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 AUTH.NAME AUTHOR AFFILIATION
 STALL, J.A. Florida Power & Light Co.
 RECIPIENT AFFILIATION
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SUBJECT: Forwards notification of change to small break LOCA ECCS evaluation model used for ST Lucie Unit 1. Anomaly was discovered & corrected. Limiting PCT is well within 10CFR50.46 acceptance criteria.

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May 20, 1999

L-99-112
10 CFR 50.46

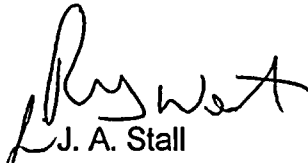
U. S. Nuclear Regulatory Commission
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Re: St. Lucie Unit 1
Docket 50-335
SBLOCA Evaluation Model
30-Day 10 CFR 50.46 Report

The attached report is submitted pursuant to 10 CFR 50.46(a)(3)(ii) to provide notification of a change to the small break loss of coolant accident (SBLOCA) emergency core cooling system evaluation model used for St. Lucie Unit 1. An anomaly was discovered and corrected that resulted in reducing the calculated peak cladding temperature (PCT) for the limiting SBLOCA by more than 50°F, and meets the criteria for reporting within 30 days. The limiting PCT is well within the 10 CFR 50.46 acceptance criteria.

Please contact us if you have any questions about this matter.

Very truly yours,


J. A. Stall
Vice President
St. Lucie Plant

JAS/RLD

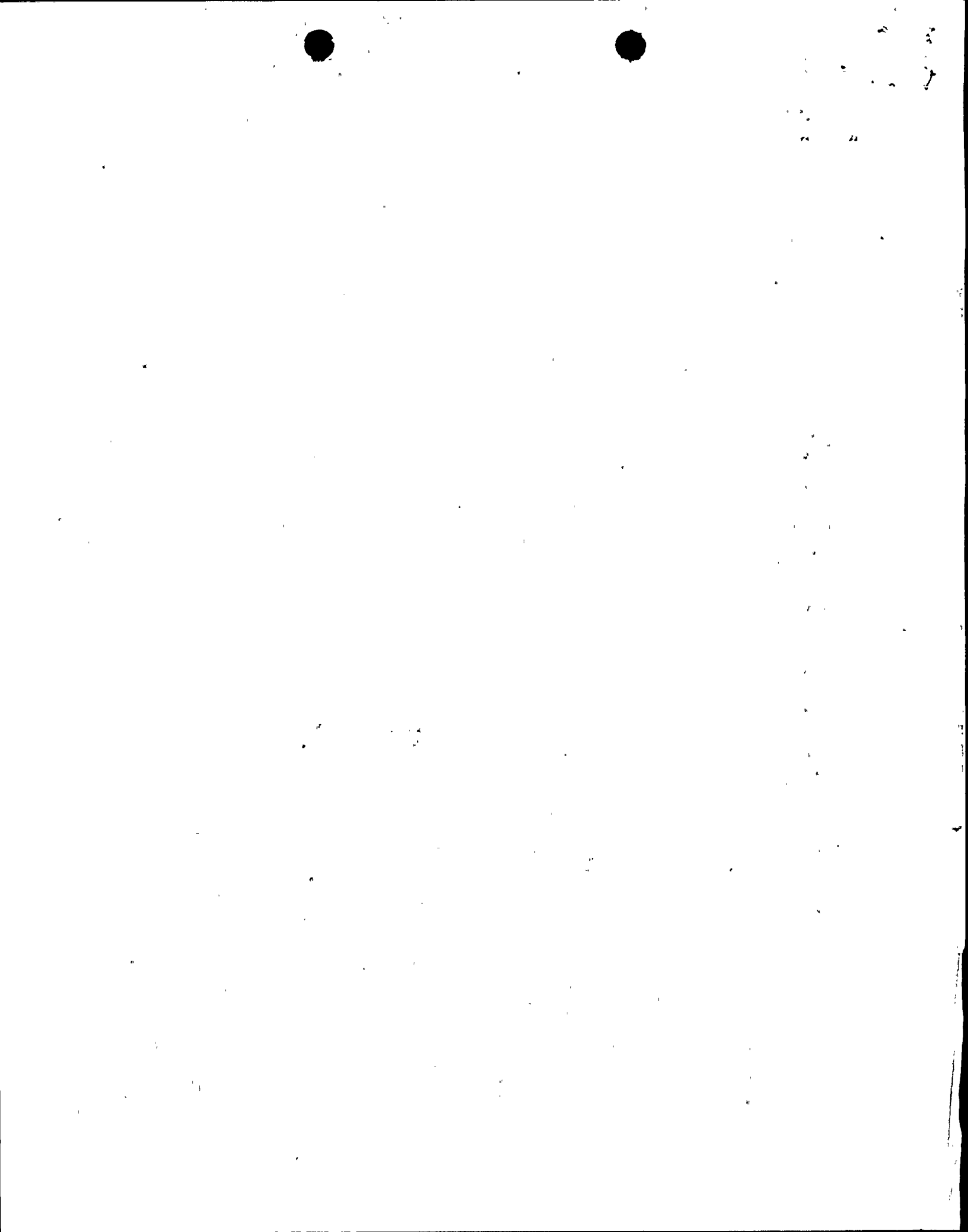
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cc:
Regional Administrator, Region II, USNRC
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Siemens Power Corporation (SPC) analyzes the St. Lucie Unit 1 emergency core cooling system (ECCS) performance in postulated loss of coolant accidents pursuant to the requirements of 10 CFR 50.46. SPC identified and resolved a deviation from the 10 CFR 50, Appendix K, requirements in that the specifications for nodes in the core model for the small break loss of coolant accident (SBLOCA) evaluation did not provide a converged solution. Correction of the anomaly resulted in a significant decrease in the calculated peak cladding temperature (PCT) for the limiting small break. It should be noted that the large break LOCA continues to be the limiting loss of coolant accident analyzed for St. Lucie Unit 1.

Nature of Deviation:

Specifications for nodes in the SBLOCA core model did not provide a converged solution for the hot assembly PCT.

Description of Error and Corrective Action:

A concern involving proper demonstration of solution convergence for core hot assembly calculations was identified in SPC Condition Report (CR) 6272. The concern led to the determination that the nodal representation used in the SBLOCA methodology did not result in a converged solution with respect to core node length. Two models were identified as principle contributors to the anomaly: the two-velocity cross-flow model and the level model. The two-velocity cross-flow model lacks sophisticated treatment for the two-phase momentum equations that are used, and causes severe oscillations during two-phase flow conditions. In addition, the level model, which sharpens the liquid-vapor interface, can have spurious behavior under some conditions. When these two models are used in conjunction, solution convergence is not demonstrated for the hot assembly PCT.

The anomaly was corrected by specifying homogeneous flow (single-velocity) at the cross-flow junctions and by using small equal-sized nodes in the core model. These revisions to the application of the SBLOCA model result in consistent and converged core solutions in both steady state and transient calculations. Calculations with the corrected model included a break-size spectrum analysis, which determined that the limiting small break changed from .05 ft² to 0.1 ft². The final result is a significant reduction in the calculated peak cladding temperature.

The corrective action eliminates the oscillatory behavior and resolves the issue of solution convergence. SPC reviewed the benchmark calculations for the current SBLOCA model and concluded that the benchmarks were not sensitive to the model changes.

Impact of the Error/Deviation:

For the St. Lucie Unit 1 SBLOCA analysis, the impact of the model change on the calculated PCT is -188°F. The revised PCT for the limiting SBLOCA is 1765°F.