for Unit 1 (Reference 1) is 24 °F. This error is not considered to be significant per 10 CFR 50.46 (a)(3)(i). The cumulative SBLOCA PCT error for Unit 2 since the last significant error report for Unit 2 (Reference 9) is 73 °F. This error is considered to be significant per 10 CFR 50.46 (a)(3)(i). The current SBLOCA analysis results are based on the earlier Westinghouse NOTRUMP small-break ECCS Evaluation Model (Reference 7), as approved by the NRC for VEGP-specific application (References 5 and 6), and the latest acceptable SBLOCA model. The limiting size break analysis continues to assume the following information important to the SBLOCA analyses:

- o 17x17 VANTAGE-5 Fuel Assembly
- o Core Power = 1.02 * 3565 MWT
- o Vessel Average Temperature = 571.9 °F
- o Steam Generator Plugging Level = 10%
- o $F_Q = 2.58$
- o $F_{\Delta H} = 1.70$

For VEGP Units 1 and 2, the limiting size small-break continues to be a three-inch equivalent diameter break in the cold leg. The SBLOCA analysis-of-record SBLOCA calculated PCT value is 1770 °F.

The Analysis-of-Record category continues to include an assessment of +8 °F for the SBLOCA fuel rod initialization error.

The steam generator lower level tap relocation and T_{avg} uncertainty items continue to be listed separately. The items are listed separately because these items are not explicitly modeled. The PCT assessment values on these items are 15 °F and 4 °F, respectively. A PCT assessment of 30 °F is also listed separately for Burst and Blockage/Time in Life.

The use of ZIRLO clad fuel rods results in a penalty of 3 °F PCT as calculated in the latest acceptable SBLOCA model.

Prior 10CFR50.46 NOTRUMP Small-Break ECCS Evaluation Model Assessments

Five prior model assessments have been combined into a single assessment of -17 °F (Reference 8) since the SBLOCA significant error report submitted in 1994 (Reference 9). These assessments are: (1) Safety Injection (SI) Flow into the Broken RCS Loop/Improved Steam Condensation Model, (2) Drift Flux Flow Regime Error, (3) LUCIFER Error

Attachment
Page 7

Corrections, (4) Boiling Heat Transfer Correlation Error, and (5) Steam Line Isolation Logic Error. This is applicable to both Unit 1 and Unit 2.

In the last significant error report for Unit 1 (Reference 1), two errors were reported: NOTRUMP Specific Enthalpy Error (+ 20 °F) and Burst and Blockage/Time in Life SPIKE Correlation Revision (+ 31 °F) totaling + 51 °F.

For Unit 1, the combined assessments previously reported in significant error reports is + 34 °F.

For Unit 2, the combined assessments previously reported in significant error reports is – 17 °F.

Current 10CFR50.46 NOTRUMP Small-Break ECCS Evaluation Model Assessments

For Unit 2, the NOTRUMP specific enthalpy error (+ 20 °F) and Burst and Blockage/Time in Life SPIKE Correlation Revision (+ 29 °F) continue to be listed separately in accordance with WCAP-13451 (Reference 3) because they have not been combined with prior model assessments.

Subsequent to the last SBLOCA significant error report and 1999 annual report (Reference 1), new errors have been identified for both Unit 1 and Unit 2. Errors were identified in how NOTRUMP deals with the stack mixture level transition across a mode boundary in a stack of fluid nodes. In addition, it was discovered that NOTRUMP was not properly updating metal node temperatures as a result of the implementation of the nodal region depletion logic which can be incurred when a fluid node empties or fills. This error results in a + 13 °F penalty. As a result of these errors, an additional Burst and Blockage/Time in Life penalty of + 11 °F is being applied to both Unit 1 and Unit 2.

For Unit 1, the combined current assessment is + 24 °F.

For Unit 2, the combined current assessment is + 73 °F.

SBLOCA 10CFR50.46 ECCS Model Assessment Summary

For Unit 1, the absolute sum of SBLOCA PCT assessments since the last Unit 1 SBLOCA significant error report (Reference 1) is 24 °F. This is not considered to be significant per 10 CFR 50.46 (a)(3)(i).

For Unit 2, the absolute sum of SBLOCA PCT assessments since the last Unit 2 SBLOCA significant error report (Reference 9) is 73 °F. This is considered to be significant per 10 CFR 50.46 (a)(3)(i).

10 CFR 50.59 Evaluation Assessments

There are two plant modifications pursuant to 10 CFR 50.59 which affect the SBLOCA analysis results for VEGP Unit 1. These are: (1) annular pellet blankets, and (2) loose part in

Attachment
Page 8

the RCS (fuel handling tool part). The PCT penalty on annular pellet blankets is the only one of the two which is applicable to VEGP Unit 2.

