



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W.
 ATLANTA, GEORGIA 30323

Report Nos.: 50-325/84-34 and 50-324/84-34

Licensee: Carolina Power and Light Company
 411 Fayetteville Street
 Raleigh, NC 27602

Docket Nos.: 50-325 and 50-324

License Nos.: DPR-71 and DPR-62

Facility Name: Brunswick 1 and 2

Inspection Conducted: November 13-16 and November 20-21, 1984

Inspectors: *J. L. Coley* 12/14/84
 J. L. Coley Date Signed
*R. W. Newsome** 12/14/84
 R. W. Newsome* Date Signed

*Participated in the November 13-16, 1984 inspection only

Approved by: *J. J. Blake* 12/15/84
 J. J. Blake, Section Chief Date Signed
 Engineering Branch
 Division of Reactor Safety

SUMMARY

Scope: This routine, announced inspection entailed 71 inspector-hours on site in the areas of independent verification of ultrasonic examinations performed in accordance with Generic Letter 84-11, review of ultrasonic examination data and observation of overlay repair welding.

Results: A violation was identified - failure to follow ultrasonic procedure for selection of angle beam transducer, performing 1½ V-Path calibration, and recording of geometric indications - paragraph 5.b.

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REPORT DETAILS

1. Licensee Employees Contacted

- **P. W. Howe, Vice President, Brunswick Steam Electric Plant (BSEP)
- **C. R. Dietz, General Manager, BSEP
- **K. E. Enzoy, Director, Regulatory Compliance, BSEP
- **B. E. Hinkley, Supervisor, Engineering Division, BSEP
- *L. W. Wheatley, ISI Project Engineer, BSEP
- *S. D. Connelly, ISI Engineer, BSEP

Other licensee employees contacted included technicians and office personnel.

Other Organization

- *J. L. Briggs, NDE Level III Examiner, General Electric

NRC Resident Inspector

- **D. O. Myers, Senior Resident Inspector

*Attended exit interview on November 21, 1984

**Attended exit interview on November 16 and November 21, 1984

2. Exit Interview

The inspection scope and findings were summarized on November 16 and 21, 1984, with those persons indicated in paragraph 1 above. The inspector discussed the inspection finding listed below in detail. No dissenting comments were received from the licensee.

Violation 50-325/84-34-01, Failure to follow ultrasonic test procedure for selection of angle beam transducer, performing $1\frac{1}{2}$ V-Path calibration, and recording of geometric indications - paragraph 5.b.

3. Licensee Action on Previous Enforcement Matters

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Independent Verification of Ultrasonic Examinations Performed in Accordance with Generic Letter 84-11 - Unit 1 (73753B)

On April 19, 1984, NRC issued Generic Letter 84-11 to all licensees of operating reactors, applicants for operating license, and holders of construction permits for boiling water reactors. This letter addressed the problem that inspections conducted at several boiling water reactors (BWRs)

revealed intergranular stress corrosion cracking (IGSCC) in large diameter recirculation and residual heat removal piping. These inspections were conducted pursuant to IE Bulletins 82-03, Revision 1, and 83-02 and the NRC August 26, 1983 Orders. The letter expressed the Commission's opinion that the results of the above inspections mandated an ongoing program for similar reinspection at all operating BWRs. The Generic Letter also described those actions which licensees should take to provide an acceptable response to the IGSCC concern.

Carolina Power and Light (CP&L) Company's letter of response to Generic Letter 84-11, dated October 9, 1984, was reviewed by Region II. In this letter, CP&L committed to inspect 100% of all nonconforming stainless steel weld joints that were four inches or greater (except those that had been repaired by weld overlays) on Unit 1.

CP&L's response also stated that the performance capability of Level 2 and Level 3 UT examiners performing evaluations would be demonstrated in accordance with IE Bulletin 83-02. Levels 1, 2, or 3 UT examiners performing operations other than evaluations (general scanning observations and discrete signal interpretation) would be required to demonstrate their field performance capability.

Examiners that perform final crack sizing measurements would have also completed the EPRI crack sizing course.

On November 13, 1984, Region II inspectors arrived at the Brunswick Plant to perform independent reverification of a select sample of welds that had been ultrasonically examined by General Electric (GE). The basis for this "hands on" inspection by Region II personnel was to resolve questions concerning differences between data taken by Southwest Research Institute (SwRI) during the IE Bulletin 82-03 examinations and data taken by General Electric during the present Generic Letter 84-11 examinations. The welds initially in question were the 22" recirculation system header end caps. SwRI had recorded numerous indications which were evaluated as geometric in origin. However, GE had not recorded any such indications. Subsequent to arriving at the Brunswick site, the inspectors found that this omission was partially due to GE's failure to examine the forging side of the end caps. Since GE was performing the missing scans on the recirculation system end caps on November 14, 1984, the inspectors performed examinations on portions of the following recirculation system welds:

<u>Welds I.D. No.</u>	<u>Results</u>
B 32 - RECIRC 28" - A3	Recorded Indications Plotted as Geometric
B 32 - RECIRC 28" - A4	Recorded Indications Plotted as Geometric
B 32 - RECIRC 28" - B3	Recorded Indications Plotted as Geometric
B 32 - RECIRC 28" - B4	Recorded Indications Plotted as Geometric

The results obtained by the inspectors on the above welds, when compared to the GE data, agreed only from the stand point that both teams considered the indications to be caused by geometric conditions and not cracks. However, significant differences were observed by the inspectors in the signal amplitude and in the method of recording geometric indications, with GE recording at least 50% (six decibels) less signal amplitude than NRC. GE's data also indicated that reflectors' end points could not be discriminated from other ID noise or other geometrical indications. Therefore, GE recorded the indications as 360° of the pipe circumference. NRC inspectors used the GE procedure and experienced no problem finding the end points to record indications one to two inches in length.

The final results of GE's examination of the end caps were compared to the SwRI data. This comparison essentially resembled the GE/NRC comparison, with GE seeing the indications six decibels less sensitive, but recording the indications 360° of the pipe diameters. During the inspectors' November 16, 1984, exit, the licensee was informed that GE's failure to record ultrasonic indications in accordance with GE Procedure UT 1.30 was an apparent violation. The licensee agreed during this meeting to have GE's Level III examiners re-examine the end caps to determine the root cause of GE's consistent differences in amplitude in comparison to those recorded by NRC and SwRI using the same essential techniques and calibration blocks. On November 19, 1984, CP&L notified Region II that GE examiners had concluded that the difference in amplitude was apparently due to the different beam profiles of the transducers involved. GE had used a 45 degree 2.25 MHz transducer, SwRI had used 45 degree and 60 degree 1.5 MHz transducer, and NRC had used a dual element 45 degree 1.5 MHz transducer. CP&L also stated that SwRI had been requested to send their transducer to CP&L in order that a comparison could be made with the GE transducer on CP&L's Nine Mile Point crack test specimen.

The Region II's analysis of the above CP&L conclusions indicated the possibility that GE's transducer was not seeing the ID indications with the principal axis of the ultrasonic beam. Both transducers had been calibrated to a common-screen height, using the same calibration reflector, and should have seen the indications within a reasonable percent error. However, six decibels difference in the ability of the equipment to see the indication when calibrated to the same reflector indicated a more serious problem than indicated by CP&L. On November 20, 1984, the inspector returned to the Brunswick site and found that CP&L had received the SwRI transducer. CP&L, GE, and the inspector decided to make equipment comparisons in two phases. The first phase was completed by using CP&L's Nine-Mile Point crack block as a reference for making comparisons between GE and SwRI equipment. The Nine-Mile Point block is a large diameter, stainless steel, pipe-to-fitting (elbow), similar to the piping welds examined the preceding week by the inspectors. The block was also used by the licensee to conduct performance demonstration tests between Level I scanning examiners and Level II

examiners who perform evaluations. The second phase of the comparison involved using GE, SwRI and NRC equipment on specific indications recorded by SwRI on the 22" RECIRC header end caps and specific indications recorded by the inspectors on the 28" RECIRC piping. Calibration of all equipment was performed by GE. The results of both phases were as follows:

- a. Three indications were plotted by GE on the Nine-Mile Point blocks. These indications were seen at 100% DAC indications when using the SwRI transducer and 50% DAC when using GE's transducer. However, the inspector observed that the amplitude of the signals were still rising when movement of both transducers was arrested by the weld crown. This indicated that neither transducer had the main axis of sound on the crack indications and that the weld crown was restricting adequate coverage of the weld examination area required by Appendix III, paragraph III-3230, of Section XI, to the ASME Code and paragraphs 5.5 and 5.5.1 of GE's Procedure VT 1.30, Revision 5. In order to ascertain if adequate coverage was being obtained, the inspectors requested that the width of the weld crown be measured, the center of the weld be determined, and thickness measurements be taken. The measurements were used in the formula for determining whether a half V-Path examination could be performed and, if so, what degree transducer would be necessary to ensure coverage of the examination area. The results revealed that when a half V-Path examination was performed, a 60° transducer should have been used in accordance with GE's procedure UT 1.30. The primary beam of the 45° transducer used GE failed to cover the required examination area by 0.480 inch. This conclusion should not have affected the results obtained by either vendor on the recirculation system end caps since both teams were calibrated to a 1½ V-Path distance and the weld crowns on the RECIRC header end caps did not restrict the examination coverage. However, the weld crowns on the 28" welds, that the inspectors had examined were very similar to the Nine-Mile Point blocks and GE had only performed ½ V-Path examinations on these welds. The inspectors had used a dual-element "send and receive" transducer which achieved full examination coverage at ½ V-Path because the sound exited at the front of the transducer. In addition, the inspectors had set up an instrument using ID and OD notches to ensure coverage at 1½ V-Path.
- b. During GE's 1½ V-Path calibration for the second phase, the inspectors noted that the GE procedure required axial drilled holes be used for calibration. In addition to this being technically incorrect, CP&L's calibration block would not allow this calibration because of additional holes drilled in the block. GE examiners had recognized that these holes could not be used and were using the side drill holes on the block. The inspector informed the licensee that procedures were to be followed, and if the procedure was recognized to be inaccurate, the procedure should be revised. The licensee was also informed that this discrepancy was considered one example of the apparent violation.

