FPL

March 26, 2003

L-2003-078
10 CFR 50.46

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Re: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
Acceptance Criteria for Emergency Core Cooling
Systems for Light Water Nuclear Power Reactors
10 CFR 50.46 Annual Report

Pursuant to 10 CFR 50.46(a)(3)(ii), the nature of any change to or error discovered in the evaluation models for emergency core cooling systems (ECCS), or in the application of such models, that affect the fuel cladding temperature calculations for St. Lucie Units 1 and 2 is reported in the attachment to this letter. The estimated effect from any such change or error on the limiting ECCS analysis for each unit is also addressed. The data interval for the report is from January 1, 2002 through December 31, 2002.

Please contact us should you have any questions regarding this submittal.

Very truly yours,

Donald E. Jernigan
Vice President
St. Lucie Plant

DEJ/spt

Attachment

A001

St. Lucie Units 1 and 2
10 CFR 50.46 Annual Report

Emergency core cooling system (ECCS) analyses for St. Lucie Unit 1 and St. Lucie Unit 2 are performed by Framatome ANP, Inc. (FRA-ANP), formerly Siemens Power Corporation, and Westinghouse Electric Company (W), respectively. The following information pertaining to the evaluation models for small break loss of coolant accidents (SBLOCA) and large break loss of coolant accidents (LBLOCA), and the application of such models to each St. Lucie unit, is provided pursuant to 10 CFR 50.46(a)(3)(ii). A summary of calculated peak cladding temperature (PCT) changes is provided in Table 1. The data interval for this report is from January 1, 2002 through December 31, 2002.

1.0   ST LUCIE UNIT 1

1.1   One error/issue was identified related to the SBLOCA ECCS performance analysis. This error/issue, not previously reported in Reference 3.1, is described below. Table 1 summarizes the estimated impact of this error/issue on the St. Lucie Unit 1 SBLOCA PCT. The limiting SBLOCA PCT with the estimated effect of the change is $1766^{0}F$.

Error in TOODEE2 Clad Thermal Expansion

TOODEE2 uses a correlation for determining clad thermal expansion with 3 ranges: Alpha phase, Beta phase, and a transition region between Alpha and Beta phases. The formulation for the Beta phase is programmed with an incorrect constant coefficient of 2.9E-6 instead of 3.2E-6. This introduces a discontinuity between the transition region and the Beta phase region, and causes all clad thermal expansion calculations at temperatures above $1773^{0}F$ to be underpredicted.

The PCT impact of correcting this error on the St. Lucie Unit 1 SBLOCA analysis is estimated to be $-1^{0}F$.

1.2   Several errors/issues were identified impacting the LBLOCA PCT. These errors, not previously reported in Reference 3.1, are described below. Table 1 summarizes the estimated impact of these errors/issues on the St. Lucie Unit 1 LBLOCA PCT. The limiting LBLOCA PCT with the estimated effect of the changes is $2033^{0}F$.

Error in TOODEE2 Clad Thermal Expansion

The description of this error is provided in Section 1.1 above. The PCT impact of this error correction on the St. Lucie Unit 1 LBLOCA analysis is estimated to be $-1^{0}F$.

RFPAC V&V Findings from Code Documentation Upgrade Program (CDUP)

FRA-ANP committed (in response to the NRC 1997 inspection) to perform additional V&V and to update or create user's manuals, theory manuals, and programmer's manuals for Framatome ANP's primary codes. One of the codes was the RFPAC code. The RFPAC code performs the refill and reflood calculations for the LBLOCA event in the SEM/PWR-98

evaluation model. A number of minor errors were identified and corrected as a result of the additional V&V activities.

The PCT impact of correcting these errors on the St. Lucie Unit 1 LBLOCA analysis is estimated to be +23^{0}F.

Incorrect Pump Junction Area Used in RELAP4 LBLOCA

For the SEM/PWR-98 evaluation model, the junction area that should be used for the recirculation pump junctions is the connecting pipe area. It was determined that the current analysis supporting St. Lucie Unit 1 used a smaller area for the pipe junctions. The analysis was corrected by using the full pipe areas. The LBLOCA guideline is being changed to require the use of the full connecting pipe area.

