

# Core Shroud Inspection Plan

## Unit 2 B213R1 Outage

SEPTEMBER, 1997

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June 12, 1997

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**Core Shroud Inspection Plan  
Brunswick Steam Electric Plant, Unit No 2  
B213R1 Outage  
September, 1997**

**SUMMARY OF PREVIOUS INSPECTIONS**

The scope of reinspection for the Brunswick Steam Electric Plant (BSEP), Unit No. 2 Core Shroud is based on the results of previous inspections performed on both BSEP Unit No. 1 and Unit No. 2, follow-up actions and commitments established from the last inspection and guidance on shroud inspections and flaw evaluation obtained in the "Core Shroud Inspection and Evaluation Guidelines", issued by the Boiling Water Reactor Vessel Internals Program (BWRVIP).

Inspection of the BSEP Unit No. 2 core shroud during the B211R1 refueling outage (May 1994) was prior to the issuance of Generic Letter 94-03. This inspection was also performed while development of some of the ultrasonic tooling currently being used was ongoing. Reliability problems arose and use of the tooling was abandoned. Automated ultrasonic testing (UT) scanners commonly used for shroud inspections will not work on the BSEP shrouds because of interference from the clamps on the H2 and H3 welds. Specialized tooling has since been developed to inspect the inside diameter (ID) and outside diameter (OD) surfaces of welds H1, H4, H5, core support ring welds H6A and H6B and associated fillet welds, and weld H7. These welds were previously inspected from the OD only using VT. The H9 weld was previously inspected as part of the vessel beltline inspections because it is located directly behind one of the vessel beltline welds. Additionally, UT measurements were repeated at selected areas on the H4 during the B212R1 outage in order to assess crack growth during that cycle.

**UNIT 2 CORE SHROUD REINSPECTION PLAN**

The reinspection plan for the core shroud focuses on the application of improved inspection techniques for welds where internal surfaces were not accessible, and on reinspecting areas inspected last outage to determine crack growth rates. Tooling commonly used in the industry will not work on the BSEP shrouds due to interference from the H2/H3 repair clamps. Specialized tooling has been developed to inspect these welds.

Welds H1, H2 and H3 will not be inspected this outage. One hundred percent (100%) of the accessible areas of the H1 weld were inspected during the B212R1 outage. Any anticipated growth of the noted indications will not impact structural margins. Welds H2 and H3 have been structurally replaced by the clamps.

Weld H4 will be UT examined at two locations for determination of crack depth growth; these two locations were previously examined during the B212R1 refueling outage. The H5 weld was visually inspected on the ID and OD during the B211R1 refueling outage with relatively little

cracking noted. Carolina Power & Light Company plans to UT inspect the H5 weld during the B213R1 outage to gain additional coverage and determine the depth of the cracking.

Welds H6A, H7, and H9 will not be inspected this outage. One hundred percent (100%) of the accessible areas of H6A, H7, and H9 were UT examined during the B212R1 outage. Any anticipated growth of the noted indications in welds H6A and H7 will not impact structural margins. No indications were noted in weld H9 during the B212R1 inspections.

Weld H6B will be re-examined this outage to determine crack growth and achieve additional coverage in areas not previously accessible. The phased array equipment utilizes smaller inspection probes which should permit access to additional areas of the weld. Additionally, the phased array techniques are being designed to reduce the error band margins for depth and length.

Weld H8, the shroud support legs and other areas below the core plate will not be inspected this outage because the BWRVIP is still developing inspection and evaluation guidelines, and equipment and techniques have not been developed for these areas. These areas will be inspected in the future consistent with BWRVIP guidance.

Although not currently required in the BWRVIP guidelines, inspection of the H9 weld has already been performed. This weld is directly behind one of the vessel beltline welds, so examination of the H9 weld was performed as part of the beltline weld examination during the B212R1 refueling outage.

Three of the twelve repair clamps will be visually inspected in accordance with BWRVIP Inspection and Evaluation Guidelines to assure no degradation during the last cycle of operation.

Details of the scope of inspection for each weld, and for the clamps, are described in Table 1. During the course of the inspections, unanticipated interferences may be encountered that will require changes to this plan. These situations will be evaluated as they arise.

