



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

Report Nos.: 50-325/84-22 and 50-324/84-22

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 Dates: July 18-20, 1984

Inspection at Brunswick site near Southport, North Carolina

Inspector: J. L. Coley
J. L. Coley

8-3-84
Date Signed

Approved by: B. R. Crowley for
J. J. Blake, Section Chief
Engineering Branch
Division of Reactor Safety

8/3/84
Date Signed

SUMMARY

Areas Inspected

This special, announced inspection involved 15 inspector-hours on site in the areas of inservice inspection, observation of work activities, inservice inspection, review of data, and independent inspection effort.

Results

Of the areas inspected, no violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *C. Dietz, General Manager-Brunswick Nuclear Project
- *G. Cheatham, Manager-Environmental and Radiation Control
- *R. Helme, Director-Onsite Nuclear Safety-BSEP
- *J. O'Sullivan, Maintenance Manager (Acting) BSEP
- *J. Holder, Manager-Outages
- *T. Cribbe, Specialist, Regulatory Compliance
- *L. Wheatley, ISI Engineer
- *B. Hinkley, Supervisor, Engineering

Other licensee employees contacted included technicians, mechanics, and office personnel.

NRC Resident Inspectors

- *D. Myers, Senior Resident Inspector
- *T. Hicks, Resident Inspector

*Attended exit interview.

2. Exit Interview

The inspection scope and findings listed below were summarized on July 20, 1984, with those persons indicated in paragraph 1 above. No dissenting comments were received from the licensee.

Inspector Follow-up Item 325, 324/84-22-01, Enlarge re-examination sample of vessel nozzles with inconel buttering

Inspector Follow-up Item 325, 324/84-22-02, Determine cause and corrective action for cracking in RWCV Valve FO-42

Inspector Follow-up Item 325/84-22-03, Determine capability of Unit 1 Terry Turbine

*Note item three was requested per telecon on July 24, 1984.

3. Licensee Action on Previous Enforcement Matters

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Independent Inspection Effort-Unit 1 & 2(92706B)

- a. On July 12, 1984, Region II was notified by the senior resident inspector at the Brunswick site that during a routine maintenance inspection of the HPCI Turbine, eight of the 20 nozzle reversing chambers were found to have cracks in the baffle plate. The licensee had sent several of the nozzle reversing chambers to their Harris laboratory for analysis. The results however, were not expected until the week of July 23-27, 1984. During this inspection the inspector observed the remaining cracked reversing chambers and reviewed a failure analysis report from Ingersoll-Rand Company on two similarly cracked reversing chambers that had been removed from a steam turbine operated by Iowa Electric. The parts in question were castings produced from 410 stainless steel.

The Ingersoll-Rand Company concluded in the failure analysis report for Iowa Electric that; (1) the parts failed as a result of the propagation of fatigue crack from pre-existing cracks in the reversing chambers, (2) the "original" cracks were formed during the cooling of the castings from the pouring temperature or during the heat treatment of the parts. The Ingersoll-Rand failure report recommended the following corrective actions be taken;

- (1) Redesign the part as far as possible to increase all radii and eliminate pronounced section changes.
- (2) The processing of the parts, particularly the thermal treatment, should be revised in order to reduce the incidence of cracking.
- (3) All reversing chambers should be subjected to stringent nondestructive testing before installation in the units.

Since the above corrective actions were taken in 1979, no instances of cracked reversing chambers in the new design chambers for this type turbine have been reported.

The inspector concluded from direct observation of the cracked chambers that the conclusion reached in the analysis performed by Ingersoll-Rand would be duplicated by CP&L's Harris laboratory. The licensee intends to replace all Unit 2 reversing chambers with the new design. The reversing chambers on Unit 1 were visually examined during the January 1983 outage and no cracks were observed, however the cracks are very tight and could have been missed since the "pre-existing cracks" mentioned in the Ingersoll-Rand analysis were obviously missed on several occasions.

Although preliminary data indicates the plant could be brought to a safe cool down condition without the use of this turbine, the inspector requested that the vendor be contacted and determinations made of the capability of the Unit 1 turbine to perform its intended function if a

piece of the reversing chamber were to break off and ricochet into the blades of the turbine. The above request will be tracked by inspector follow-up item 50-325/84-22-03, Determine capability of Unit 1 Terry Turbine.

- b. Also during this inspection and as a result of excessive leakage past the valve seat in reactor water clean-up valve FO-42, the licensee discovered that the internal surfaces of this valve were severely cracked. The cracks appeared to be intergranular in nature. However, in order for the cracks to be intergranular corrosion the valve would have to be sensitized. This would mean that the valve was improperly heat treated. Later analysis performed by personnel from the Harris laboratory determined that this was in fact the situation. Immediate attention was then directed to Unit 1 which was operating and which had a similar manufactured valve. The licensee is presently exploring the depths of the crack on the Unit 2 valve and preparing a request to the NRC that Unit 1 be allowed to operate based on leak before break analysis and surveillance of this valve for leakage, once each shift. The licensee is also discussing this problem with the valve vendor to determine if any more of these valves were produced using similar processes and whether a 10 CFR, part 21 report is appropriate. Inspector follow-up item 325, 324/84-22-02, "Determine cause and corrective action for cracking in RWCV valve FO-42", was opened to track the licensee's actions to this possibly generic problem.