The PCT impact of correcting this error on the St. Lucie Unit 1 LBLOCA analysis is estimated to be +1^{0}F.

2.0   ST. LUCIE UNIT 2

2.1   No errors were found in W's SBLOCA analysis impacting the PCT previously reported in Reference 3.1. The limiting PCT for SBLOCA remains at 2125^{0}F.

2.2   St. Lucie Unit 2 LBLOCA analysis was performed by W using the 1985 evaluation model (EM). There were two errors, not previously reported in Reference 3.1, found in the LBLOCA ECCS performance analysis as described below. Both of these errors were in STRIKIN-II code models that affect the results of LBLOCA analyses using the 1985 EM. Table 1 summarizes the estimated impact of these errors on the St. Lucie Unit 2 LBLOCA PCT. The limiting LBLOCA PCT with the estimated effect of the changes is 2151^{0}F.

Time Step Algorithm

The algorithms used in the automatic time step selection method for STRIKIN-II are designed to automatically adjust the time step length such that STRIKIN-II calculates an appropriate solution for the fuel, cladding and coolant temperature and the heat flux to the coolant. In particular, they are designed to ensure that the Courant number is less than or equal to 0.5. This ensures that the solution conserves energy. An error in the implementation of the algorithm that bypassed this test and allowed the Courant number to exceed this limit was discovered and corrected. An error test was also added that would stop the code with an error message if the time step specified by the user would allow the Courant number to exceed 0.99.

Coffman Plastic Strain Model for Cladding

A problem with the implementation of the Coffman plastic strain model for fuel cladding in STRIKIN-II produced discontinuous plastic strain behavior. This model is only used when the heating rate and the cladding temperature are within bounds set for application of the model. The calculated plastic strain is continuous except when the cladding conditions move outside these bounds and later return within the bounds at a higher cladding temperature. In order to address the resulting discontinuity, a ramp function is used to introduce the strain over several time steps. The problem occurred when the heating rate fell below the lower bound for the model within the time duration of the ramp. This was corrected by terminating the ramp when the conditions for the use of the model described above are not satisfied.

Effect of Correcting STRIKIN-II Errors

The total effect on PCT due to the correction of STRIKIN-II errors described above is estimated to be less than $1^{0}F$ for the 1985 EM that is used for the LBLOCA analysis of St. Lucie Unit 2.

3.0 REFERENCES

3.1 FPL Letter L-2002-062, D. E. Jernigan to USNRC (DCD), St. Lucie Units 1 and 2, Docket Nos. 50-335 and 50-389, Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors: 10 CFR 50.46 Annual Report, March 27, 2002.

Table 1: **2002 St. Lucie Units 1 and 2 SBLOCA and LBLOCA PCT Summary**

Unit 1 SBLOCA Summary	PCT
Year 2001 10 CFR 50.46 Annual Report (L-2002-062)	1767^0F
Change due to Error in TOODEE2 Clad Thermal Expansion	-1^0F
Year 2002 10 CFR 50.46 Annual Report	1766^0F

Unit 1 LBLOCA Summary	PCT
Year 2001 10 CFR 50.46 Annual Report (L-2002-062)	2010^0F
Change due to Error in TOODEE2 Clad Thermal Expansion	-1^0F
Change due to RFPAC V&V Findings from CDUP	$+23^0$F
Change due to Incorrect Pump Junction Area Used in RELAP4	$+1^0$F
Year 2002 10 CFR 50.46 Annual Report	2033^0F

Unit 2 SBLOCA Summary	PCT
Year 2001 10 CFR 50.46 Annual Report (L-2002-062)	2125^0F
Change during Year 2002	0^0F
Year 2002 10 CFR 50.46 Annual Report	2125^0F

Unit 2 LBLOCA Summary	PCT
Year 2001 10 CFR 50.46 Annual Report (L-2002-062)	2150^0F
Change due to STRIKIN-II Errors	$<1^0$F
Year 2002 10 CFR 50.46 Annual Report	2151^0F