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MAY 03 1995

SERIAL: BSEP 95-0193

U. S. 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  
NUREG-0313 RE-INSPECTION OF RECIRCULATION SYSTEM PIPING WELDS

Gentlemen:

The purpose of this letter is to request Nuclear Regulatory Commission concurrence with a change to Carolina Power & Light Company's re-inspection schedule for two 28-inch reactor recirculation system suction piping-to-elbow welds for the Brunswick Steam Electric Plant, Unit 1. The re-inspection schedule for these piping welds, which are classified as piping welds susceptible to intergranular stress corrosion cracking (IGSCC), was established based on NRC Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping" and NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping."

The basis for this request is provided in Enclosure 1 of this letter. The information provided in this request was summarized and discussed with members of the NRC Staff in telephone discussions on April 24 and 25, 1995. Carolina Power & Light Company requests expedited NRC Staff review of this request in order to support current Unit 1 outage work activities. Based on the current outage schedule for close-out of the drywell, approval of this request is needed by May 12, 1995 to avoid possible delay to Unit 1 start-up.

Please refer any questions regarding this submittal to Mr. R. P. Lopriore at (910) 457-2212.

Sincerely,

John Paul Cowan

WRM/wrm

Enclosures

cc: Mr. S. D. Ebner, Regional Administrator, Region II  
Mr. D. C. Trimble, NRR Project Manager (Acting) - 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. 1

DOCKET NO. 50-325

LICENSE NO. DPR-71

NUREG-0313 RE-INSPECTION OF RECIRCULATION SYSTEM PIPING WELDS

### BACKGROUND:

On January 25, 1988, the Nuclear Regulatory Commission (NRC) issued Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping." This generic letter outlined NRC Staff positions regarding intergranular stress corrosion cracking (IGSCC) in boiling water reactor (BWR) austenitic stainless steel piping. The technical basis for the Staff positions was published in NUREG-0313, Revision 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping."

NUREG-0313 established category definitions for piping weldments based on the susceptibility of these weldments to IGSCC. Category E weldments were defined as those with known cracks but having been reinforced by an acceptable weld overlay or having been mitigated by a stress improvement treatment with subsequent examination by qualified examiners and procedures to verify the extent of cracking.

NUREG-0313 also established inspection schedules for the various categories of IGSCC susceptible weldments. For Category E weldments, the NUREG indicated that these weldments should be inspected at least once every two refueling outages after repair. Approximately half of these weldments should be inspected during the first refueling outage after repair.

By letter dated July 18, 1988, Carolina Power & Light Company (CP&L) agreed to follow the NRC Staff positions regarding the extent and frequency of inspections for the various categories of weldments. Subsequently, in letters dated January 24, 1991 and January 30, 1991, CP&L provided IGSCC inspection results from the Unit 1 Reload 7 outage inspections and the schedule for future inspections of the classified weldments.

### CURRENT SITUATION:

The 28-inch recirculation suction pipe-to-elbow welds (1B32RECIRC-28A4 and 1B32RECIRC-28B4) are classified as Category E in accordance with NUREG-0313. These two welds were ultrasonically (UT) examined during the Reload 4 outage (1985). Circumferential and axial IGSCC indications were identified and engineered (i.e., leak barrier) overlays were applied to both weldments. Also during the Reload 4 outage, inductive heat stress improvement (IHSI) was performed on both weldments. During the Reload 5 outage (1987), the two original overlays were upgraded to full structural overlays. Re-examinations of the two weldments during the Reload 5 outage did not identify growth of the original indications into the overlay or outer 25 percent of the piping. The two weldments were again re-examined during the Reload 7 outage (1990-91) and changes to the original indications were not identified. The 28-inch recirculation suction pipe-to-elbow welds (1B32RECIRC-28A4 and 1B32RECIRC-28B4) were scheduled for UT examination during the current Unit 1 outage consistent with NRC Generic Letter 88-01 and NUREG-0313, Revision 2.

NUREG-0313 states that if improved water chemistry control, including hydrogen addition is implemented, the time schedule for inspections may be extended and that such extension will be evaluated on a case-by-case. NUREG-0313 also states that it was anticipated that periods between inspections could be lengthened by about a factor of two for Category B, C, D, and E weldments.

The use hydrogen water chemistry promotes the recombination of injected hydrogen with coolant dissolved oxygen and other oxidizing species, thereby reducing the concentration of coolant system oxygen. In order for hydrogen water chemistry to be fully effective, the electrochemical corrosion potential (ECP) of the coolant should be lowered to below -230 mV on the standard hydrogen electrode scale. Although hydrogen addition was not used during Cycle 8 operation (from 1990 until 1992), hydrogen addition was used through Cycle 9 operation (from February 1994 until March 1995). Hydrogen water chemistry availability for Cycle 9 was approximately 88 percent during times when reactor coolant system temperature exceeded 200°F. During some operating cycles prior to Cycle 8, ECPs were measured using a crack arrest verification system (CAVS). Previous observations using the CAVS demonstrated that hydrogen rates of approximately 12 to 18 scfm were sufficient to maintain ECP levels less than -230 mV in recirculation system piping. Hydrogen injection rates during Cycle 9 were significantly higher than the rates used during prior operating cycles and were therefore sufficient to ensure that ECP was maintained less than -230 mV in the recirculation system piping. Brunswick Unit 1 has implemented improved water chemistry control since 1990. Average reactor coolant system conductivity levels during Cycle 8 were approximately 0.18  $\mu$ S/cm; average reactor coolant system conductivity levels during Cycle 9 were approximately 0.105 to 0.072  $\mu$ S/cm. Thus, it can be seen that improved water chemistry, including hydrogen addition, has been implemented.

