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SERIAL: BSEP 97-0167

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
REVISED PLANS FOR CORE SPRAY SYSTEM SPARGER BRACKET SEAL WELD

Gentlemen:

The purpose of this letter is to inform the NRC of Carolina Power & Light (CP&L) Company's revised plans regarding the core spray system sparger repair bracket seal weld application for the Brunswick Steam Electric Plant, Unit No. 2. The basis for CP&L's decision regarding this commitment change is provided in Enclosure 1. No regulatory commitments are contained in this letter.

Please refer any questions regarding this submittal to Mr. Mark Turkal, Supervisor - Licensing at (910) 457-3066.

Sincerely,

C. S. Hinnant

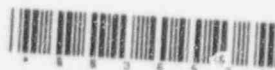
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Enclosure

1. Technical Bases

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pc (with enclosure):

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The Honorable J. A. Sanford
Chairman - North Carolina Utilities Commission
P.O. Box 29510
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ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2 DOCKET NO. 50-324/LICENSE NO. DPR-62 REVISED PLANS FOR CORE SPRAY SYSTEM SPARGER BRACKET SEAL WELD

In a letter dated November 27, 1991 (Serial: NLS-91-303), Carolina Power & Light (CP&L) Company submitted the results of visual examinations of the in-vessel core spray piping and spargers for the Brunswick Steam Electric Plant (BSEP), Unit No. 2. This submittal also provided a description of the repair of a crack indication located at the 90 degrees azimuth on the north core spray line.

The crack indication on the north loop core spray line was repaired during the B210R1 outage by reinforcing the piping with a bracket assembly at the T-box junction of the horizontal header pipes. The bracket assembly covers the cracked T-box location and consists of an upper and lower bracket welded across the piping arms and T-box. The brackets provide full structural integrity of the piping, even if the crack indication were to grow to 360 degrees of circumference. The bracket and weld filler materials (316L stainless steel) are resistant to intergranular stress corrosion cracking (IGSCC).

The underwater welding of the bracket was performed in accordance with the guidance of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI and the American Welding Society Specification for Underwater Welding, ANSI/AWS D3.6-89. The repair was performed using manual welding with coated weld electrodes. The design of the brackets included fillet weld attachments on the T-box and on each of the two header pipes. During qualification of the welding process, the end of the bracket could not be welded because the water within the welded structure would turn to steam and blow out the weld. It was decided to proceed with the repair without a complete fillet weld since a drain down of the upper part of the reactor vessel was planned for the subsequent refueling outage. The reactor drain down would allow the ends of the welds to be welded using manual welding in a dry environment.

Following the repair, a remote visual examination of the bracket welds was performed to assure the welds were of acceptable quality for at least one cycle of operation. Because the reactor vessel was not drained at the time of the repair, a liquid penetrant (LP) examination of the bracket welds could not be performed. As a result, CP&L committed to (1) perform an LP examination of the bracket assembly welds and (2) apply seal welds to the open ends of the bracket assemblies during the next Unit 2 refueling outage (B211R1) to eliminate the potential for crevice corrosion cracking.

The repair was also discussed in NRC Inspection Reports 50-325/91-32 and 50-324/91-32 dated December 4, 1991. In a Safety Evaluation dated January 14, 1994, the NRC concluded that this modification would maintain full structural integrity and support continued operability of the core spray line.

Subsequently, in a letter dated February 8, 1994 (Serial: BSEP 94-0042), CP&L notified the NRC that LP examination of the bracket assembly welds and application of the seal welds to the bracket assemblies were being deferred to the B212R1 refueling outage. The NRC documented its concurrence with these schedule changes in a letter dated April 7, 1994. The inspection results obtained during the B211R1 outage were subsequently submitted to the NRC in a letter dated July 26, 1994 (Serial: BSEP 95-0285). In a letter dated November 9, 1995 (Serial: BSEP 95-0445), CP&L notified the NRC that the application of the seal welds to the bracket assemblies was being deferred until the B213R1 refueling outage. The B213R1 outage is currently scheduled to begin on September 13, 1997.

Draining of the BSEP Unit No. 2 reactor vessel is not planned for the upcoming B213R1 refueling outage; therefore, completion of the core spray line bracket assembly seal welds cannot be accomplished. Additionally, an evaluation of the core spray line repair bracket assembly was performed by General Electric to justify leaving the fillet weld permanently unsealed.

The primary technical issue concerning the repair bracket is that the fillet weld, without the closure welds, creates a crevice condition which is not ideal from a stress corrosion perspective. However, the materials for both the repair bracket and the core spray line are 316L stainless steel with a carbon content of less than 0.02 percent. As a result, the susceptibility of these components to intergranular stress corrosion is significantly reduced.

General Electric has determined susceptibility of the core spray T-box to stress corrosion by calculating a stress rule index (SRI) value. This method uses the applied stress that the component experiences for a sustained period of time to assess susceptibility. Using this method, the criterion which was established for crevice conditions involving materials with low susceptibility was 0.70. The stresses at the core spray line repair location are low during all operating conditions, except for an emergency core cooling system (ECCS) injection event. The ECCS injection event does not need to be considered in the stress corrosion susceptibility evaluation because this event is not a sustained operating condition contributing to stress corrosion. Using sustained stresses that were calculated for the BSEP configuration, the SRI value was determined to be 0.69 versus the criterion value of 0.70 for crevice conditions. Therefore, the weld meets the IGSCC criteria in the General Electric Materials Handbook, and continued long-term operation with the weld in the current configuration is acceptable. Although the calculated SRI value is close to the allowable value, the actual SRI value is much lower due to the following conservatism in the SRI calculations:

1. The majority of the stress contribution to the SRI value of 0.69 is due to weld residual stresses which were created during the installation of the repair. In General Electric's procedure for calculating the SRI value, the weld residual stresses are determined from a chart that contains a curve which has bounding values. Since the core spray line repair is not a piping configuration, a maximum stress value of 45 ksi from the chart was used. This value is considered extremely conservative for this application for the following reasons:
 - a. Since the repair was performed underwater, the weld is similar to a heat sink weld, which causes low tensile (or compressive) stresses. The weld residual stresses were lower due to the rapid cooling rates during welding. Furthermore, because of the short time at temperature and the

fact the material involved is low carbon L Grade stainless steel, there is minimal weld sensitization.

- b. Because of the relatively small size of the fillet weld, the residual stresses are likely to be low. Furthermore, since the bracket is not restrained, the high residual stresses that typically arise in constrained piping butt welds do not apply to this configuration. Therefore, the actual weld residual stress is expected to be well below the 45 ksi value assumed in the SRI calculation.
2. Outside the weld residual stresses, other applied stresses are due to the weight and thermal effects. These applied stresses are negligible and do not contribute to the potential for IGSCC.

Based on the results of the evaluation, General Electric has concluded that the weld residual stresses in the current configuration are low and that the actual SRI value is well below the threshold value of 0.70. Therefore, the susceptibility of the repair configuration to stress corrosion crack initiation is low.

Based on the technical information above, and the fact that visual inspections during the B211R1 and B212R1 refueling outages have not indicated degradation, CP&L has concluded that the existing BSEP Unit No. 2 core spray line repair is acceptable for use throughout unit life. As a result, CP&L does not plan to complete the seal welds for the core spray line bracket repair assembly. However, as a conservative action, CP&L plans to continue remote, enhanced, visual examination of the north loop core spray line bracket repair assembly during future refueling outages.