August 10, 2007

Mr. Robert J. Duncan II, Vice President
Shearon Harris Nuclear Power Plant, Unit 1
Carolina Power & Light Company
P.O. Box 165
New Hill, NC 27562

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 - RESPONSE TO GENERIC LETTER 96-06 "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS" (TAC NO. M96818)

Dear Mr. Duncan:

On September 30, 1996, the U. S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." In GL 96-06, the NRC staff expressed concerns that cooling water systems serving the containment air coolers may (1) be exposed to the hydrodynamic effects of waterhammer during either a loss-of-coolant accident or a main steamline break, (2) experience two-phase flow conditions during these postulated accidents, and/or (3) be overpressurized due to overheating of isolated water-filled piping sections in containment. These events could jeopardize the ability of accident mitigating systems to perform their safety functions and lead to a breach of containment integrity. The NRC staff requested that addressees assess these concerns, take certain actions as appropriate, and provide certain information to the NRC staff within specified times.

Carolina Power & Light Company, the licensee for Shearon Harris Nuclear Power Plant, Unit 1 (HNP), provided responses to GL 96-06 in letters dated October 30, 1996, January 28, 1997, August 24, 1998, September 28, 1998, January 26, 1999, October 29, 2002, January 19, 2004, June 23, 2004, and March 8, 2007.

Waterhammer and Two-Phase Flow

Subsequent to the issuance of GL 96-06, the Electric Power Research Institute (EPRI) developed an analytical methodology for evaluating the GL 96-06 waterhammer issue that was documented in EPRI Technical Reports 1003098 and 1006456 (previously EPRI Report TR-113594). The EPRI methodology was approved by the NRC in an evaluation dated April 3, 2002, and is included as an Appendix to the EPRI Technical Reports. Section 3.3 of the NRC staff's safety evaluation identified additional information that licensees who choose to use the EPRI methodology were required to provide in order to confirm that the EPRI methodology was properly applied and that plant-specific risk considerations were consistent with the EPRI risk perspective, justify any proposed exceptions to the EPRI methodology, and address the GL 96-06 two-phase flow issue.

In letters dated August 24, 1998, and January 26, 1999, the licensee indicated that further action to address the GL 96-06 waterhammer and two-phase flow issues would be deferred

pending completion of the EPRI initiative (referred to above). Upon completion of the EPRI initiative and as requested by NRC letter dated May 24, 2002, the licensee provided the additional information needed for using the EPRI methodology in a letter dated October 29, 2002. Based on a preliminary review of the information that was provided, the NRC staff questioned the analytical methodology, check valve reliability, and plant-specific risk assessment that had been completed. Consequently, in response to these and subsequent questions that were posed by the NRC staff, additional information was submitted by letters dated January 19 and June 23, 2004. The licensee submitted the results of a new waterhammer analysis in a letter dated March 8, 2007, that was performed using a conventional force-time-history approach to calculate the most limiting waterhammer impact.

The licensee's approach for evaluating the consequences of the most limiting waterhammer event as described in the March 8, 2007, letter appears to be consistent with the EPRI methodology and provides a conservative estimate of the resultant waterhammer pressures. The waterhammer void size was determined based on hydraulic equilibrium and did not credit the check valves for preventing back leakage, thereby resolving the NRC staff's concerns relative to the impact that check valve back leakage could have on the assumed void size.

Analytical considerations relative to pipe stresses and pipe support loads are discussed in the licensee's January 19, 2004, and March 8, 2007, letters. Relative to pipe stresses and pipe support load considerations, the NRC staff confirmed that the licensee's evaluation and acceptance were based on the combined effects of waterhammer and other loading conditions (dead weight, pressure, seismic). Based on the analyses that were performed, the licensee determined that modifications were required for eight pipe supports in order to accommodate the resultant waterhammer loads. The necessary plant modifications were completed in the spring of 2006 during Refueling Outage 13, as stated in the licensee's March 2007, letter.

The licensee discussed the risk considerations that are credited in part for using the EPRI methodology in the October 29, 2002, letter, and additional clarification was provided in the January 19, 2004, letter. The licensee's risk assessment appears to be consistent with the EPRI guidance and the results are bounded by the EPRI criteria approved by the NRC staff.

The licensee addressed the GL 96-06 two-phase flow considerations in letters dated January 28, 1997, and October 29, 2002. The licensee determined that any occurrence of two-phase flow in the emergency service water system (ESWS) would stop before the containment fan coolers (CFCs) are credited for removing heat from the containment and consequently, any initial reduction in CFC effectiveness is inconsequential. However, the licensee also determined that the closure times for the normal service water system (NSWS) supply to ESWS header valves (1SW-39 and 1SW-40) are important to assure isolation of the NSWS flow path when the ESWS is started. Limits were placed in the quarterly test procedure for these valves to assure that the applicable valve closure time criteria are satisfied.

Based on a review of the information that was provided and the considerations discussed above, the NRC staff is satisfied that the licensee has adequately addressed the GL 96-06 waterhammer and two-phase flow issues for the HNP. The required plant modifications have been completed and time limits for the NSWS/ECWS isolation valves have been established; this completes the necessary actions identified by the licensee for resolving these issues. The NRC staff concurs with this assessment.

While the NRC staff is satisfied with the licensee's resolution of the GL 96-06 waterhammer and two-phase flow issues, a detailed quantitative assessment of the licensee's waterhammer and two-phase flow analyses was not performed and a review of the licensee's use and application of computer codes for performing these analyses was not performed. Consequently, these areas could be the subject of future NRC audit or inspection activities.

Thermal Overpressurization

In letters dated January 28, 1997, and September 28, 1998, HNP provided responses to the issue of thermally-induced pressurization of piping runs penetrating the containment. In the January 1997 letter, eight penetrations were identified as vulnerable to a potential increase in pressure due to heating of a solid volume of trapped fluid. In the September 1998 letter, the licensee stated that pressure relief valves on the containment fan coil service water outlet line were installed and that engineering analysis of the remaining seven lines indicated that the stresses were within the design basis allowable limits. Based on this information, the NRC staff has concluded that HNP has provided an acceptable resolution for the issue of thermally-induced pressurization of piping runs penetrating the containment.

Conclusion

Based on the information discussed above, the NRC staff considers the licensee's response to GL 96-06 to be complete, but subject to future NRC inspection activities as indicated above.

This completes our activity on TAC No. M96818. If you have questions regarding this letter, please contact me at (301) 415-1906.

Sincerely,

/RA/

Lisa M. Regner, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

cc: See next page

While the NRC staff is satisfied with the licensee's resolution of the GL 96-06 waterhammer and two-phase flow issues, a detailed quantitative assessment of the licensee's waterhammer and two-phase flow analyses was not performed and a review of the licensee's use and application of computer codes for performing these analyses was not performed. Consequently, these areas could be the subject of future NRC audit or inspection activities.

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Lisa M. Regner, Project Manager
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