The results of the examinations which compared specific indications using GE, SwRI and NRC equipment on the recirculation system header end cap revealed that all equipment gave identical signal responses for the indications. All indications were 90% DAC or above, except for one indication which all instruments agreed was 50% DAC.

The inspectors also confirmed that all indications had end points which could clearly be resolved from the noise level when compared to the calibration reference level established by the GE procedure. GE was questioned as to how they were able to report indications 360° when their equipment demonstrated end points to the indications. GE demonstrated how they had accomplished this by increasing their sensitivity by six decibels from the primary reference level and combining all indications regardless of W measurements or sweep reading as a single indication that would be represented by one plot.

The licensee was notified that GE's procedure established a primary reference level for recording indications. Indications with recordable amplitudes, different W measurements, sweep readings and observed end points at primary reference levels should be recorded in accordance with the GE procedure. This item was identified as a second example of GE's failure to follow this procedure.

The last portion of the equipment comparison dealt with the recorded differences between NRC's examination and GE's examination on the 28" recirculation welds, Nos. A3 and A4. As expected, the weld crown was a restricting factor. The NRC's transducer peaked the indications above DAC; however, the GE transducer would lift off due to the irregular ground surface with the signal only 30% to 40% DAC in amplitude. The licensee was informed that GE had not followed their procedure for determining the angle of transducer they should have used in order to obtain full examination coverage (this was also demonstrated on the Nine-Mile Point block in 5.2 above) and that this deficiency would be the third example of GE's failure to follow procedure. This violation was identified as 50-325/84-34-01. Failure to follow ultrasonic test procedure for selection of angle beam transducer, performing 1½ V-Path calibration, and recording of geometric indications.

In order to determine if cracks would have been detected in all the large diameter RECIRC piping, the licensee was requested to perform precise measurements on the Nine-Mile Point block to ensure that the three indications recorded by GE were cracks. If the GE transducers could see cracks when restrictions were encountered, the next step was to determine how typical was this weld crown restriction to all of the 28" pipe welds previously examined for compliance with Generic Letter 84-11. On November 28, 1984, CP&L notified NRC that radiographs and weld profiles had been reviewed for all 28" welds. CP&L had determined that if cracks were located in the near side weld fusion line on all of these welds except one (B-2), they would have detected

them based on determinations made on the Nine-Mile Point block restrictions. CP&L also stated that weld B-2 had been re-examined with a 60° transducer and found to be acceptable. Based on a review of the data by the inspector, actual observation of the restriction on the 28" pipe at Brunswick, the proficiency of the GE examiner to discern cracks, and the adequacy of GE's procedure for evaluating all low amplitude indications, the inspector concurred with CP&L's analysis that cracks in the 28" welds would have been recorded.

Within the areas examined, no violations or deviations were observed except as noted in paragraph 5.b above.

6. Data Review and Evaluation - Unit 1 (73755B)

The inspector reviewed GE's completed data for Generic Letter 84-11 and compared this data where applicable with data taken by SwRI. This comparison was made to ascertain if any difference in recorded data existed. Data for the following welds were reviewed:

<u>Weld No.</u>	<u>GE Data Reviewed</u>	<u>SWRI Data Reviewed</u>
1-ELL-20" A-Suction-2	Yes	Yes
1-B32-22" AM-6	Yes	Yes
1-B32-22" BM-1	Yes	Yes
1-B32-28" A-4	Yes	No
1-B32-28" A-3	Yes	No
1-B32-28" B-2	Yes	No
1-B32-28" B-4	Yes	No

The inspectors' review of this data revealed that differences in the methods of recording indications between the two vendors as discussed in paragraph 5 above, prevented the inspector from obtaining any useful information from the comparison.

Within the area examined, no violations or deviations were observed.

7. Observation of Overlay Repair Welding - Unit 1 (55050)

The inspector observed in-process welding for the following reactor water clean-up system weld overlays:

Weld Nos.
6" RWCU-10-A
6" RWCU-6-A

Welding observed on the above welds was compared to the parameters of Welding Procedure 8BU12-R2, Drawing FSM-409-Sheet 1-SK-P-84-315-21, and Plant Modification 84-315.

Within the areas examined, no violations or deviations were observed.