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SERIAL: BSEP 95-0459

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U. S. Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NO. 50-324/LICENSE NO. DPR-62  
NUREG-0619 INSPECTIONS OF FEEDWATER NOZZLES

Gentlemen:

The purpose of this letter is to advise the Nuclear Regulatory Commission (NRC) of Carolina Power & Light Company's (CP&L) revised plans for inspection of the feedwater nozzle blend radii for the Brunswick Steam Electric Plant, Unit No. 2. As discussed in Enclosure 1, CP&L requests NRC concurrence with deferring the NUREG-0619 feedwater nozzle liquid penetrant (LP) examination from the upcoming Unit 2 Reload 11 outage (B212R1) to the Reload 12 outage (B213R1). The deferral is being requested to allow additional time to complete development and qualification of an ultrasonic inspection technique that will be used during the Unit 2 Reload 12 (B213R1) in lieu of a LP examination. Approval of the examination schedule deferral is requested by December 15, 1995 in order that planning for the upcoming Unit 2 Reload 11 (B212R1) outage may proceed with this consideration. The Unit 2 Reload 11 outage is presently scheduled to begin on February 2, 1996. A list of the regulatory commitments contained in this submittal is provided in Enclosure 2. A copy of the Brunswick Unit 2 feedwater nozzle fracture mechanics analysis is provided in Enclosure 3.

Please refer any questions regarding this submittal to Mr. George Honma at (910) 457-2741.

Sincerely,

William R. Campbell

WRM/wrm

Enclosures

cc: Mr. S. D. Ebnetter, Regional Administrator, Region II  
Mr. D. C. Trimble, NRR Project Manager - Brunswick Units 1 and 2  
Mr. C. A. Patterson, NRC Senior Resident Inspector - Brunswick Units 1 and 2  
The Honorable H. Wells, Chairman - North Carolina Utilities Commission

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## ENCLOSURE 1

### BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2 DOCKET NO. 50-324/LICENSE NO. DPR-62 NUREG-0619 INSPECTIONS OF FEEDWATER NOZZLES

#### SUMMARY:

The purpose of this letter is to advise the Nuclear Regulatory Commission (NRC) of Carolina Power & Light Company's (CP&L) revised plans for inspection of the feedwater nozzle blend radii for the Brunswick Steam Electric Plant, Unit 2 and request NRC concurrence with deferring the next NUREG-0619 feedwater nozzle liquid penetrant (LP) examination from the upcoming Unit 2 Reload 11 outage (B212R1) to the Reload 12 outage (B213R1). The deferral is being requested to allow additional time to complete development and qualification of an enhanced ultrasonic inspection technique. Approval of the examination schedule deferral is requested by December 15, 1995 in order that planning for the upcoming Unit 2 Reload 11 outage may proceed with this consideration. The Unit 2 Reload 11 outage is presently scheduled to begin on February 2, 1996.

#### BACKGROUND:

On November 13, 1980, the Nuclear Regulatory Commission issued NUREG-0619 due to the discovery of thermal fatigue cracking in the feedwater and control rod return line nozzles of several boiling water reactors. In NUREG-0619, the NRC recommended additional non-destructive testing for the feedwater and control rod return line nozzles to ensure their continued structural integrity. The recommended frequency for ultrasonic (UT), visual (VT), and liquid penetrant (LP) examinations were specified in Table 2 of NUREG-0619. Since the issuance of NUREG-0619, Carolina Power & Light Company has been performing inspections of the feedwater sparger and feedwater nozzles in accordance with the schedules of NUREG-0619.

#### DISCUSSION

##### Feedwater Spargers:

In a letter dated August 17, 1995 (Reference 1), CP&L informed the NRC of revised plans for replacement of the Unit 2 feedwater spargers. The most recent feedwater sparger inspection results for Unit 2 were previously provided by CP&L's letter dated December 21, 1994 (Reference 2).

