Progress Energy

GL 96-06

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United States Nuclear Regulatory Commission
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

ADDITIONAL INFORMATION REGARDING GENERIC
LETTER 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND
CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS"

Ladies and Gentlemen:

By letter dated August 27, 2002, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, provided a response to an NRC request for additional information regarding Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." In a conference call between Carolina Power and Light Company and NRC personnel on November 22, 2002, it was determined that additional information would facilitate NRC review of the HBRSEP, Unit No. 2, response to the request for additional information.

Attachment I provides an Affirmation for this submittal. The additional information that was requested by the NRC is provided in Attachment II.

If you have any questions concerning this matter, please contact Mr. C. T. Baucom.

Sincerely,

B. L. Fletcher III
Manager – Support Services – Nuclear

Attachments:
I. Affirmation
II. Additional Information Regarding Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions"

c: Mr. L. A. Reyes, NRC, Region II
Mr. C. Patel, NRC, NRR
NRC Resident Inspector, HBRSEP

A012

Progress Energy Carolinas, Inc
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AFFIRMATION

The information contained in letter RNP-RA/02-0190 is true and correct to the best of my information, knowledge and belief; and the sources of my information are officers, employees, contractors, and agents of Carolina Power and Light Company. I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 28 JAN. 2003

J. W. Moyer
Vice President, HBRSEP, Unit No. 2

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

ADDITIONAL INFORMATION REGARDING GENERIC LETTER 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS"

Background

By letter dated August 27, 2002, H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, provided a response to an NRC request for additional information regarding Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." In a conference call between Carolina Power and Light Company and NRC personnel on November 22, 2002, it was determined that additional information would facilitate NRC review of the HBRSEP, Unit No. 2, response to the request for additional information. The following additional information is hereby being provided:

NRC Information Request

Describe the method used to determine pipe stress and support loads and discuss the results. Specifically discuss and justify the load combinations used.

Response

HBRSEP, Unit No. 2, tested the service water (SW) system by performing a specific test to simulate loss of offsite power (LOOP) conditions and by monitoring the waterhammer magnitude produced by the LOOP event. Observations made during the testing documented the maximum piping displacement of ½ inch in proximity to the location at which column closure waterhammer would be expected to occur. No piping or support damage was observed.

Piping stress and acceptability were determined using the observed pipe displacements that occurred during simulated LOOP system testing. An "ADLPipe" stress model was used to impose the displacement in both positive and negative directions at the location of maximum observed displacement. The pipe analysis model included stress due to waterhammer, pressure, and deadweight loads. The peak LOOP transient pressure of 554 psi, obtained from the test, was conservatively applied as a static pressure in the displacement model. These stresses were combined with seismic stresses using the square root sum of squares (SRSS) method. The pipe was found to meet ASME code requirements for stress and potential fatigue due to repeated waterhammer events. Pipe supports were determined to be acceptable under the combined loading.

For HBRSEP, Unit No. 2, the magnitude of the waterhammer produced by a concurrent LOOP and loss of coolant accident (LOCA) was determined by analysis methods that were consistent with the Electric Power Research Institute (EPRI) Report TR-113594,

"Resolution of Generic Letter 96-06 Waterhammer Issues," methodology. This analysis confirmed that the LOOP stresses would bound the concurrent LOOP/LOCA stresses.

NRC Information Request

Provide additional detail regarding the risk perspective and the specific values for the risk evaluation. Show that the methodology used was consistent with the EPRI methodology.

Response

For HBRSEP, Unit No. 2, the applicable initiating event frequencies are estimated as follows:

Large Break LOCA Frequency	2.2×10^{-5}/yr
Medium Break LOCA Frequency	3.2×10^{-6}/yr
Main Steam Line Break (MSLB) Frequency	2.8×10^{-4}/yr
LOOP Frequency *	3.7×10^{-2}/yr

* The random occurrence of a LOOP simultaneously with a LOCA or MSLB within a 24 hour period is a very low probability event and is bounded by the LOCA or MSLB with consequential LOOP.

The probability of a consequential LOOP caused by the LOCA or MSLB is estimated as follows:

Probability of a Consequential LOOP Following LOCA or MSLB	1.4×10^{-2}

Based on these estimated event frequencies and the probability of a consequential LOOP following a LOCA or MSLB, a conservative combination of both events produces the frequency estimate for both a combined LOCA and LOOP, and a combined MSLB and LOOP, as follows:

$$(3.2 \times 10^{-6})(1.4 \times 10^{-2}) + (2.2 \times 10^{-5})(1.4 \times 10^{-2}) + (2.8 \times 10^{-4})(1.4 \times 10^{-2}) = 4.28 \times 10^{-6}/\text{yr}$$

This result is less than the initiating event risk threshold of 1×10^{-5}/yr provided in the EPRI report.

There is negligible probability of pipe failure as a result of GL 96-06 conditions for HBRSEP, Unit No. 2, because the stresses produced by GL 96-06 transients are within ASME code limits. Therefore, it is conservatively assumed that the probability would be no more than that described under "Item b" of the NRC safety evaluation report (SER) for EPRI Report TR-113594, which is 1×10^{-4}.

The combined risk perspective, based on combining the waterhammer event frequency estimate and the pipe failure probability, results in the following estimated frequency for a waterhammer event which results in pipe failure:

(Initiating Event Risk) x (Pipe Failure Probability) = $(4.28 \times 10^{-6})(1 \times 10^{-4}) = 4.28 \times 10^{-10}$/yr

Therefore, the HBRSEP, Unit No. 2, risk perspective is bounded by the EPRI risk perspective of 1×10^{-7}/yr.

NRC Information Request

Discuss procedure changes that were implemented at HBRSEP, Unit No. 2, which have made waterhammer events less likely.

Response

An investigation of the potential causes and mitigating actions was conducted based on the observed pressure transient in the SW system during the simulated LOOP conditions. In conjunction with this investigation, a review was conducted to determine possible procedural changes, and instrumentation was placed in the system to determine waterhammer magnitudes.

A specific change that was made based on the results of the investigation, review, and data collection included the isolation of the containment fan cooler piping by closing valves prior to pump shutdown. This prevents draining, voiding, and subsequent waterhammer in the fan cooler piping. Additionally, instructions were added to a maintenance procedure to ensure a slow refill following activities that could cause this piping to be drained. Refill is controlled by slowly opening valves that supply flow to the fan coolers.

NRC Information Request

Describe the measured pressure from previous testing and the potential for amplification in the measured results.

Response

The HBRSEP, Unit No. 2, test results provided a maximum measured pressure of 554 psi for the LOOP-induced transient conditions. The pressure instruments for this test were located on vent lines in portions of the piping that would become voided during the test. Magnification of the waterhammer pressure is expected (up to a factor of 2) due to refill of the vent line. This occurred due to void closure in the proximity of the closed end of the vent line, producing a temporarily higher peak pressure in the vent line only. This amplified value was conservatively used in the main piping without reduction, as described above. However, the ½ inch diameter vent line would only transmit a small fraction (<1%) of this peak pressure to the 6 inch diameter main line due to area attenuation effects.