CP&L

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United States Nuclear Regulatory Commission
Attn: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
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REPORT OF SIGNIFICANT CHANGE TO
AN ACCEPTABLE LOSS-OF-COOLANT ACCIDENT EVALUATION
MODEL APPLICATION FOR THE EMERGENCY CORE COOLING SYSTEM

Ladies and Gentlemen:

The purpose of this letter is to transmit the Carolina Power & Light (CP&L) Company report of a significant change to an acceptable Loss-of-Coolant Accident (LOCA) evaluation model (EM) application for the Emergency Core Cooling System (ECCS) at the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

This report describes the retraction of a previously reported error in the Siemens Power Corporation (SPC) EXEM Pressurized Water Reactor (PWR) Large Break LOCA (LBLOCA) EM. The estimate of the effect of this change in the LBLOCA EM on HBRSEP, Unit No. 2 Peak Clad Temperature (PCT) is summarized in Attachment I.

The latest PCT estimates for the LBLOCA, Small Break LOCA, and transfer of the ECCS from the Injection Mode to the Recirculation Mode are included in Attachment II.

If you have any questions concerning this matter, please contact me or Mr. H. K. Chernoff.

Sincerely,

B. L. Fletcher III
Manager - Regulatory Affairs

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Attachments

I. Report of Change to an Acceptable Loss-of-Coolant Accident Evaluation Model for the Emergency Core Cooling System
II. Latest Peak Clad Temperature Estimates

c: L. A. Reyes, USNRC, Region II
R. Subbaratnam, NRC, NRR
NRC Resident Inspector, HBRSEP

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

REPORT OF A CHANGE TO AN
ACCEPTABLE LOSS-OF-COOLANT ACCIDENT
EVALUATION MODEL FOR THE EMERGENCY CORE COOLING SYSTEM

This report provides an estimate of the effect of a significant change in the application of the Siemens Power Corporation (SPC) EXEM Pressurized Water Reactor (PWR) Large Break Loss-of-Coolant Accident (LBLOCA) Evaluation Model (EM)[1] for the Emergency Core Cooling System (ECCS) at the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

Change in Application of Large Break Loss-Of-Coolant Accident Evaluation Model

By letter dated July 20, 2000, Carolina Power & Light (CP&L) Company reported an error in the application of SPC's EM regarding simulations of the ECCS injection from the accumulators and the Low Head Safety Injection (LHSI). The RELAP4 code is used to calculate accumulator flow during blowdown, but because of code limitations, the code assumes that the accumulator flow is terminated just prior to the flow of the nitrogen gas into the lines. Recognizing that flow will not stop at this time, the EM extends the accumulator flow to inject the water remaining in the accumulator, accumulator lines, and part of the cold legs into the reactor vessel. In the HBRSEP, Unit No. 2 analysis, the LHSI injects into the accumulator lines, and the model calculates LHSI flow into the accumulator line based on the backpressure at the injection points. The flow of LHSI is calculated to start at the same time the accumulator flow is stopped in the RELAP4 blowdown model. The methodology was reported as non-conservative by not modeling a delay in LHSI while the accumulators and lines finish emptying and the calculated LHSI flow is transported from the accumulator line injection point to the cold legs. The estimated effect of adding a delay in LHSI on Peak Cladding Temperature reported on July 20, 2000, was +102°F.

Since the July 20, 2000, report, SPC has further examined the injection of LHSI in their 10 CFR 50, Appendix K EMs. SPC has concluded that the injection of LHSI in the Appendix K EMs is a reasonable representation of expected LHSI delivery behavior and that the overall conservatism of the EM is large compared to any uncertainty in the LHSI flow. Based upon this position, SPC has retracted their previous classification of this as an error in their model. The basis for this retraction was provided to the NRC by SPC letter dated November 17, 2000. Although the discussion in the Siemens letter is focused on LHSI delivery in the SPC SEM/PWR-98 LBLOCA EM[2], the discussion is also applicable to the HBRSEP, Unit No 2 analysis of record EM (EXEM/PWR).

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[1] EXEM PWR LBLOCA Evaluation Model as accepted in NRC Letter, D. M. Crutchfield (NRC) to G. N. Ward, "Safety Evaluation of Exxon Nuclear Corporation's Large Break ECCS Evaluation Model EXEM/PWR and Acceptance for Referencing of Related Licensing Topical Reports," July 8, 1986.

