June 26, 2003

Mr. J. W. Moyer, Vice President
Carolina Power & Light Company
H. B. Robinson Steam Electric Plant,
Unit No. 2
3581 West Entrance Road
Hartsville, South Carolina 29550

SUBJECT: SAFETY EVALUATION RELATING TO RELIEF REQUEST FOR THE FOURTH 10-YEAR INTERVAL INSERVICE TESTING PROGRAM AT H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 (TAC NO. MB8447)

Dear Mr. Moyer:

By letter dated April 15, 2003, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a, Carolina Power & Light Company (CP&L), licensee for H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2), submitted Relief Request IST-RR-3 related to the HBRSEP2 fourth 10-year interval inservice testing (IST) program for pumps and valves. CP&L requested relief from certain American Society of Mechanical Engineers (ASME) inservice testing requirements for containment spray pumps at HBRSEP2. Interim relief until the end of Refueling Outage 22 had been granted by the NRC on June 27, 2002.

The subject relief request proposes to perform the quarterly Code-required testing of the containment spray pumps at approximately 33 percent of minimum design flow in lieu of performing the biennial Comprehensive Pump Test within $\pm$ 20 percent of design flow. CP&L also indicated that quarterly tests would include additional performance monitoring of pump vibration, the use of high accuracy pump discharge pressure gauges and periodic lubrication oil sampling and analysis.

The NRC staff reviewed the relief request and associated proposed alternative testing method for these pumps against the requirements of the ASME Operation and Maintenance (OM) Code, 1995 Edition and the 1996 Addenda, that are incorporated by reference in 10 CFR 50.55a. The NRC staff findings are provided in the enclosed Safety Evaluation.

Relief Request IST-RR-3 is denied on the basis that the proposed alternative test does not provide an acceptable level of quality and safety. Furthermore, the NRC staff concluded that CP&L did not demonstrate that compliance with Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore,

CP&L must meet the IST requirements of the ASME OM Code by implementing any necessary modifications to HBRSEP2 to enable the Code-required full-flow test capability of its containment spray pumps within 1 year from issuance of this letter. The interim relief granted by letter of June 27, 2002, is hereby extended and will expire 1 year from the date of this letter.

Sincerely,

/RA/

Allen G. Howe, Section Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO RELIEF REQUEST IST-RR-3 FOR THE FOURTH 10-YEAR INTERVAL
INSERVICE TESTING PROGRAM
CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261

1.0 INTRODUCTION

By letter dated April 15, 2003, Carolina Power & Light Company (CP&L, the licensee) submitted Relief Request IST-RR-3 related to the H. B. Robinson Steam Electric Plant Unit No. 2 (HBRSEP2) fourth 10-year interval inservice testing (IST) program for pumps and valves.

Relief Request IST-RR-3 was previously submitted on August 24, 2001, as part of the HBRSEP2 fourth 10-year interval IST Program. In IST-RR-3, the licensee proposed to conduct quarterly inservice tests to monitor the parameters (differential pressure, discharge pressure, flow rate, and vibration) specified for a Group A test. The additional vibration acceptance criteria would be as specified in Table ISTB 5.2.1-1 of American Society of Mechanical Engineers (ASME) *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code). The difference between a Group A and Group B test is the additional monitoring of discharge pressure and vibration. By a June 27, 2002, letter (Ref. 1), the NRC staff authorized interim relief pursuant to 10 CFR 50.55a(f)(6) until the end of refueling outage RO #22 on basis that the Code-required test is impractical to perform without significant plant modification. The NRC staff also stated that for the long-term assessment of the operational readiness of the pump (from RO#22 until the end of the fourth 10-year interval), it would be necessary for the licensee to perform a test at or near the pump's design flow rate or where the pump design performance characteristics are well represented. Interim relief was authorized to allow time for the licensee to explore other alternatives, make necessary plant modifications for performing the required test, or to submit a revised relief request.

By letter dated April 15, 2003, the licensee resubmitted IST-RR-3. In the revised request, the licensee proposed to perform quarterly testing of the containment spray (CS) pumps at approximately 33 percent of minimum design flow in lieu of performing the biennial comprehensive pump test (CPT) within $\pm$ 20 percent of design flow as required by the Code. Quarterly tests would include additional performance monitoring of pump vibration, the use of high accuracy pump discharge pressure gauges, and periodic lubrication oil sampling and analysis. This revised proposal is identical to the original proposal with the addition of the periodic lubrication oil sampling and analysis.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a requires that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with the ASME *Boiler and Pressure Vessel Code* (ASME Code), Section XI and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee

and granted by the Commission pursuant to paragraphs (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. The Code of record for HBRSEP2 is the 1996 Addenda to the 1995 Edition of the ASME OM Code. In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternative provides an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for its facility. Section 10 CFR 50.55a authorizes the Commission to approve alternatives and to grant relief from ASME Code requirements upon making the necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provides alternatives to the Code requirements that are acceptable to the NRC staff. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants."

