



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

Report Nos.: 50-325/85-15 and 50-324/85-15

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

Inspection Conducted: May 13 - 17, 1985

Inspector:

*James L. Colby*  
J. L. Colby

*6/10/85*  
Date Signed

Approved by:

*J. J. Blake*  
J. J. Blake, Section Chief  
Engineering Branch  
Division of Reactor Safety

*6/10/85*  
Date Signed

SUMMARY

Scope: This routine, unannounced inspection entailed 34 inspector-hours on site in the areas of independent inspection effort, inservice inspection - review of procedure and observation of work, observation of completed welding by visual examination, and review of radiographic film.

Results: No violations or deviations were identified.

Carolina Power and Light Company

2

**JUN 12 1985**

bcc w/encl:  
NRC Resident Inspector  
Document Control Desk  
State of North Carolina

RII  
JL Coley:cdg  
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## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- \*C. R. Dietz, General Manager - Brunswick Nuclear Project (BNP)
- \*B. E. Hinkley, Manager, Technical Support - BNP
- \*A. G. Cheatham, Manager, Environmental and Radiation Control - BNP
- \*K. E. Enzor, Director, Regulatory Compliance - BNP
- \*L. Wheatley, Inservice Inspection (ISI) Project Specialist - BNP
- \*B. L. Mann, ISI Senior Specialist - BNP

Other licensee employees contacted included construction craftsmen, engineers, technicians, operators, mechanics, security force members, and office personnel.

#### NRC Resident Inspector

- \*T. E. Hicks, Resident Inspector

\*Attended exit interview

### 2. Exit Interview

The inspection scope and findings were summarized on May 17, 1985, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee. The following new items were identified during this inspection:

- a. Unresolved Item 50-325, 324/85-15-01, Recording Areas of Examination as Limited Scans because Nondestructive Examinations Procedures Limit Equipment Selection, paragraph 6.b(2).
- b. Inspector Followup Item 50-325, 324/85-15-02, Circumferential Scans on Weld Metal for Axial Defects Should Be Performed With Refracted Longitudinal Wave Transducers, paragraph 5.a.

The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

### 3. Licensee Action on Previous Enforcement Matters

(Open) Violation 50-325/84-34-01, Failure to follow procedure for selection of angle beam transducer, performing 1 1/2 V-Path calibration and recording of geometric indications as a result of the inspector's review of ultrasonic data taken after induction heat stress improvement on Unit 1. The inspector

concluded that the licensee has not determined the extent of problems detailed in this violation. Also as a result of subsequent inspection findings detailed in this report and in NRC Inspection Report 50-325, 324/85-10 dated May 20, 1985, it is apparent that corrective actions as delineated in Carolina Power and Light Company's (CP&L) letter of response dated January 25, 1985, were insufficient and ineffective. The inspector has discussed this matter in detail with CP&L's management and technical personnel. Determinations as to whether effective corrective actions are taken by the licensee will be reviewed by the inspector during a subsequent inspection this outage.

#### 4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violations or deviations. One new unresolved item identified during this inspection is discussed in paragraph 6.b.(2).

#### 5. Independent Inspection Effort - Units 1 and 2 (92706)

- a. NRC independent measurements of licensee reported throughwall crack indication on weld No. 1-B32-Recirc-AR-12"-D3.

On May 10, 1985, Region II was notified by CP&L that throughwall cracks had been detected visually by observation of leakage on four welds that had been ultrasonically examined during the October 1984 outage and found free of intergranular stress corrosion cracking (IGSCC). The cracked four welds were part of a total population of 25 welds that had received induction heat stress improvement (IHSI) during the present outage. On May 13, 1985, the inspector arrived at the Brunswick site and during discussions with CP&L cognizant personnel discovered that ultrasonic examinations performed on the above four welds after IHSI could not detect any of the indications of crack where leakage had been observed. However, General Electric (GE), CP&L's nondestructive test vendor, was now reporting significant circumferential cracking in three of the four welds with throughwall depths ranging from 60% to 80%. No indications were recorded in these areas during the October outage. The inspector decided to examine the four welds and determine why GE could not see ultrasonically an indication that was observed visually leaking. As a result of in-process IHSI on loop "B" the inspector was limited to the examination of Weld 1-B32-Recirc-AR-12" D3 on the loop "A". The inspector's examination of weld D3 using shear wave transducers similar to the transducers used by GE did not reveal the crack when examining in a circumferential direction, an axial direction or tangentially. The inspector then set up NRC's equipment using a refracted longitudinal wave transducer which industry research and development organizations, such as the Electric Power Research Institute (EPRI) in Charlotte, North Carolina, have been suggesting for over a year should be used to ensure complete examination of weld metal. When the inspector scanned circumferentially on the weld in a counter clock wise direction the throughwall indication was observed

