UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-325/94-10 and 50-324/94-10

Licensee: Carolina Power and Light Company
P. O. Box 1551
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: April 25-29, 1994

Inspector: J. E. Coley, Jr 5-10-94
Date Signed

Approved by: J. J. Blake, Chief 5/10/94
Date Signed
Materials and Processes Section
Engineering Branch
Division of Reactor safety

SUMMARY

Scope:

This routine, inspection was conducted in the areas of inservice inspection - observation of ultrasonic examinations and jet pump beam replacement activities (Unit 2). Radiographic film for the Residual Heat Removal (RHR) valve replacement welds (Unit 2) were also examined.

Results:

In the areas inspected, violations or deviations were not identified. Ultrasonic work activities scheduled for the week of this inspection progressed very slowly. General Electric's (GE's) Automated Ultrasonic System (Smart 2000) which was used to conduct examinations on the Recirculation System, the Core Support Shroud, and the Shroud Manway Access Hole Covers was plagued with problems. The problems appeared to be due to insufficient refurbishment of the equipment between jobs. Another factor was the configuration differences between the Unit 2 shroud and the last shroud GE examined; differences in clearances continuously hindered job progress.

Regardless of the performance of the equipment, the licensee's initiative to use the automated ultrasonic system to obtain and record data was a sound decision because of the quality of the data taken, and its repeatability.

Other activities examined included the Jet Pump Beam replacement activities and radiographic examinations performed on the Residual Heat Removal (RHR) valve replacement activities. These activities were being conducted in an effective manner.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*R. Anderson, Vice President, Brunswick Nuclear Plant (BNP)
*H. Beane, Manager, Quality Control (QC)
*E. Black, Level III Examiner, Nondestructive Examination (NDE)
*J. Crider, Manager, Inservice Inspection (ISI)/ Inservice Test (IST)
*G. Honma, Manager, Licensing
*W. Levis, Plant Manager, Unit 1
*C. Pardee, Manager, Technical Support
*C. Robertson, Manager, Environmental and Radiation Control
*J. Tritrington, Manager, Unit 2, Operations
*G. Thearling, Senior Specialist Investigator
*V. Wagoner, Project Manager, Core Shroud
*C. Warren, Plant Manager, Unit 2

Other licensee employees contacted during this inspection included engineers, technicians, and administrative personnel.

NRC Resident Inspectors

*R. Prevatte, Senior Resident Inspector
P. Byron, Resident Inspector

*Attended exit interview

Acronyms and initialisms used throughout this report are listed in the last paragraph.

2. Inservice Inspection (ISI) Unit 2 (73753)

The inspector reviewed documents and observed work activities, as indicated below, to determine whether ISI was being conducted in accordance with applicable procedures, regulatory requirements, requirements imposed by NRC or industry initiatives, including the augmented examinations identified in NUREG-0313 and Generic Letter 88-01 (Recommendations for Intergranular Stress Corrosion Cracking [IGSCC] Mitigation and Schedule for Piping Examinations), NUREG-0619 (Recommendations for Feedwater Crack Mitigation and Schedule for Nozzle Examinations), Information Notices 88-03 and 92-57 (Cracking in Shroud Support Access Hole Cover Weld), GE's Service Information Letter (SIL) No. 572 (Cracking in Core Support Shroud), and GE's Rapid Information Communication Services Information Letter (RICSIL) No. 065 (Jet Pump Beam Failures). This inspection is a continuation of activities previously reported in Region II Inspection Report (IR) 94-08.

The applicable code for the ISI is the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME B&PV) Code, Section XI, 1980 Edition with Addenda through Winter 1981. Unit 2 is presently in the tenth refueling outage; the 2nd, 40-month period; and the 2nd, ten-year ISI interval. For the current outage GE is the contractor for all

nondestructive examination work with the exception of radiography, which Carolina Power and Light (CP&L) examiners and film interpreters performed.

a. Observation of ISI Work and Work Activities

(1) Observation of the Automated Ultrasonic Examination of the Core Support Shroud

The inspector observed while GE conducted portions of the automated ultrasonic (UT) examinations of circumferential weld No. H-4, on the reactor core support shroud. (The core support shroud is the reactor internal component which surrounds the core and directs coolant flow.) As a result of extensive cracking observed at welds H-2 and H-3 during the examination of the Unit 1 Shroud in 1993, the licensee had committed to repair welds H-2 and H-3 on Unit 2, without inspection, because of the similarity in plant operations and environmental conditions. The licensee also elected to perform limited (sample consisted of approximately 10%) visual inspections on the outside diameter (OD) of circumferential welds H-6A, H-6B, and H-7 of the Unit 2 shroud, and ultrasonically examine welds H-4 & H-5 in the shroud core region. Visual examinations were conducted in accordance with the enhanced visual techniques delineated in GE's Service Information Letter (SIL) No. 572 and the UT examinations were conducted in accordance with GE's Ultrasonic Procedure No. GE-UT- 222, Revision 1, with Field Revision Request No. 94BRU2-3 dated 4-21-94.

