November 24, 1999

MEMORANDUM TO: George Hubbard, Section Chief
Balance of Plant and Containment Systems Section
Plant Systems Branch
Division of Systems Safety and Analysis

THROUGH: Eric Weiss, Section Chief /original signed by W. Lyon for/
PWR Systems Section
Reactor Systems Branch
Division of Systems Safety and Analysis

FROM: Yi-hsiung Hsii, Sr. Reactor Engineer /s/
PWR Systems Section
Reactor Systems Branch
Division of Systems Safety and Analysis

SUBJECT: SAFETY EVALUATION INPUT ON OPERATION OF HARRIS SPENT FUEL POOLS C AND D (TAC # MA4432)

The Reactor Systems Branch was requested to support your review of Carolina Power & Light Company's request of an amendment to the Harris Nuclear Plant license to place spent fuel pools (SFP) C and D in service. The attached is our input to the safety evaluation regarding the analysis of an unreviewed safety question of the tie-in of the component cooling water (CCW) system to the SFP C and D heat exchangers, described in Enclosure 9 of the licensee's December 23, 1998, letter. We concur with the licensee's conclusion that the required residual heat removal system heat removal capability can be met with reduced CCW flow of approximately 5200 gpm.

As you incorporate this input into your safety evaluation, you may make any editorial change, if necessary, to fit the overall report.

Attachment: as stated

DISTRIBUTION:
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R. Laufer Y. Hsii

Concurrence:

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ATTACHMENT

SRXB SE INPUT REGARDING USQ ANALYSIS ON
HARRIS SPENT FUEL POOLS C AND D OPERATION

In Enclosure 9 to the December 23, 1998, letter, CP&L (the licensee) provided an evaluation of an unreviewed safety question (USQ) related to the tie in of the Harris Unit 1 Component Cooling Water (CCW) System to the Fuel Pool Cooling and Cleanup System (FPCCS) for the spent fuel pools "C" and "D."

The CCW system provides cooling to the residual heat removal (RHR) system heat exchangers, RHR pumps, the SFP heat exchangers, and other non-safety related systems. Two RHR trains provide long-term cooling during the containment sump recirculation phase of a LOCA by circulating the reactor coolant from the containment sump, through the heat exchangers, and returning to the reactor coolant system cold legs. Each RHR train is capable of removing up to 111.1 MBtu/hr in the post-LOCA scenario. In the USQ thermal-hydraulic analysis, the licensee demonstrates that adequate excess thermal capacity existed in the CCW system to accommodate the additional heat loads of 1.0 MBtu/hr (which is a limitation specified in technical specification 5.6.3) from the SFP C and D during all normal and accident modes of system operation, i.e., the required RHR heat removal capability can be met with reduced CCW flow through the RHR heat exchanger due to the tie-in of the C and D FPCCS.

The USQ thermal-hydraulic calculations did not change any assumptions regarding maximum sump temperatures or RHR heat removal requirements under post-LOCA containment conditions. However, the licensee identified that fluid properties at the higher RHR temperatures associated with the post-LOCA scenario would result in an increase in the heat exchanger heat transfer coefficient values over the fixed value assumed in the existing analysis. The analyses used a "dynamic" RHR heat exchanger performance model in which the tube side inlet temperature is postulated to rise to 244.1° F during the initial phase of containment sump recirculation, rather than a fixed 139 °F currently assumed. This increased tube side fluid temperature increases the overall RHR heat exchanger heat transfer coefficient (HTC) by approximately 10% due to change in tube side fluid viscosity. Based on this increase heat exchanger HTC, the calculations showed that a minimum CCW system flow rate through the RHR heat exchanger of 4874 gpm at 120°F is required at the beginning of the sump recirculation phase. Assuming a 6% model uncertainty, the required CCW system flow to the RHR heat exchanger would be 5166 gpm, which is less than 5600 gpm in the existing analysis.

The licensee also provided, In response to a staff question (Question 6, September 3, 1999, letter), the results of analyses based on a time-dependent heat rejection load of the RHR heat exchanger, and the containment sump water temperature during a LOCA. The staff has performed an audit calculation of these results, and found that the analyses were conservatively based on a lower density and mass flow of the CCW volumetric flow rate of 4874 gpm. The staff concurs with the licensee's analysis conclusion that the required RHR heat removal capability can be met with the reduced CCW flow of approximately 5200 gpm.