##### Feedwater Nozzles:

Carolina Power & Light Company inspected the Unit 2 feedwater nozzle blend radii from the nozzle inside surface using liquid penetrant (LP) examination techniques during the Unit 2 Reload 9 outage. No blend radii cracks were identified during the LP examinations. The Company also inspected the feedwater nozzle blend radii from the nozzle outside surface using ultrasonic (UT) examination techniques. No blend radii cracks were identified during the UT examinations. The results of the Unit 2 feedwater nozzle and sparger examinations performed

during Refueling Outage 9 were provided in CP&L's letter dated June 8, 1992 (Reference 3). These results were subsequently supplemented by a CP&L letter dated July 27, 1992 (Reference 4). Based on these examination results, CP&L concluded that feedwater nozzle blend radii cracks did not exist for Unit 2.

#### Feedwater Nozzle Fracture Mechanics Analysis:

In 1990, a fracture mechanics analysis, as described in NUREG-0619, was prepared by General Electric using design and plant-specific data. The fracture mechanics analysis was documented in General Electric Report NEDC-30633, Revision 1, "Brunswick Steam Electric Plant, Unit 2 Feedwater Nozzle Fracture Mechanics Analysis" (copy enclosed). This analysis demonstrated that an assumed 0.25-inch deep crack in the nozzle blend radius will reach a depth of 1.0 inches in a 32.3 year period.

If a crack was assumed to be present at the start of the operating cycle following Refueling Outage 9, the crack would not exceed ASME Code, Section XI allowable limits during the remaining design life of Unit 2. This meets the intent of a NUREG-0619 analysis to demonstrate that crack growth will remain less than one (1) inch over a plant life of 40 years.

Section 7.0, "Conclusions" of GE Report NEDC-30633, Revision 1 includes a recommendation that some form of feedwater sparger leakage monitoring be performed. Carolina Power & Light Company has reviewed the GE recommendation and determined that implementation of feedwater sparger leakage monitoring is not needed at this time. Bypass leakage past the juncture of the thermal sleeve and nozzle safe end (associated with loose fitting sparger designs) has been attributed with causing crack initiation due to high cycle thermal fatigue. NUREG-0619 questioned the long term effectiveness of the interference-fit sparger design because "the interference fit may be lost with time" (Section 3.1), General Electric Report NEDC-30633, Revision 1 used conservative heat transfer coefficients to accommodate the potential for possible leakage flow and assumed that all the cycles (experienced to date and projected) are full design cycles. Nevertheless, the absence of cracking in the Brunswick Unit 2 feedwater nozzle blend radii suggests that the interference-fit is tight and that there is presently minimal or no bypass leakage. The fatigue usage calculated (Reference: Structural Integrity Associates Report SIR-93-037 dated April 16, 1993) for the Unit 2 feedwater nozzles as of April 21, 1992 is 0.064 with a extrapolated usage of 0.210 for 40 years. This indicates that the cycles experienced to date have not been as severe as those used in the original feedwater nozzle design. Thus, on this basis, CP&L has determined that implementation of feedwater sparger leakage monitoring is not needed at this time.

#### Inspection Plans:

As noted above, Table 2 of NUREG-0619 specifies the performance of a liquid penetrant (LP) examination every second refueling outage for interference fit feedwater spargers such as those installed in Brunswick Unit 2. Presently, the next LP examination for Unit 2 must be performed during the upcoming Unit 2 Reload 11 outage (scheduled to begin February 1, 1996) in order to meet the NUREG-0619 inspection plan. Therefore, in lieu of the LP examination, CP&L is developing and qualifying an ultrasonic inspection technique to inspect the feedwater nozzle inside surface from the nozzle outside surface.

The ultrasonic inspection technique will be capable of inspecting the area extending from the nozzle inner radius to the safe end. The technique will be developed using modeling and

qualified on a full-scale mockup. The recommendations in the BWR Owners' Group document "Alternate BWR Feedwater Nozzle Inspection Requirements," which the BWR Owners' Group plans to submit to the NRC during October 1995, will be followed.

