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SERIAL: BSEP 95-0043

United States Nuclear Regulatory Commission  
ATTENTION: Document Control Desk  
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1  
DOCKET NO. 50-325 / LICENSE NO. DPR-71  
WELD OVERLAY REPAIR OF FEEDWATER PIPING AND SAFE-ENDS

Gentlemen:

The purpose of this letter is to request Nuclear Regulatory Commission (NRC) concurrence with Carolina Power & Light Company's (CP&L) contingency plans to use weld overlay repair techniques for the feedwater piping and safe-ends for the Brunswick Steam Electric Plant, Unit 1. These repairs will be implemented only if defects are identified which require repair. A discussion of the specific circumstances, as well as the technical basis supporting the use of these repair methods as a contingency measure, is enclosed.

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

Very truly yours,

R. P. Lopriore  
Manager  
Regulatory Affairs Section

WRM/wrm

Enclosures

cc: Mr. S. D. Ebnetter, NRC Region II - Regional Administrator  
Mr. D. C. Trimble, Jr., NRC/NRR Project Manager (Acting) - Brunswick  
Mr. C. A. Patterson, NRC Senior Resident Inspector - Brunswick  
The Honorable H. Wells, Chairman - North Carolina Utilities Commission

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## ENCLOSURE 1

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1  
NRC DOCKET NO. 50-325  
OPERATING LICENSE NO. DPR-71  
WELD OVERLAY REPAIR OF FEEDWATER PIPING AND SAFE-ENDS

### SUMMARY

The Brunswick Steam Electric Plant, Unit 1 has feedwater inlet piping to the reactor vessel that is carbon steel up to the nozzle safe-end. A plant modification removed the original carbon steel safe-end, except for a short stub, and installed an Alloy 600 safe-end that accommodated a new feedwater sparger thermal sleeve design.

As a contingency measure, Carolina Power & Light Company (CP&L) is preparing plans for a modification to perform a weld overlay repair of certain feedwater piping welds, if required, in accordance with the NRC Staff positions contained in Generic Letter 88-01, "NRC Position On IGSCC In BWR Austenitic Stainless Steel Piping"; NUREG-0313, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping", Revision 2; the American Society of Mechanical Engineers (ASME) Code, Section XI, 1989 Edition, no addenda; and the ASME Code Committee guidance of Code Case N-504. Such repairs would be made using a material that is highly resistant to intergranular stress corrosion cracking (IGSCC).

Nuclear Regulatory Commission (NRC) review and approval of weld overlay repairs is needed because such repairs are not detailed in the ASME Code, Section XI, 1980 Edition through Winter 1981 Addenda, IWA-4000 and because Code Case N-504 specifically addresses austenitic stainless steel. These repairs will be implemented only if defects are identified which require repair.

### DISCUSSION

The basic function of the feedwater system is to return the condensed steam from the turbine (via the condensate system) back to the reactor pressure vessel (RPV). The feedwater piping affected by this modification is classified as part of the feedwater system. The feedwater piping is connected to the reactor pressure vessel nozzle via a safe-end and four transition pieces. The feedwater inlet piping to the reactor vessel is carbon steel up to the nozzle safe-end. A plant modification removed the original carbon steel safe-end, except for a short stub, and installed an Alloy 600 safe-end that accommodated a new feedwater sparger thermal sleeve design.

The twelve welds listed below are classified as Category "D" using the guidance of NUREG-0313, Revision 2:

Nozzle A	1B21N4A-2-SW2-3
	1B21N4A-2-FWN4A45-3
	1B21N4A-2-SW1-2
Nozzle B	1B21N4B-3-SW2-3
	1B21N4B-3-FWN4B135-3
	1B21N4B-3-SW1-2
Nozzle C	1B21N4C-6-SW2-3
	1B21N4C-6-FWN4C225-3
	1B21N4C-6-SW1-2

Nozzle D

1B21N4D-5-SW2-3

1B21N4D-5-FWN4D315-3

1B21N4D-5-SW1-2

NUREG-0313 requires inspections of these welds and provides repair options if unacceptable flaws are identified. Use of a weld overlay is one repair method recognized by NUREG-0313.