[2] EMF-2087 (P)(A), "SEM/PWR-98: ECCS Evaluation Model for PWR LBLOCA Applications."

In the SPC letter to the NRC, SPC concluded that the original ECCS injection modeling is a "reasonable representation" of expected behavior. That conclusion was based upon comparison of the Appendix K model's predicted ECCS flow to the ECCS injection flow predicted by the unapproved SPC "Realistic LBLOCA Model" currently under development. SPC acknowledged that the current Appendix K LBLOCA EM predicts ECCS flow "a few percent" higher than the Realistic LBLOCA Model after about 25 seconds into the event.

The SPC justification for retraction of the error in their letter to the NRC was based upon identification of specific, quantified conservatism in the SPC Appendix K LBLOCA EM that would compensate for the uncertainty and potential non-conservatism in the ECCS injection model. SPC determined that their Appendix K LBLOCA EM provides a conservatively delayed prediction of the time of "end of bypass" due to its inherent limitations associated with the homogeneous equilibrium model and one-dimensional downcomer model. This conservatism in the timing of "end of bypass" was quantified by using SPC's "Realistic LBLOCA model" (with its non-homogeneous equilibrium model) to predict a more realistic time for "end of bypass." SPC demonstrated that "about 13,600 lbm [pounds mass] of accumulator water" is discarded in the SPC Appendix K LBLOCA EM by its homogeneous equilibrium code and thus is conservatively predicting a delayed time for "end of bypass" (as demonstrated by comparison to the time of "end of bypass" predicted by their Realistic LBLOCA model). Siemens has concluded that this conservatism offsets any potential non-conservatism associated with their ECCS injection flow modeling.

During CP&L review of the SPC error retraction position, CP&L independently assessed the potential magnitude of the non-conservatism associated with the ECCS injection modeling. This assessment used conservative, simplifying assumptions and judgments and did not rely upon a comparison of the Appendix K ECCS injection flow to that predicted by the Realistic LBLOCA model. This conservative assessment confirmed that the 13,600 lbs of identified conservatism provides ample margin to compensate for any postulated uncertainty in the ECCS injection portion of the model.

The estimated effect of this change in application on the analysis of record PCT is -102°F. Since the last reported PCT value for the LBLOCA is 2143°F, the net effect on PCT is a new reported PCT value for the analysis of record of 2041°F.

Analyses for the current operating cycle using the revised SPC SEM/PWR-98 LBLOCA EM, with the above change in application, indicate that the calculated limiting PCT from SEM/PWR-98 is 1979°F.

CP&L received Amendment No. 188 to the Facility Operating License, by letter dated August 3, 2000, revising Technical Specifications Section 5.6.5, "Core Operating Limits Report." This amendment permits HBRSEP, Unit No. 2 to implement a new analysis of record using the SPC SEM/PWR-98 LBLOCA EM. In accordance with the NRC statement in the letter issuing Amendment No. 188, the SEM/PWR-98 LBLOCA methodology will be

implemented in the HBRSEP, Unit No. 2 LBLOCA analysis of record prior to unit restart after Refueling Outage No. 20.

The ECCS PCT during the transfer to recirculation has been reanalyzed by SPC and the analysis is currently being reviewed by CP&L. Upon acceptance by CP&L, the results will significantly reduce the reported PCT associated with switchover operation, and the results will be reported to the NRC in accordance with 10 CFR 50.46(a)(3)(ii).

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
LATEST PEAK CLAD TEMPERATURE ESTIMATES

The current Peak Clad Temperatures (PCTs) associated with Loss-of-Coolant Accidents (LOCAs) are listed below. The estimates include the cumulative effects of significant and non-significant error corrections and evaluation model changes to date.

The current PCTs associated with Loss-of-Coolant Accident (LOCA) Emergency Core Cooling System (ECCS) Evaluation Models are listed below.

Event	PCT (°F)
Large Break (LB) LOCA ECCS Injection Mode	2041
LBLOCA Transfer to Recirculation Mode	2102

Event	PCT (°F)
Small Break (SB) LOCA ECCS Injection Mode	2010
SBLOCA Transfer to Recirculation Mode	900