The Electric Power Research Institute (EPRI), Nondestructive Examination Center (EPRI NDEC) is assisting CP&L in the development and qualification of the ultrasonic examination technique. The EPRI NDEC will computer model the vendor's examination procedure. A qualification demonstration will also be performed by the vendor on a full-scale mock-up with implanted cracks. The qualification is scheduled to be performed during December 1995.

Carolina Power & Light Company requests NRC concurrence with deferring the next NUREG-0619 LP examination for Unit 2, currently scheduled for the Reload 11 (B212R1) outage, in order to allow for completion of development and qualification of the enhanced ultrasonic inspection technique. Based on the present BWR Owners' Group submittal schedule and the EPRI qualification schedule, CP&L will not be able to adapt the enhanced UT inspection plan for the Reload 11 outage (currently scheduled to begin February 2, 1996). CP&L plans to perform the enhanced UT inspections during the Unit 2 Reload 12 outage (presently scheduled to begin in September 1997).

In addition, the Unit 2 feedwater nozzle examinations performed during Refueling Outage 9 demonstrated that no cracks were present in the nozzles at that time. As discussed above, NRC Generic Letter 81-11 specifies that a plant-specific feedwater nozzle fracture mechanics analysis must provide assurance that a 0.25 inch deep feedwater nozzle crack will grow to no greater than one inch deep in forty years. Even if a 0.25 inch deep crack were present at the start of the operating cycle following Refueling Outage 9, the Unit 2 fracture mechanics analysis provided in General Electric Report NEDC-30633, Revision 1 demonstrates the crack would not exceed ASME Code, Section XI allowable limits during the remaining design life of Unit 2. This meets the intent of a NUREG-0619 analysis to demonstrate that crack growth will remain less than one (1) inch over a plant life of 40 years. Thus, deferral of the scheduled NUREG-0619 LP examination of the Unit 2 feedwater nozzles for one additional operating cycle is considered acceptable. Carolina Power & Light Company plans to qualify the use of enhanced UT for the nozzle blend radii inspections to be implemented during the Unit 2 Reload 12 (B213R1) outage in lieu of the LP examinations.

#### REFERENCES:

1. Letter from J. P. Cowan (CP&L) to NRC Document Control Desk, "Revised Plans for Replacement of Feedwater Spargers" dated August 17, 1995.
2. Letter from R. P. Lopriore (CP&L) to NRC Document Control Desk, "NUREG-0619 Feedwater Nozzle and Safe End Examination Results" dated December 21, 1994.
3. Letter from R. B. Starkey, Jr. (CP&L) to NRC Document Control Desk, "NUREG-0619 Feedwater Nozzle and Sparger Examination Results" dated June 8, 1992 (Serial No. NLS-92-134).
4. Letter from D. C. McCarthy (CP&L) to NRC Document Control Desk, "NUREG-0619 Feedwater Nozzle and Sparger Examination Results, Submittal of Replacement General Electric Report," dated July 27, 1992 (Serial No. NLS-92-194).

ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NO. 50-324  
OPERATING LICENSE NO. DPR-62  
NUREG-0619 INSPECTIONS OF FEEDWATER NOZZLES

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by Carolina Power & Light Company in this document. Any other actions discussed in the submittal represent intended or planned actions by Carolina Power & Light Company. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager--Regulatory Affairs at the Brunswick Nuclear Plant of any questions regarding this document or any associated regulatory commitments.

Commitment	Committed date or outage
1. Perform UT inspections of the feedwater nozzle blend radii in lieu of the NUREG-0619 stipulated LP inspections during B213R1.	B213R1

ENCLOSURE 3

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2  
DOCKET NO. 50-324/LICENSE NO. DPR-62  
NUREG-0619 INSPECTIONS OF FEEDWATER NOZZLES

GENERAL ELECTRIC NUCLEAR ENERGY REPORT NEDC-30633, REVISION 1  
BRUNSWICK STEAM ELECTRIC PLANT, UNIT 2  
FEEDWATER NOZZLE FRACTURE MECHANICS ANALYSIS