As noted above, the 28-inch recirculation suction pipe-to-elbow welds have flaws that have been repaired with weld overlays. The full structural weld overlay designs assume a 360 degree through-wall flaw that does not penetrate the overlay metal. The weld overlay metal has a high chromium content and is considered resistant to IGSCC. Ultrasonic examinations performed in 1990 confirmed that changes in crack size since the full structural overlays were applied in 1987 were not evident.

The Brunswick Unit 1 refueling outage began on April 1, 1995. As part of the outage work activities, a chemical decontamination of the reactor recirculation piping using the LOMI-AP-LOMI process had been planned. When artifact testing was performed prior to initiating the decontamination, the decontamination factors yielded were much lower than expected. As a result, Carolina Power & Light Company (CP&L) decided to use nitric permanganate (NP), a more aggressive decontamination solution. However, it was considered prudent to limit the use of the NP solution to the recirculation piping instead of circulating the solution through the annulus as originally planned for the LOMI-AP-LOMI solution. For this reason, certain portions of the recirculation system piping were not chemically decontaminated including the 28-inch recirculation suction elbows at the N1 nozzles.

Carolina Power & Light Company estimates that because the chemical decontamination performed did not include at these weld locations, approximately 24 person-REM of personnel radiation exposure would be incurred to conduct the necessary UT examinations of these two recirculation welds (approximately 12.2 person-REM and 11.7 person-REM for the A4 and B4 welds, respectively). Inspection would require approximately 27.5 person-hours for each weld to support the removal of a pipe whip restraint, removal and re-installation of piping insulation, installation and removal of temporary shielding, and installation and removal of the track for the automated UT transducers. Extension of the UT re-inspection interval for these two welds will

allow additional time for CP&L to evaluate alternate measures for reducing radiation dose levels in these two areas when the re-inspections are performed.

#### CONCLUSION:

NUREG-0313 allows for extensions to inspection periods if improved water chemistry and hydrogen water chemistry are implemented. Carolina Power & Light Company has maintained improved water chemistry during the last two operating cycles and has used hydrogen injection during the last operating cycle at levels sufficient to mitigate IGSCC propagation in recirculation system piping. If IGSCC growth should occur in the two recirculation suction pipe-to-elbow weldments (1B32RECIRC-28A4 and 1B32RECIRC-28B4), the weld overlay design will maintain structural integrity and full design margins will be met. Carolina Power & Light Company plans to re-inspect the two recirculation suction pipe-to-elbow welds during the Unit 1 Reload 10 outage (currently scheduled to begin in September 1996). Due to the technical justification provided, Carolina Power & Light Company (CP&L) requests NRC concurrence with a one operating cycle extension of the re-inspection interval for the 28-inch recirculation suction pipe-to-elbow welds.

#### REFERENCES:

1. NRC Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping." January 25, 1988.
2. NUREG-0313, Revision 2, "Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping," January 1988.
3. Letter from A. B. Cutter (CP&L) to D. B. Vassallo (NRC) dated August 16, 1985, "IGSCC Inspection Results."
4. Letter from S. R. Zimmerman (CP&L) to D. B. Vassallo (NRC) dated October 31, 1985, "Correction to IGSCC Inspection Results."
5. Letter from L. W. Eury (CP&L) to Document Control Desk (U.S. Nuclear Regulatory Commission) dated July 18, 1988, "Response to Generic Letter 88-01 and IGSCC Inspection Plans — BSEP-1 Refueling Outage 6."
6. Letter from L. I. Loflin (CP&L) to Document Control Desk (U.S. Nuclear Regulatory Commission) dated January 27, 1989, "IGSCC Inspection Results - Refueling Outage 6."
7. Letter from L. I. Loflin (CP&L) to Document Control Desk (U.S. Nuclear Regulatory Commission) dated March 14, 1989, "Final IGSCC Inspection Results - Refueling Outage 6."
8. Letter from G. E. Vaughn (CP&L) to Document Control Desk (NRC) dated January 24, 1991, "IGSCC Inspection Results — Refueling Outage 7."
9. Letter from S. D. Floyd (CP&L) to Document Control Desk (NRC) dated January 30, 1991, "IGSCC Inspection Results — Refueling Outage 7."

ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1  
NRC DOCKET NO. 50-325  
OPERATING LICENSE NO. DPR-71  
NUREG-0313 RE-INSPECTION OF RECIRCULATION SYSTEM PIPING WELDS

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 re-inspection of the 1B32RECIRC-28A4 and 1B32RECIRC-28B4 recirculation suction pipe-to-elbow welds in accordance with NRC Generic Letter 88-01 and NUREG-0313, Revision 2.	B111R1