## **INSPECTION SCOPE EXPANSION**

Additional areas of the shroud welds will be inspected if crack growths are unusually higher than predicted crack growth and NDE measurement uncertainty. The NDE uncertainty will be determined in qualification testing by the inspection vendor. These qualifications will be in accordance with the BWRVIP inspection guidelines.

If any unusual findings are confirmed upon inspection of the three clamps, the remaining clamps will be inspected to determine the extent of any changes.



## **EVALUATION**

An engineering evaluation will be performed on the inspection results, using the flaw evaluation guidance of the BWRVIP "Core Shroud Inspection and Evaluation Guidelines." No significant changes from the last inspection results are expected.

**TABLE 1**  
**Unit 2 Refueling Outage 12 (B213R1) Core Shroud Reinspection**

WELD	PREVIOUS INSPECTION RESULTS	REINSPECTION METHOD*	COMMENTS
H1	1994 - VT of OD between 4 lug sets with no indications noted.  1996 - UT of 100% of the accessible ID and OD areas.	None planned	Not scheduled for examination this outage. Sufficient structural margins exist. Any anticipated growth of indications will not impact structural margins.
H2	VT at 2 locations with circumferential cracking.	N/A	Replaced by clamps.
H3	None	N/A	Same as H2.
H4	1994 - UT of 100% of accessible area (78.8%) from OD. Found 110.6" of random ID circumferential cracking. No OD cracking found. Depths from 0.10" to 0.86".  1996 - UT at 2 - 20" areas for crack depth growth determination. No significant growth detected.	UT	UT at 2 - 20" areas for crack depth growth determination.
H5	1994 - VT of 100% of ID and 30.5% of OD. 59.3" of circumferential cracking found on ID and 11" of circumferential cracking found on the OD  1996 - None performed.	UT	Relatively little cracking found during 1994 (B211R1) outage inspections. Will UT this outage to obtain additional coverage.
H6A	1994 - VT 6% of OD with a 1.5" circumferential crack.  1996 - UT 100% of accessible areas. 79% of weld length examined with 5.3% of examined weld length flawed.	None planned	Not scheduled for examination this outage. Sufficient structural margins exist. Any anticipated growth of indications will not impact structural margins.
H6B	1994 - VT 6% of OD with no circumferential cracking.  1996 - UT 100% of accessible areas. 78.4% of weld length examined with 69.6% of examined weld length flawed.	UT	UT with phased array techniques to improve coverage and refine length and depth sizing capabilities..

WELD	PREVIOUS INSPECTION RESULTS	REINSPECTION METHOD*	COMMENTS
H7	1994 - VT of 6% of the OD with no circumferential cracking.  1996 - UT 100% of accessible areas. 75.6% of weld length examined with 10.9% of examined weld length flawed.	None planned	Not scheduled for examination this outage. Sufficient structural margins exist. Any anticipated growth of indications will not impact structural margins.
H8	None	None planned	BWRVIP developing inspection tools/techniques.
H9	1996 - UT 100% of accessible areas. 99% of weld length examined with no flaws noted.	None planned	Not scheduled for examination this outage. Sufficient structural margins exist. Any anticipated growth of indications will not impact structural margins.
Shroud support legs	Not inspected.	None planned	BWRVIP developing inspection tools/techniques.
Shroud clamps	1994 - VT of 2 installed clamps.  1996 - VT of 3 different installed clamps.	VT	Inspect 3 clamps for general appearance, missing parts, and integrity of tack welds. Will bring the total clamps inspected to 8 of the 12 total installed.

\* NDE methods to be qualified in accordance with "BWRVIP Reactor Pressure Vessel and Internals Examination Guidelines" issued by the BWRVIP.



ENCLOSURE 2

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2  
NRC DOCKET NO. 50-324  
OPERATING LICENSE NO. DPR-62  
SUBMITTAL OF UNIT 2 CORE SHROUD RE-INSPECTION PLANS

LIST OF REGULATORY COMMITMENTS

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

Commitment	Committed date or outage
1. Perform reinspections of the BSEP Unit No. 2 core shroud in accordance with the Core Shroud Reinspection Plan dated June 12, 1997.	B213R1
2. Submit the results of BSEP Unit No. 2 core shroud re-inspections.	Within 30 days following completion of the inspections.