running completely from the inside diameter to the outside diameter in an axial direction on the pipe side. In addition to the throughwall indication, the inspector noted several other axial indications within inches of the throughwall indication that were exhibiting depth measurements of near throughwall magnitude. These indications could only be seen when scanning on the weld. However, plots made by the inspector indicated that although the leak was detected on the pipe near the toe of the weld, the cracks were in the heat affected zone on the pipe side and their detection was being masked by the weld metal when shear wave transducers required by the GE procedure were being used. The inspector reported his findings to the licensee who had GE use the inspector's transducer and reinspect the weld circumferentially. The first GE team including a Level III examiner could not duplicate the inspector's findings. However, a second GE team including a different Level III examiner was later able to reproduce the findings. The inspector recommended to the licensee that whenever the weld crown would allow scanning in a circumferential direction that a refracted longitudinal wave transducer should be used. However, until the licensee can make further evaluation of this equipment selection, this item will be reported as Inspector follow-up item 50-325, 324/85-15-02, Circumferential scans on weld metal for axial defects should be performed with refracted longitudinal wave transducers.

- b. During a previous inspection, reported in NRC Report No. 50-325/85-10 and 50-324/85-10, the inspector had questioned the examination results of reactor vessel nozzles which had been buttered with Inconel-182. The licensee was examining the Inconel-182 butter for axial cracks as recommended by NRC Information Notice 84-41, "IGSCC In BWR Plants." The inspector questioned the examination for three reasons: (1) the examiner was getting an interface signal from the carbon steel (CS) to Inconel-182 when scanning in an axial direction on the nozzle that indicated total sound deflection from the CS/Inconel boundary; (2) the examination procedure required a 2.25 Mega Hertz (MHz) shear wave transducer be used. This was a technically poor selection of transducers because a shear wave transducer with a frequency of 2.25 MHz cannot be depended upon to fully examine weld metal and particularly Inconel-182 which is extremely difficult to examine. A lower MHz, refracted longitudinal wave transducer as described in (a) above would have been the more technically practical equipment to have use; (3) the licensee did not have a calibration block buttered with Inconel-182 so that it could be demonstrated that the weld butter was being examined.

During this inspection period, the inspector was informed that blocks with notch reflectors in the weld and inconel butter had been procured and that they were available for the inspector to examine. The inspector used NRC equipment and examined these welds with a refracted longitudinal wave transducer. The inspector's examination concluded that although an interface signal was obtained at the CS to Inconel 182 boundary when scanning axially from the CS side the inspector could readily detect the inside diameter (I.D.) notches in the buttered

material when scanning circumferentially. This means that the axial cracks in the buttered material that were the concern addressed in the Information Notice could be detected if proper equipment is used. The licensee informed the inspector that the EPRI Nondestructive Test Center in Charlotte, North Carolina, has agreed to come to the Brunswick site and examine the nozzle welds using "state of the art" technique and equipment that have been developed at the center. The inspector will review their results, techniques, and equipment on a subsequent inspection.

- c. During the inspector's surveillance of the Unit 1 drywell, the inspector noted that lug attachments on the 24-inch mainsteam (MS) piping were not welded 360° on pipe elbows. However, lug attachments on other 24-inch mainsteam piping were welded 360°. Examples of welds that were not 360° were on lug attachments for snubber 1PSN-C35556 and snubber 1PSN-D3SS-73. The inspector reviewed construction drawings for both of these lug attachments which required that they be welded 360°. However, prior to the exit meeting the licensee found the basis for this deviation from the drawings in their history file. The basis for deviation was that the MS system used welded elbows and the pipe vendor did not want lug attachments to be welded over the longitudinal weld in the elbows. The inspector reviewed the data furnished by the licensee and has no further questions on this drawing deviation.

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

#### 6. Inservice Inspection (ISI) - Unit 1

Inservice examinations of Unit 1, Classes 1 and 2, ASME Boiler and Pressure Vessel Code piping, excluding the recirculation system, were being performed by Southwest Research Institute (SWRI). The applicable edition of the ASME Code for these examinations is the 1977 edition including addendum through the summer 1978.