By letter dated August 24, 2001, the licensee submitted its fourth 10- year interval IST program for pumps and valves. The HBRSEP2 fourth 10-year IST interval began on February 19, 2002, and ends on February 18, 2012. The program for pump testing was developed in accordance with the requirements of the 1996 Addenda to the 1995 Edition of the ASME OM Code.

The NRC's findings with respect to authorizing alternatives and granting or denying the IST program relief request are given below.

3.0 TECHNICAL EVALUATION

The NRC staff has reviewed the licensee's regulatory and technical analysis in support of the request for relief from ASME OM Code, Subsection ISTB IST requirements, which are described in Attachment I of the licensee's submittal.

3.1 Relief Request No. IST-RR-3

In Relief Request IST-RR-3, the licensee has requested relief from the CPT requirements of the OM Code, subparagraph ISTB 4.3(e)(1). Paragraph ISTB 4.3(e)(1) states, "Reference values shall be established within $\pm$ 20% of pump design flow rate for the comprehensive test."

The licensee proposes to perform quarterly Code-required testing of the CS pumps at approximately 33 percent of minimum design flow in lieu of performing the biennial CPT within $\pm$ 20 percent of design flow. Quarterly tests would include additional performance monitoring of pump vibration, the use of high accuracy pump discharge pressure gauges, and periodic lubrication oil sampling and analysis.

The components affected by this relief request are CS Pumps CS-A and CS-B. These pumps are classified as Group B pumps in the IST Program.

3.1.1 Licensee's Basis For Requesting Relief

In its request for relief, the licensee states, "To establish the capability to test at the Code-required flow rate would require a substantial plant modification and redesign of the CS system. The cost of a permanent modification and associated activities has been estimated at $220,000." The licensee also states that compliance would result in an unusual hardship without a compensating increase in the level of quality and safety.

The CS pumps are currently tested quarterly using a test line that recirculates back to the Refueling Water Storage Tank (RWST). This test line produces a flow rate of approximately 25 percent of the design flow. Additional flow is also circulated from the pump discharge through an eductor. Total flow during the quarterly pump test is approximately 33 percent of design flow. Original plant design did not include provisions for full-flow testing or near-full-flow testing of the CS system. The only available flow path that is currently installed and able to accommodate the Code-specified (80 percent to 120 percent of design) flow rate test is the path through the containment spray header. Testing the pumps by flowing water through the containment spray headers would cause extreme hardship on the licensee.

The licensee states that the CS pumps are seldom used and only run for testing. Total run time is less than 2 hours per year. Pump degradation is expected to be minimal due to low run hours and because the pumps are not subjected to events that could cause degradation. The licensee concludes that the condition monitoring as outlined in the alternative testing coupled with quarterly testing will adequately allow for pump degradation to be identified and corrected.

3.1.2 Alternative Testing

As an alternative to the Code-required CPT, the licensee proposes quarterly tests to include monitoring pump vibration, differential pressure and test line flow rate.

> Vibration data would be collected and analyzed in accordance with OM Code requirements. Acceptance criteria will be as specified in Table ISTB 5.2.1-1 for CPT. The discharge pressure instrument will be a 2 psi accuracy instrument. Additional condition monitoring to include oil sampling and analysis and vibration spectral analysis will be performed annually.

3.1.3 Evaluation

The HBRSEP2 CS System contains two, single-suction, single-stage centrifugal pumps operating in parallel. The primary purpose of the CS system is to spray cool water into the containment atmosphere, when appropriate, in the event of a loss-of-coolant accident (LOCA), thereby ensuring that containment pressure does not exceed its design value of 42 psig at 263°F (100-percent relative humidity). A second purpose of the CS system is to remove elemental iodine from the containment atmosphere should it be released during a LOCA. The system is designed to limit offsite thyroid doses to within 10 CFR Part 100 limits following a LOCA.

The CS pumps fall within the scope of the ASME OM Code, are defined as Group B Pumps, and, therefore, are subject to quarterly Group B tests and a biennial comprehensive pump test. Pump speed as well as differential pressure or flow rate are required to be monitored for the Group B test for the CS pumps. Additionally, speed, differential pressure, flow rate, discharge pressure, and vibration are required for the CPT. ASME OMa 1996, paragraph ISTB 4.3(e)(1) requires the establishment of reference values for the CPT to be within $\pm$ 20 percent of pump design flow. The Code does not define design flow.