The inspector observed GE's Smart 2000 automated ultrasonic (UT) system acquire data between the following shroud head lug set locations:

Area Examined	Degrees
Lug Set 4-5	33° to 43°
Lug Set 5-6	43° to 53°
Lug Set 6-7	53° to 63°
Lug Set 31-32	305° to 315°
Lug Set 32-33	315° to 325°
Lug Set 33-34	325° to 335°

The above examinations took several days to observe because of equipment failures and unexpected shroud clearance problems. The equipment failures resulted in the licensee electing to examine the accessible shroud areas on the inside and outside surfaces of weld H-5 utilizing visual examination in lieu of UT. GE's UT system did however acquire data for 345 total inches or 78% of weld H-4.

The analysis of the data revealed that 110" of intermittent circumferential cracking had been detected. The depth of cracks ranged from less than 0.500" to 0.860" with the average depth of approximately 0.750" deep or 1/2 the throughwall thickness of the shroud plate. Although the licensee had not conducted an evaluation of the weld by the conclusion of this inspection, cracking dispersed around the shroud, with depths not exceeding the dimensions found on weld H-4, should not require a repair of the weld at this time. This conclusion is based on GE's acceptance criteria used on Brunswick Unit 1. The examination of H-5 had not started prior to the conclusion of the inspector's visit.

The inspector's observation of the data acquisition and the analysis processes revealed that the GE examiners were well qualified and knowledgeable of the parameters of the examination procedure.

(2) Observation of the Automated Ultrasonic Examinations on the Core Support Shroud 180° Manway Access Hole Cover Weld

Information Notices 88-03 and 92-57 alerted licensees of boiling water reactors (BWRs) of the potential for cracks in the welds of the covers to the shroud support access holes within the reactor vessel. Each BWR has two of the access hole covers (AHC) in the shroud plate, one at 0 degrees and the other at 180 degrees. The inspector observed GE conduct the axial and radial scans for the 180° AHC utilizing their Smart 2000 automated UT system. These examinations were conducted in accordance with GE's Ultrasonic Procedure No. GE-UT- 211 Rev. 3 (Procedure for Automated Ultrasonic Examination of Shroud Support Access Cover Plate with Smart 2000). The procedure used the immersion method of scanning the weld.

The Smart 2000 system used for these examinations also experienced equipment failures which resulted in extended delays; however, by the end of the week the 180° AHC had been completed and the data analyzed. The result of analysis indicated that the 180° AHC did not have any crack indications.

The inspector's observation of the data acquisition and analysis processes revealed that the examiners were well qualified and knowledgeable of the parameters of the procedure.

(3) Observation of Manual UT Examinations of the Feedwater Nozzles

NUREG-0619 recommended mitigation actions that could be taken by licensee to prevent thermal fatigue cracking in BWR feedwater nozzles. Also included in this document was inspection schedules for the various sparger designs and nozzle configurations (whether or not the welded clad had been removed from the nozzle.)

During this inspection the inspector observed GE conduct manual UT examinations of zones 3 and 4A (nozzle bore) on Feedwater Nozzles N4C and N4D. These examinations were performed in accordance with GE's Ultrasonic Procedure No. GE-UT-BRU-311VO (Ultrasonic Examination of Nozzle Inner Radius and Bore). The examination procedure, examiner, and equipment qualifications were based on qualification tests performed on an actual reactor vessel mockup at GE's San Jose, California facility. The manual UT techniques had also been demonstrated to the inspector at San Jose on July 28 and 29, 1993.

The manual UT examiners were knowledgeable of the requirements in their examination procedure. The evaluation of ultrasonic reflectors appeared adequate and the data was properly recorded. No crack indications were found as a result of these examinations.

(4) Verification of Ultrasonic Personnel and Equipment Certifications

Certification records for the following personnel, equipment, and materials were reviewed by the inspector.

<u>Examiners and Job Audited</u>

E.M.- Level II - Recirculation System (The Smart 2000 system used for these inspections experienced problems so frequently that the examinations could not be audited.)

