



March 6, 2000

L-2000-58  
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 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 through December 31, 1999.

Should there be any questions, please contact us.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Rajiv S. Kundalkar', is written over the typed name.

Rajiv S. Kundalkar  
Vice President  
St. Lucie Plant

RSK/GRM

Attachment

cc: Regional Administrator, Region II, USNRC  
Senior Resident Inspector, USNRC, St. Lucie Plant

Emergency core cooling system (ECCS) analyses for St. Lucie Unit 1 and St. Lucie Unit 2 are performed by Siemens Power Corporation (SPC) and Asea Brown Boveri-Combustion Engineering (ABB-CE), 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 through December 31, 1999.

## **1.0 ST. LUCIE UNIT 1**

1.1 Several errors/issues were identified impacting the SBLOCA PCT. The 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 SBLOCA PCT. The limiting PCT with the estimated effect of the changes is 1767°F.

### Corrosion Model Error

Two errors/deficiencies were discovered in the cladding corrosion calculation in RODEX2 used for LOCA analyses. One error was in the MATPRO coding and the other in the corrosion enhancement factor. For the corrosion enhancement factor, the approved value of 1.82 was not incorporated into the version of RODEX2 used in the safety analyses. The impact of these errors on the limiting PCT is estimated to be +2°F

### Error in Flow Blockage Model

An error was identified in the flow diversion model relating to fuel rod swelling used for SBLOCA and LBLOCA calculations. A 1/cos factor was dropped from a term in the derivation of the flow diversion model which could result in an under prediction of the blockage factor for SBLOCA and LBLOCA analyses. This deficiency required modification to the TOODEE2 coding. The impact of the deficiency on the St. Lucie Unit 1 SBLOCA analysis is 0°F.

### Change in TOODEE2 - Calculation of QMAX

A change was made to the TOODEE2 code which is part of the LBLOCA evaluation model. Though the code TOODEE2 is also used in the SBLOCA evaluation model, the change is in a portion of the code not used in the SBLOCA analysis. The impact of this change on the limiting PCT is 0°F.

1.2 Several errors/issues were identified impacting the LBLOCA PCT. The errors not previously reported in Reference 3.2 are described below. Table 1 summarizes the estimated impact of these errors/issues on the St. Lucie Unit 1 LBLOCA PCT. The limiting PCT with the estimated effect of the changes is 1929°F.

### SISPUNCH/ujun98 Code Error

An error was discovered in the SISPUNCH code version ujun98, which can cause the accumulator flow rates written by SISPUNCH in the data transfer file to be incorrect. Under certain conditions, the RELAP4 calculated accumulator flow rates placed in the data transfer file may extend beyond the time when the accumulator flows are shut off in the RELAP4 calculation. This error did not exist in the St. Lucie Unit 1 calculation and the impact of the error on the limiting PCT is 0°F.

### Error in Flow Blockage Model

An error was identified in the flow diversion model relating to fuel rod swelling used for SBLOCA and LBLOCA calculations. A 1/cos factor was dropped from a term in the derivation of the flow diversion model which could result in an under prediction of the blockage factor for SBLOCA and LBLOCA analyses. This deficiency required modification to the TOODEE2 coding. The impact of the deficiency on the St. Lucie Unit 1 LBLOCA analysis is 0°F.

### Change in TOODEE2 - Calculation of QMAX

A change was made to the TOODEE2 code which is part of the LBLOCA evaluation model. The change is in the calculation of the variable QMAX, above 10.333 ft elevation, which is used in the calculation of the heat transfer coefficients during the LBLOCA reflood period. In the original implementation, an approximation was made in solving the equation defining QMAX. The code has been modified to reflect an exact solution to the equation defining QMAX. The impact of this change on the limiting PCT is estimated to be 0°F.

### Change in Gadolinia Modeling

The modeling of gadolinia-bearing fuel rods was modified in the following manner:

- a). The pin-to-pin power distribution is taken from the 5x5 fuel rod array surrounding the highest power gadolinia-bearing rod at the exposure where the peak gadolinia-bearing rod to uranium dioxide (UO<sub>2</sub>) rod power ratio occurs. Previously, the pin power distribution was taken at end of cycle (EOC) conditions since this is conservative for UO<sub>2</sub> rods.
- b). The power of the eight fuel rods surrounding the gadolinia-bearing rod is calculated from their average power with the highest of the eight rods assumed to be at the Technical Specification power level. Previously all eight surrounding rods were assumed at the Technical Specification limit power level.
- c). The maximum decay heat is used in the TOODEE2 heatup calculation. The maximum product of the power ratio (gadolinia-bearing rod to UO<sub>2</sub> rod) and the gamma-smearing factor over the cycle is used to determine an effective gamma-smearing factor. Previously, the maximum gamma-smearing factor and the maximum power ratio were used rather than the maximum of their product.

- d) A middle of cycle (MOC) axial shape is used in the power history calculations for the purpose of finding the maximum stored energy. The previous calculations changed the spiked power shape from beginning of cycle (BOC) to MOC and then to EOC as the exposure increased. The change simplifies the power history calculation allowing it to be automated and has a negligible impact on the time of maximum stored energy.

The impact of this change on the limiting PCT is estimated to be 0°F since for the current analyses the gadolinia-bearing rod is not the limiting fuel rod.

## **2.0 ST. LUCIE UNIT 2**

No errors were found in ABB/CE's SBLOCA analysis for this reporting period. The peak cladding temperature for the analysis of record remains at 1915°F.

No errors were found in ABB/CE's LBLOCA analysis for this reporting period. The peak cladding temperature for the analysis of record remains at 2171°F.

## **3.0 REFERENCES**

- 3.1 FPL Letter L-99-112, J. A. Stall to USNRC (DCD), Re: St. Lucie Unit 1, Docket 50-335, SBLOCA Evaluation Model, 30-Day 10 CFR 50.46 Report; May 20, 1999.
- 3.2 FPL Letter L-99-236, J. A. Stall to USNRC (DCD), Re: St. Lucie Unit 1, Docket 50-335, LBLOCA Evaluation Model, 30-Day 10 CFR 50.46 Report; October 29, 1999.

**Table 1**  
**1999 St. Lucie Units 1 and 2 SBLOCA and LBLOCA PCT Summary**

Unit 1 SBLOCA Summary	PCT
1998 10 CFR 50.46 Annual Report	1953 °F
30-Day 10 CFR 50.46 Report (L-99-112) (New Evaluation Model PCT)	1765 °F
Change from Corrosion Model	+ 2 °F
Change from Error in Flow Blockage Model	0 °F
Change from Change in TOODEE2 - Calculation of QMAX	0 °F
1999 10 CFR 50.46 Annual Report	1767 °F

Unit 1 LBLOCA Summary	PCT
1998 10 CFR 50.46 Annual Report	2058 °F
30-Day 10 CFR 50.46 Report (L-99-236) (New Evaluation Model PCT)	1929 °F
Change from SISPUNCH/ujun98 Code Error	0 °F
Change from Error in Flow Blockage Model	0 °F
Change from Change in TOODEE2 - Calculation of QMAX	0 °F
Change from Change in Gadolinia Modeling	0 °F
1999 10 CFR 50.46 Annual Report	1929 °F

Unit 2 SBLOCA Summary	PCT
1998 10 CFR 50.46 Annual Report	1915 °F
Changes during 1999	0 °F
1999 10 CFR 50.46 Annual Report	1915 °F

Unit 2 LBLOCA Summary	PCT
1998 10 CFR 50.46 Annual Report	2171 °F
Changes during 1999	0 °F
1999 10 CFR 50.46 Annual Report	2171 °F