The HBRSEP2 Updated Final Safety Analysis Report (Sections 6.2 and 6.5) and Attachment 1 to the April 15, 2003, submittal define CS pump performance and required flows during various operational scenarios. In their current configuration, the CS pumps are tested using a test line that recirculates flow back to the RWST. Additional flow is circulated from the pump discharge

through an eductor. Total flow during the quarterly pump test is approximately 320 gpm. Considering the range of stated flows, the proposed test flow is approximately 27.5 percent to 33 percent of design flows. The CS system flow path currently available that could produce the required flow is a direct suction off the RWST through the containment spray header. This method would spray containment with a solution of sodium hydroxide and borated water and would require an extensive post-test cleanup. This test method would be detrimental to the installed carbon steel components and non-qualified electrical circuits and is, thus, impractical.

The CPT—which first appeared in the 1995 Edition of the OM Code—results in a more accurate assessment of the pump's operational readiness and performance characteristics at a reduced frequency (once every refueling cycle versus once every 3 months). The test is intended to be conducted at or near a pump's design flow rate because this area of the pump curve is considered to be most representative of the pump's design performance characteristics. The quarterly Group A or B test is primarily a qualitative test to detect gross mechanical or hydraulic failures and not to assess hydraulic performance capabilities or to detect minor imbalances through vibration measurements.

ASME OMa 1996, paragraph ISTB 4.3(e)(2) requires reference values for Group B tests to be within $\pm$ 20 percent of pump design flow, if practicable. If not practicable, the reference point shall be established at the highest practical flow rate. The licensee states that this is approximately 33 percent of the stated design flows. The licensee did not justify how operation at low flow confirms the capability of the pump to perform as required under design flow conditions nor how it meets the intent of the CPT.

The licensee stated that the pump's pre-service test was a pump shutoff head test. Factory test curves were provided; however, the CS system has never been operated in its as-installed configuration. Analytical flow models of the system exist but have not been field validated by test.

The proposed test monitors discharge pressure and vibration more frequently than a Group B test. Increased monitoring of vibration may detect minor imbalances and may aid in condition assessment and assessment of pump degradation. The use of lube oil sampling and analysis is also a good practice and can aid in the condition assessment of rotating equipment. However, the additional monitoring and sampling does not compensate for not testing at higher flow rates nor do they assess hydraulic performance capabilities under design flow conditions.

Based on the above discussion, the NRC staff finds that the proposed alternative does not provide an acceptable level of quality or safety because the alternative does not provide reasonable assurance of the operational readiness of the CS pumps to perform their safety functions at design-basis conditions. For the long-term assessment of the operational readiness of the pump, it is necessary that a test be performed at or near the pump's design flow rate or where the pump design performance characteristics are well represented.

In addition, the licensee did not demonstrate that compliance with Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Although the need to implement plant modifications at an estimated cost of $220,000 (necessary to test the pumps at or near the pump's design flow rate) may be a hardship, these modifications will provide the Code-required testing capability to verify operational readiness of the CS pumps at design-basis conditions. This capability to perform a

full-flow test as required by the CPT provides an increase in the level of quality and safety commensurate with the associated costs. Consequently, the CPT will provide a technically sound evaluation and reliable assessment of the pump's operational readiness and performance characteristics under design-basis accident conditions. This evaluation and assessment of design performance provides reasonable assurance that the CS system will accomplish its safety-related functions of spraying cool water into the containment atmosphere, ensuring that containment pressure does not exceed its design value of 42 psig at 263°F, and of removing elemental iodine from the containment atmosphere should it be released, thus aiding in limiting offsite thyroid dose to within 10 CFR Part 100 limits following a LOCA.

4.0 CONCLUSION

The NRC staff concludes that the licensee's proposed alternative does not provide an acceptable level of quality and safety, nor does it explain why compliance with Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety; therefore, the request is denied. Performance of the Code-required CPT will provide reasonable assurance that the HBSEP2 containment spray pumps will perform their safety-related functions under design-basis conditions.

5.0 REFERENCE

1. Letter from K. Jabbour (NRC) to J. W. Moyer, H. B. Robinson Steam Electric Plant, Unit No. 2, Relief Requests for the Fourth 10-Year Pump and Valve Inservice Testing Program (TAC Number MB2798), June 27, 2002.

Principal Contributor: S. Unikewicz, NRR

Date: June 26, 2003

Mr. J. W. Moyer
Carolina Power & Light Company

H. B. Robinson Steam Electric Plant,
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