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November 19, 2001

U. S. Nuclear Regulatory Commission  
ATTENTION: L. N. Olshan, NRC Senior Project Manager, ONRR  
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Subject: Duke Energy Corporation  
Oconee Nuclear Station, Units 1, 2, and 3  
Docket Numbers 50-269, 50-270, and 50-287

Report Pursuant to 10 CFR 50.46, Error Related to  
Application of the SBLOCA Evaluation Model

References: 1) Letter, M. S. Tuckman (DEC) to USNRC, "Report  
Pursuant to 10 CFR50.46, Error in LOCA Analysis",  
July 16, 2001.  
2) Letter, W. R. McCollum, Jr. (DEC) to USNRC,  
"Licensee Event Report 269/2001-001, Revision 0",  
February 16, 2001.

10 CFR 50.46 (a) (3) (ii) requires the reporting of changes to or errors in ECCS evaluation models (EM) or in the application of such models that affect the temperature calculation. On October 29, 2001 Duke Energy Corporation received notification from Framatome ANP indicating a cumulative change in the limiting case for the full power small break LOCA (SBLOCA) analysis in excess of 50°F.

The original SBLOCA break spectrum was analyzed in October of 1994 and revised in February of 1998. The maximum peak cladding temperature (PCT) of 1369°F was determined for a 0.15 ft<sup>2</sup> cold leg pump discharge break (Reference 1). Framatome ANP recently updated the LOCA summary report to include additional SBLOCA evaluations for Oconee. An independent review of this summary report revealed that the 1994 and 1998 analyses were completed with a non-conservative initial core flood tank (CFT) level. Upon discovery of this error, Framatome reanalyzed the limiting SBLOCA case resulting in an increase in PCT by 43°F. This ΔPCT was determined using the void-dependent cross-flow model that is

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currently under review by the NRC. Therefore, this change in PCT is viewed as an estimate since it is not determined using the currently approved EM.

Three minor PCT reductions had been previously identified that were not taken into account in the SBLOCA PCT reported in the LOCA summary report. The sum of these three PCT changes is a reduction in PCT of 44°F. The details of each of these PCT reductions are presented in the attached Table 1. The PCT rack-up for the Oconee full power SBLOCA analysis is presented in the attached Table 2. The new PCT for the limiting SBLOCA event is 1368°F based on a PCT rack-up. Although the revised PCT decreased by 1°F, the sum of the absolute values of the PCT changes is greater than 50°F and therefore is considered to be a significant error/change per the definition in 10 CFR 50.46.

These errors also impact the part power SLOCA analysis (1 high pressure injection pump case at 75%FP), however the power level under these conditions is presently restricted to 50%FP based on the CFT line break case. The analysis performed for the 50%FP conditions correctly addressed the above mentioned errors. Therefore, these errors do not impact the calculated PCTs for the part power SBLOCA analysis at 50%FP.

10 CFR 50.46 (a)(3)(ii) also requires a proposed schedule for reanalysis for changes that are determined to be significant. Other than using the void-dependent cross flow model, used to evaluate the initial CFT water level error, all other evaluations were determined through reanalysis. The void-dependent cross-flow model is currently under review by the NRC. Therefore it is proposed that the reanalysis to address this error, be performed following the completion of this model review.

Please address any comments or questions regarding this matter to J. S. Warren at (704) 382-4986.

Very truly yours,



M. S. Tuckman

Attachment

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xc:

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U. S. Nuclear Regulatory Commission  
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Mr. M. A. Scott  
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Table 1  
Errors / Evaluation Model Changes with PCT Impact

Maximum vs. Minimum CFT Water Level

Recent SBLOCA sensitivities revealed that the maximum CFT water level assumption would result in higher PCTs than a case assuming the minimum CFT water if the PCT occurs while the CFTs are discharging. The PCT for the limiting Oconee SBLOCA case occurs while the CFTs are discharging. Two Oconee SBLOCA cases were analyzed using the void-dependent cross-flow model which is currently under NRC review. The PCT for the case using the minimum CFT water volume (975 ft<sup>3</sup>/tank) is 43°F greater than when the maximum CFT water volume is used (1085 ft<sup>3</sup>/tank). This PCT increase is considered an estimate since the void-dependent cross-flow model is not yet approved by the NRC.

B&W Slug Drag Model Inside the SG Tubes

The original SBLOCA spectrum for Oconee was performed without the B&W slug drag model inside the SG tubes. This model was used in the code benchmark calculations and the EM demonstration cases and should have been used in the Oconee SBLOCA analyses. When the error was discovered, the worst SBLOCA case was reanalyzed with drag model corrected and resulted in a decrease in PCT of 14°F

Water Properties File Changes and Recompiled Code Version

Framatome ANP was made aware that INEL made several water property file changes (one correction and several model improvements) in the file used by the RELAP5/MOD-B&W computer code. These changes were incorporated in a new version of RELAP5 that was compiled on a new HP operating system. The limiting Oconee SBLOCA was reanalyzed with the new water property file changes and new operating system and the PCT decreased by 25°F.

PSC 1-99, Reactor Coolant Pump Type and Two-Phase Degradation

Preliminary Safety Concern (PSC) 1-99 dealt with RCP type and two-phase degradation model for large break LOCA (LBLOCA) analyses. LBLOCA sensitivity studies were used to establish the limiting RCP type (Bingham versus Westinghouse for the Oconee units) and the two-phase degradation modeling (head difference curves and two-phase multiplier) for LOCA applications. This limiting combination of RCP parameters from the LBLOCA (Westinghouse pump, RELAP5 two-phase difference curves with M3-modified head multipliers) was applied to the small break LOCA cases analyzed with loss of offsite power (LOOP). Reanalysis of the limiting SBLOCA case resulted in a minimal decrease in PCT (5°F), because the SBLOCA with LOOP is not a flow-dominated transient. These revised RCP parameters are consistent with the limiting assumptions used for the SBLOCA analyses with delayed RCP trip as documented in the PSC 2-00 analyses.

Table 2  
 Oconee Full Power Small Break LOCA  
 Peak Cladding Temperature Summary

SBLOCA	PCT (°F)	Comments
Evaluation model : RELAP5/MOD2-B&W		
Analysis of record PCT	1369	Full Power 0.15 ft <sup>2</sup> break
Prior errors (ΔPCT) 1. None	0	
Prior evaluation model changes (ΔPCT) 1. None	0	
Errors (ΔPCT) 1. Change from min to max CFT level 2. SG primary tube region drag model input error 3. Limiting RCP type and two-phase degradation model (PSC 1-99) 4. RELAP5 water property and Unix operating system	43 -14 -5 -25	PCT impact estimated PCT determined by analysis PCT determined by analysis PCT determined by analysis
Evaluation model changes (ΔPCT) 1. None	0	
Absolute value of errors/changes for this report (ΔPCT)	87	
Net change in PCT for this report	-1	
Final PCT	1368	