As discussed earlier, CP&L is preparing contingency plans for a modification to install a weld overlay repair of the referenced welds, if required. The modification includes a weld overlay design for the three Inconel 82/182 welds connecting the reactor pressure vessel nozzle, safe-end, and feedwater piping in each feedwater line. The structural integrity of the reactor coolant pressure boundary will not be degraded by installation of the overlay repair. The structural integrity of the nuclear boiler system and reactor pressure vessel will be unchanged by this modification.

The weld overlay will provide full structural design margin with no credit taken for the base material at the crack location and assuming a 360 degree through-wall crack. The weld overlay design is in accordance with the requirements of the ASME Code, Section XI, IWA-4300, 1989 Edition with guidance taken from Code Case N-504. The overlay design has been verified by analysis to be acceptable for the existing design loads and materials. The weld overlay will be a series of weld beads that build up a minimum of two layers on the outside of the pipe to meet the minimum wall thickness required by the ASME Code, Section XI. The overlay length and taper are designed to transfer the loads to the base metal within design allowances. The weld overlay profile will accommodate future inspections by visual, ultrasonic, and radiographic techniques as required by the ASME Code, Section XI and NUREG-0313, Revision 2 to verify that any identified flaw does not propagate into the weld overlay and that the flaw size remains within allowables. Unflawed Inconel welds on the feedwater lines at these safe-end locations may be overlaid to mitigate IGSCC, to minimize future schedule impacts and resource costs, and to minimize accumulated personnel exposure.

The overlay design will use filler metal UNS N06052 (e.g., Alloy E-52). This filler metal will meet the requirements of Code Case 2142. The code case defines the filler metal as a NiCrFe composition to meet SFA 5.14 criteria for manufacture. Welding filler metal UNS N06052 is equivalent to Alloy 690 and contains approximately twice the chromium (28 to 31 percent) of Alloy 82 material (approximately 15 percent chromium).

Alloy 690 has been shown to be highly resistant to IGSCC initiation and propagation. Filler metal UNS N06052 will be effective in mitigating crack propagation due to the same high chromium content, even considering dilution with the base material. Therefore, the first layer of the overlay deposit will constitute the first layer of the weld reinforcement design thickness without field verification of the alloy content.

A copy of the overlay design analysis prepared by Structural Integrity Associates, Inc. is provided in Enclosure 2. A copy of Engineering Service Request 94-00458, "Unit 1 FW Piping and Safe-End Weld Overlay" for the Brunswick Steam Electric Plant, Unit 1 is provided in Enclosure 3.

A technical summary of an example of UNS N06052 weld material is provided in Enclosure 4.

#### CONCLUSION:

Based on the information provided herein, Carolina Power & Light Company requests NRC approval of contingency plans to use weld overlay repair techniques for the feedwater spargers in accordance with the NRC Staff positions contained in Generic Letter 88-01, "NRC Position On IGSCC In BWR Austenitic Stainless Steel Piping"; NUREG-0313, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping", Revision 2; the

American Society of Mechanical Engineers (ASME) Code, Section XI, 1989 Edition, no addenda; and the ASME Code Committee guidance of Code Case N-504. Carolina Power & Light Company also requests NRC approval for using UNS N06052 weld filler metal in accordance with ASME Code 2142 as described herein.

ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1  
NRC DOCKET NO. 50-325  
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WELD OVERLAY REPAIR OF FEEDWATER PIPING AND SAFE-ENDS

STRUCTURAL INTEGRITY ASSOCIATES, INC.  
CALCULATION PACKAGE  
"Weld Overlay Repair Design For BSEP Unit 1 Feedwater Safe-End Welds"