##### a. Review of Procedures (73052)

The inspector reviewed SwRI ultrasonic examination procedure SwRI-NDT-600-1, Revision 0, dated April 1985, to ascertain whether the procedure pertaining to the inservice inspection was consistent with regulatory requirements and licensee commitments. During the inspector's review and subsequent observation of the procedures implementation three areas of concern were noted.

- (1) The procedures required time period for calibration confirmation of the instrument was at the beginning and end of the weld examination performed during one outage. In the case of Brunswick Unit 1 this could be a period of seven months. This calibration time period was taken from Code Case N-335 which was written for



equipment used on specific materials for specific type discontinuities. However, the ASME Code requires that instrument calibration confirmation be verified at the beginning of each period of extended use or every three months whichever is less. The licensee was notified of this inconsistency of requirements and agree that the three-month period for instrument calibration confirmation should take precedence over the requirement in Code Case N-335. The licensee required SwRI to issue a deviation to the procedure to correct this situation. The inspector considered the licensee's corrective action satisfactory on this item and no further action is required.

- (2) The inspector's second concern involved the procedure requirements for marking the examination reference starting point and direction of scanning. This point is designated as the Lo point by Code terminology. The ASME Code, Appendix III, Supplement 2, and Code Case N-335, Supplement 2, require this point to be applied by a low stress metal V-stamp in accordance with the rules of Supplement 2. SwRI procedure allows the mark to be applied by vibro-tooling, low stress metal stamps, or grease pencil whichever method the licensee requires. SwRI uses a grease pencil at Brunswick and this mark would be erased before the examination was completed. However, during observation of SwRI examinations on the main steam line the inspector found that although the Lo points had been established on the pipe they were not established in accordance with the rule of Supplement 2 of the ASME or Code Case N-335. SwRI started their examination from the Lo point and referenced how far this was from the rules in Supplement 2. This technique is satisfactory to Region II because it assures that previous data can be compared. However, all future markings should be established with a low stress stamp in accordance with Supplement 2 for cases of new piping modification, such as the Class 1, 6-inch reactor water cleanup system that will be installed this outage and cases where present systems are found not to be marked and previous examination data cannot accurately determine where the Lo mark was located. The licensee agreed with the inspector's interpretation of the Code requirements.
- (3) The inspector's third procedure concern was identified after observing SwRI personnel limit areas of scan based only on procedure restrictions on the size of transducer that could be used. This item will be discussed in more detail under Observation of Work in paragraph 6.b. below.

The above procedure was verified for compliance to the following attributes:

- Procedure approval
- Qualification of personnel

- The type of apparatus to be used including frequency range as well as linearity and signal attenuation accuracy requirements were specified.
- The extent of coverage (beam angles, scanning surface, scanning rate and directions) as well as the scanning techniques are specified and are consistent with the ASME Code.
- Calibration requirements, methods and frequency including type, size, geometry and material of calibration blocks as well as location and size of calibration reflectors within the block are clearly specified and consistent with the applicable ASME.
- The sizes and frequencies of search units are specified and are consistent with the ASME code.
- Beam angle or angles are specified and are consistent with the ASME Code.
- Methods of compensation for the distance traversed by the ultrasonic beam as it passes through the material including distance - amplitude correction curves, electronic distance - amplitude correction and transfer mechanism, if used, are specified and are consistent with the ASME Code.
- The reference level for monitoring discontinuities is defined and the scanning gain setting specified and that these values are in accordance with the ASME Code.
- Levels or limits for evaluation and recording for indications are specified and are in accordance with ASME Code, Section XI.
- Method of recording significant indications is established and the reporting requirements are in accordance with licensee requirements.

b. Observation of Work Activities - Unit 1 (73753B)

On May 14, 1985, the inspector observed SwRI examiners perform an examination of Weld No. 7 on Line No. B21-PS-24-C. This was an ASME Code, Class 1, 24-inch diameter mainsteam pipe to elbow weld.

The inspector observed the SwRI examination to ascertain if the following criteria were being performed:

- Approved NDE procedures are available, are being followed and specified NDE equipment is being used.