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

6. Inservice Inspection Unit 2 (73753B & 73755B)

During replacement of primary recirculation system piping at Pilgrim Station a dye penetrant test (PT) conducted on the exposed ID surfaces of the reactor vessel nozzle welds disclosed a number of axially oriented crack indications in the inconel 182 weld butter which joins the 28-inch diameter piping safe end to the reactor vessel nozzle. Preliminary metallography results confirm the cracking to be IGSCC. Axial cracking of a similar nature was also found in three of the ten inconel 182 weld butters joining the 12 inch diameter jet pump inlet riser safe ends to reactor vessel nozzles. In addition to the above, Monticello and Browns Ferry reported cracking in the jet pump instrument line nozzle welds. On June 1, 1984, NRC issued IE Information Notice No. 84-41 in order that recipients could review their facilities status and consider additional nondestructive examinations (NDE) as appropriate, to assess potential degradation of such piping welds during their ISI activities or planned piping replacement programs. In discussions with CP&L's ISI engineer, the inspector found that the recirculation system nozzles with inconel butter welds had been inspected this outage. However, further discussion revealed that Southwest Research Institute (SwRI) examiners used for these examinations had not demonstrated their ability to detect intergranular stress corrosion cracking (IGSCC) as required by IE Bulletin 83-02. CP&L had used these examiners

because the safe-ends at the Brunswick plant were inconel in lieu of stainless steel and CP&L did not expect IGSCC to occur in inconel at the time of the inspections. However, a review of data revealed that, CP&L's calibration block for the recirculation system nozzles was not representative in that it did not have inconel buttering on the nozzle I.D. Therefore, the adequacy of the test sensitivity was questionable, and the area of base material examined in accordance with the licensee's procedure was also not adequate to cover the entire buttered area.

In addition to the above, discussions concerning the jet pump instrument seal line at the reactor vessel nozzle, revealed that the transducer used to perform the axial scans was too large for the four inch pipe diameter without having contouring the transducer wedge. This problem had been recognized by TVA examiners during their examination of throughwall indications, however CP&L was not aware that TVA had encountered this problem during their examinations.

As a result of conversation with Region II, CP&L realized that their examinations may not have achieved their objectives. The following actions were taken by CP&L to insure conditions reported in IE Information Notice No. 84-41 did not exist on Unit 2 at Brunswick:

- (1) The Pilgrim calibration block was obtained from Georgia Power Company for a procedure sensitivity comparison.
- (2) One 28 inch and two twelve inch recirculation welds were re-examined by IGSCC qualified examiners and results of the two inspections compared.
- (3) Notches were added to the four inch jet pump instrument seal line calibration block and the transducer wedges ground to conform to the pipe radius.

On July 18, 1984, the inspector arrived at the Brunswick site to observe work associated with the above re-examinations. A demonstration of calibration block comparability was performed by CP&L for the inspector and the Authorized Nuclear inspector. The demonstration revealed that the Pilgrim Block Calibration would be more sensitive than the calibration performed on the CP&L calibration block; however, the difference was small enough that indications of cracks should have been observed regardless of which calibration block had been used.

Records of four welds with recorded indications were reviewed to determine how low of a threshold the SwRI examiners had used for identifying indications. The following records were reviewed by the inspector:

<u>Weld No.</u>	<u>Nozzle No.</u>
2B32 Recirc-28A-1	N1B
2B32 Recirc-12BRF-5	N2F
2B32 Recirc-12ARE-5	N2E
2B32 Recirc-28B-1	N1A

The records revealed that SwRI did record signals at a very low threshold. The inspector also observed drawings for each nozzle of the inconel buttered welds to determine how much of the buttering would have been missed when using the SwRI procedure. The drawings indicated that the area of high probability for cracking in the inconel were examined. However, nozzle N1B, a 28 inch diameter Recirculation system nozzle had a significant area of weld buttering that would not have been examined in accordance with the SwRI procedure. The licensee agreed to re-examine this weld using examiners certified in the detection of IGSCC. Inspector follow-up item 325, 324/84-22-01 was opened to track this licensee commitment. In telecon discussions with the licensee on July 26, 1984, the inspector was informed that the licensee had re-examined eleven of a total of seventeen nozzles, including the N1B nozzle and no indications of cracking were observed. The inspector considers this to be an adequate reverification of previous inspected welds and no additional action will be required.

Re-examinations that were to be performed on the jet pump instrument line nozzles were not performed during the inspector's trip because modifications to the CP&L calibration block and grinding of the transducer wedges had not been completed. The inspector did however review drawings of the nozzle configuration and conducted a visual inspection of the welds to be examined.

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