Unit 1 Licensing Basis SBLOCA PCT

Based on the above discussions concerning the VEGP-specific application of the Westinghouse NOTRUMP small-break ECCS Evaluation Model, the licensing basis SBLOCA PCT is as follows:

A. SBLOCA NOTRUMP ECCS Model Analysis-of-Record

1. SBLOCTA Analysis Result	1770 °F
2. SBLOCTA Fuel Rod Initialization Error	+ 8 °F
3. Evaluation for Steam Generator Lower Level Tap Relocation	+ 15 °F
4. Evaluation for +/- 6 °F Uncertainty Band	+ 4 °F
5. Burst and Blockage/Time in Life	+ 30 °F
6. ZIRLO Clad Fuel Rods	+ 3 °F

B. Prior 10CFR50.46 NOTRUMP Small-Break ECCS Model Assessments

Combined assessments previously reported as significant in References 1, 8 and 9	+ 34 °F
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C. Current 10CFR50.46 NOTRUMP Small-Break ECCS Model Assessments

1. NOTRUMP Mixture Level Tracking/Region Depletion Errors	+ 13 °F
2. Additional Burst and Blockage/Time in Life Penalty Due to C.1	+ 11 °F

D. 10 CFR 50.59 Evaluations

1. Annular Pellet Blankets	+ 10 °F
2. Loose Part	+ 2 °F

Licensing Basis SBLOCA PCT = 1900 °F

Conclusion

When the effects of assessments to the NOTRUMP ECCS Evaluation Model and the effects of safety evaluations were combined with the VEGP SBLOCA analysis results, it was determined that compliance with the requirements of 10 CFR 50.46 is being maintained for Unit 1.

Attachment
Page 9

Unit 2 Licensing Basis SBLOCA PCT

Based on the above discussions concerning the VEGP-specific application of the Westinghouse NOTRUMP small-break ECCS Evaluation Model, the licensing basis SBLOCA PCT is as follows:

A. SBLOCA NOTRUMP ECCS Model Analysis-of-Record

1. SBLOCA Analysis Result	1770 °F
2. SBLOCA Fuel Rod Initialization Error	+ 8 °F
3. Evaluation for Steam Generator Lower Level Tap Relocation	+ 15 °F
4. Evaluation for +/- 6 °F Uncertainty Band	+ 4 °F
5. Burst and Blockage/Time in Life	+ 30 °F
6. ZIRLO Clad Fuel Rods	+ 3 °F

B. Prior 10CFR50.46 NOTRUMP Small-Break ECCS Model Assessments

Combined assessments previously reported as significant in References 8 and 9	- 17 °F
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C. Current 10CFR50.46 NOTRUMP Small-Break ECCS Model Assessments

1. NOTRUMP Specific Enthalpy Error	+ 20 °F
2. Burst and Blockage/Time in Life SPIKE Correlation Revision	+ 29 °F
3. NOTRUMP Mixture Level Tracking/Region Depletion Errors	+ 13 °F
4. Additional Burst and Blockage/Time in Life Penalty Due to C.3	+ 11 °F

D. 10 CFR 50.59 Evaluations

Annular Pellet Blankets	+ 10 °F
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Licensing Basis SBLOCA PCT = 1896 °F

Conclusion

When the effects of assessments to the NOTRUMP ECCS Evaluation Model and the effects of safety evaluations were combined with the VEGP SBLOCA analysis results, it was determined that compliance with the requirements of 10 CFR 50.46 is being maintained for Unit 2.

REFERENCES

1. LCV-1436, "Vogtle Electric Generating Plant, 10 CFR 50.46 ECCS Evaluation Models Significant Error Report and 1999 Annual Report," letter from J. B. Beasley, Jr. (SNC) to USNRC, dated April 4, 2000.
2. LCV-0998, "Vogtle Electric Generating Plant, 10 CFR 50.46 ECCS Evaluation Models 1996 Annual Report and Significant Error Report," letter from C. K. McCoy (SNC) to USNRC, dated March 31, 1997.
3. WCAP-13451, "Westinghouse Methodology for Implementation of 10 CFR 50.46 Reporting," dated October 1992.
4. "The 1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code," WCAP-10266-P-A, Rev. 2, (Proprietary), March 1987.
5. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment Nos. 43 and 44 to Facility Operating License NPF-68 and Amendment Nos. 23 and 24 to Facility Operating License NPF-81, attachment to letter from Hood (USNRC) to Hairston (GPC), dated September 19, 1991.
6. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 60 to Facility Operating License NPF-68 and Amendment No. 39 to Facility Operating License NPF-81, attachment to letter from Hood (USNRC) to Hairston (GPC), dated March 22, 1993.
7. "Westinghouse Small-Break ECCS Evaluation Model Using the NOTRUMP Code," WCAP-10054-P-A (Proprietary) and WCAP-10081-A (Non-Proprietary), August 1985.
8. LCV-0579, "Vogtle Electric Generating Plant, 10 CFR 50.46 ECCS Evaluation Models 1994 Annual Report," letter from C. K. McCoy (GPC) to USNRC, dated March 17, 1995.
9. LCV-0327-B, "Vogtle Electric Generating Plant, 10 CFR 50.46 ECCS Evaluation Models Significant Change Report," letter from C. K. McCoy (GPC) to USNRC, dated December 8, 1994.
10. LCV-1388, "Vogtle Electric Generating Plant, 10 CFR 50.46 ECCS Evaluation Models Significant Error Report," letter from J. B. Beasley, Jr. (SNC) to USNRC, dated October 19, 1999.