- NDE personnel are knowledgeable of examination method and operation of NDE equipment.
- NDE personnel with proper level of qualification and certification are performing the various examination activities including designation of NDE method/technique to be used, equipment calibration, examination, and interpretation/evaluation/acceptance of test results.
- The type of apparatus used, including frequency range as well as linearity and signal attenuation accuracy.
- The extent of coverage (beam angles, scanning surface, scanning rate and directions) as well as the scanning technique.
- Calibration, methods and frequency including the type, size, geometry and material of identified calibration blocks as well as location and size of calibration reflectors within the block are clearly determined and recorded.
- The sizes of frequencies of search units.
- Beam angle or angles.
- Methods of compensation for the distance traversed by the ultrasonic beam as it passes through the material including distance - amplitude correction curves, electronic distance - amplitude correction and transfer mechanism, if used.
- The reference level for monitoring discontinuities is as defined and the scanning gain setting is as specified.
- Levels or limits for evaluation and recording of indications.
- Method of recording significant indications.
- Acceptance limits are determined.

During the examination, the inspector noted the following areas of concern:

- (1) The examiner was scanning and observing the instrument at the same time. SwRI Procedure NDT-600-1, Rev. 0, required scanning be performed by overlapping the transducer scans by 50% or by oscillating the transducer approximately  $\pm 20$  degrees while scanning. The SwRI examiner elected to scan by oscillating the transducer. However, the examiner's attention was on the instrument and not the direction he was scanning. The inspector noted that he was scanning only in one tangential direction. The inspector pointed this out to CP&L's Quality Control (QC) and to the SwRI examiner and questioned him as to whether the examina-

tion being observed was intended to be a tangential scan or an axial scan. The examiner stated it was entered to be an axial scan. Discontinuities could have easily been missed if the examiner had not corrected his scanning technique. CP&L QC is presently performing examination surveillance and the inspector requested that CP&L's QC examiner make this scanning technique observation an attribute on his surveillance in the future.

- (2) The inspector's second area of concern came when the examiner told his recorder to list two areas of scan limitations. The limitations were expansion guide bars welded to the pipe support and not to the pipe or weld being examined. In fact, the inspector could easily slide his hand between the pipe and the support guide bar. However, the design of the SwRI transducer wedge and the size of the transducer prevented this transducer from performing the examination. The inspector reviewed the SwRI procedure and found that it limited the examiner to use this transducer. The inspector discussed this finding with CP&L cognizant personnel and emphasized the fact that if the weld can be examined the ASME Code and NRC expects the weld to be examined. The ASME Code and Code Case N-335 only set limits on the maximum size transducer that can be used in an examination not the minimum size. This item was reported to the licensee as Unresolved Item 50-325, 324/85-15-01, Recording areas of examination as limited scans because nondestructive examination procedures limit equipment selection.

Within the areas examined, no violations or deviation was identified.

## 7. Observation of Completed Welding - Unit 1

CP&L's letter serial No. NLS-85-045, dated February 26, 1985, informed NRC of their inspection plans and mitigating actions to control intergranular stress corrosion cracking (IGSCC) for Unit 1 during the present outage. One of the mitigating actions that CP&L was taking was to replace the isolable portion of the Class 1, 6-inch reactor water cleanup (RWCU) system piping which is presently 304 stainless steel (SS) with Nuclear Grade 316 SS which is much less susceptible to IGSCC. Observation of this welding was on the inspector's agenda for verification during this inspection. However, the inspector found that the licensee had completed all shop fabrication on this system and had not started field installation at this time. The inspector decided to verify workmanship and weld soundness on the shop fabrication by reviewing the records, visual examination, and review of the radiographic film. Inspection modules used for this confirmation and welds observed are as follows:

### a. Visual Examination - Work Observation/Record Review (57050)

The inspector performed a visual inspection of the Class 1, RWCU fabricated welds external and internal surfaces (extension mirror used internally). The welds examined are as follows:

Weld No.

1RWCU-933  
1RWCU-935  
1RWCU-950  
1RWCU-951  
1RWCU-952

Spool Piece No.

PC-3  
PC-4  
PC-7  
PC-6  
PC-6

The inspector's examination revealed the records to be satisfactory and the welding, visual inspection and preparation for subsequent ISI to be excellent.

Within this area of examination, no violations or deviations were identified.

b. Radiographic Examination - Review of Film and Associated Records - (57090)

The inspector reviewed radiographs and associated records for the welds listed in (a) above.

Within this area of examination, no violations or deviations were observed.