R.M.- Level II - Manual UT of Feedwater Nozzles

E.C.- Level II - Manual UT of Feedwater Nozzles

T.R.- Level II - Core Support Shroud & Manway AHC Welds

A.C.- Level II - Core Support Shroud & Manway AHC Welds

Ultrasonic Instruments	Serial Numbers
Staveley, Sonic 136 Plus	SN 136-7661
TEC-RAD, Tomoscan	SN TTS10092119
TEC-RAD, Tomoscan	SN TTS10091108
TEC-RAD, Tomoscan	SN TTS10092113

Couplant used for manual examinations - Humex - Batch No.93865-B

Serial No. of Transducers Used

9238-93040
2290-94005
2290-94004
3510-94004
3510-94005
9237-93014 R38
9238-93041 R62
9237-92013 R23
9238-93011 R35
9237-93011 R35
9238-93042 R67
9237-93007 R31

Certification records for the above personnel,equipment, and materials were found to be satisfactory.

b. Observation of the Jet Pump Beam Replacement Activities

As a result of a jet pump beam failure at another utility in 1993 GE issued RICSIL No. 065 which recommended that certain BWR utilities replace their jet pump hold down beams with inconel beams which have received an improved heat treatment. The heat treatment should allow the new beams to be more resistant to IGSCC cracking.

The jet pump beams on Unit 1 were replaced during the last refueling outage and work on the Unit 2 beam replacements started during the week of this inspection. The inspector reviewed GE's Procedure No. JP-94-2, Revision 1 (Jet Pump Beam Bolt Assembly and Jet Pump Inlet mixer removal and replacement), observed the work activities, and verified that the work travelers had been properly signed off for Traveler Nos. B2-JP- 5,6,7,8,9,& 10.

Within the areas examined in 2.a and 2.b above, no violations or deviations were identified.

3. Review of Radiographic Film (57090) (Unit 2)

The inspector reviewed radiographic film and associated records for the welds listed below to determine whether the radiographs were prepared, evaluated, and maintained in accordance with the applicable licensee's approved radiographic procedure (No. RT-101, Revision 15) and Sections III and V of the 1986 Edition to the ASME Code. Radiographs in each film package were also reviewed to determine whether the following examination parameters had been correctly adhered to: film quality; penetrameter type, size, placement, and sensitivity; film density and density variation; film identification; and weld coverage.

Radiographs for the following Class 2 Residual Heat Removal welds were examined:

Weld Identification	Size	Drawing No.
2-E11-514	4" Diameter	SK-90034-M-2006
2-E11-513	4" Diameter	SK-90034-M-2006
2-E11-672	4" Diameter	SK-90034-M-2012
2-E11-610	16" Diameter	SK-90034-M-2011
2-E11-515	16" Diameter	SK-90034-M-2004
2-E11-649	16" Diameter	SK-90034-M-2004
2-E11-611	16" Diameter	SK-90034-M-2011
2-E11-638	16" Diameter	SK-90034-M-2005
2-E11-660	16" Diameter	SK-90034-M-2005
2-E11-659	16" Diameter	SK-90034-M-2005
2-E11-665	16" Diameter	SK-90034-M-2012
2-E11-640	20" Diameter	SK-90034-M-2017

The radiographic quality of the above radiographs was good. Discontinuities were properly interpreted, evaluated, and recorded. Associated records were also complete and examiner's comments were properly documented.

The inspector's film density concerns addressed in IR 94-08 had also been addressed by the licensee by re-examining weld No. 2-E11-616 and issuing interim change 2 to the radiographic procedure. This procedure change would allow radiographers to lay a penetrameter across the weld in accordance with the 1986 Edition of the ASME Code. By laying the penetrameter across the weld more latitude is obtained by the varying densities through the body of the penetrameter and the welded joint. This would allow radiographs of welds with differing base metal thicknesses to qualify with a single penetrameter since the penetrameter is based on the thickness of the weld not the pipe or valve thickness.

Within the areas examined, no violation or deviation were identified.

4. Exit Interview

The inspection scope and results were summarized on April 29, 1994, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

5. Acronyms and Initialisms

AHC	-	Access Hole Cover
ASME	-	American Society of Mechanical Engineers
B&PV	-	Boiler and Pressure Vessel
BNP	-	Brunswick Nuclear Plant
BWR	-	Boiling Water Reactor
CP&L	-	Carolina Power and Light Company
GE	-	General Electric
ID	-	Inside Diameter
IGSCC	-	Intergranular Stress Corrosion Cracking
IR	-	Inspection Report
ISI	-	Inservice Inspection
IST	-	Inservice Testing
NDE	-	Nondestructive Examination
No.	-	Number
NRC	-	Nuclear Regulatory Commission
NRR	-	Nuclear Reactor Regulations
OD	-	Outside Diameter
PT	-	Liquid Penetrant Testing
QC	-	Quality Control
Rev.	-	Revision
RHR	-	Residual Heat Removal
RICSIL	-	Rapid Information Correspondence Service Information Letter
SIL	-	Service Information Letter
UT	-	Ultrasonic Testing