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

Report No.: 50-395/84-13

Licensee: South Carolina Electric and Gas Company
Columbia, SC 29218

Docket No.: 50-395 License No.: NPF-12

Facility Name: Summer

Inspection Date: May 3, 1984

Inspection in NRC Regional Offices, Atlanta, GA

Inspectors: _____ 5/23/84
J. L. Coley Date Signed

for _____ 5/23/84
R. W. Newsome Date Signed

Approved by: _____ 5/23/84
J. J. Blake, Section Chief Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: On May 3, 1984, a technical meeting was held with South Carolina Electric and Gas Company (SCE&G) representatives in the Region II Office for the purpose of allowing SCE&G an opportunity to demonstrate the ability of their ultrasonic examination procedure and equipment (which included a new design transducer) to detect, locate, and size actual flaws and artifical reflectors in Region II's centrifugually cast stainless steel test specimens. SCE&G was successful in detecting, locating, and sizing I.D. reflectors, including cracks, that had previously not been detectable. This demonstration and procedure review resolved inspector followup items 395/82-13-03: "Criteria for Locating and Sizing Any Indications Detected by Refractive Wave Scanning", and 395/82-41-05: "Inservice Inspection and Testing (Section 5.2.4, SSER 3)."

REPORT DETAILS

1. Licensee Contacted

H. I. Donnelly, Senior Licensing Engineer, SCE&G
D. R. Moore, Group Manager, Quality Services, SCE&G
P. V. Fant, Manager, Nuclear Quality Control, SCE&G
A. R. Caban, QC Technician, SCE&G

NRC Region II

J. L. Coley, Reactor Inspector, Engineering Branch
R. Newsome, Reactor Inspector, Engineering Branch
B. Hehl, Senior Resident Inspector

2. Technical Issues Involved

a. During an inspection in 1981, by Region II inspectors, of the licensee's baseline ultrasonic examinations on the reactor coolant system weld joints, the inspectors discovered that the reactor coolant pipe at Summer was wrougnt stainless steel, whereas the fittings were statically cast stainless steel. The inspectors had previously been informed by the licensee that the pipe was cast material. The licensee's reports for Preservice (PSI) UT examinations of pipe to fitting welds indicated that the procedure used was a refracted longitudinal wave procedure developed by their contractor, Westinghouse, for use on cast stainless steel.

Subsequently, the inspectors discovered that this procedure had also been used to examine reactor coolant main loop branch connection welds, where the piping on both sides of the weld was wrought stainless steel.

The Westinghouse refracted longitudinal wave scanning procedure did not provide a fully adequate examination of welds for crack-like discontinuities in cast stainless steel material as reported in paragraph 3 of IE Report 395/81-22. However, if properly applied, it did provide a limited "state of the art" examination for welds in cast stainless steel. The inspectors noted the licensee had not demonstrated that the refracted longitudinal wave scanning procedure would provide an adequate examination of the welds in wrought piping. The inspectors contended that the wrought piping may have been more properly examined with a proven shear wave scanning procedure that had been calibrated on a wrought calibration block.

The licensee did not have a wrought stainless steel calibration block representative of the wrought stainless steel reactor coolant main loop piping. The refracted longitudinal wave transducer had been calibrated on a cast stainless steel block. The licensee agreed to demonstrate that their refracted longitudinal wave technique, when calibrated on a cast block, would provide examinations through wrought piping that were

equivalent to or superior to the commonly used shear wave technique calibrated on a wrought block. This demonstration was conducted by the licensee on January 28, 1982. For this demonstration, the licensee obtained and used a wrought calibration block. The wrought calibration block contained a saw-cut notch as described in ASME Section XI (77 edition), Appendix III, Supplement 7(b)(2) and side drilled holes. For the demonstration, the contractor's refracted longitudinal wave transducer was calibrated on their cast calibration block, and a commonly used shear wave transducer was calibrated on the wrought calibration block for comparison. Both calibrations were performed using the contractor's Procedure ISI-205. The two transducers were positioned to obtain the maximum amplitude from the opposite side notch (½ V-path away) on the wrought calibration block. The refracted longitudinal wave transducer produced a signal at the proper sweep range location. When calibrated in accordance with ISI-205, utilizing a double DAC with the 3/4 T hole at 80% screen height (100% DAC), the signal from the notch was 3 DB's lower than the shear wave signal produced with a normal code required DAC curve.

ISI 205, which was used in examining the reactor coolant main loop piping welds, required that all flaw indications which produce a response greater than 75 percent of the primary response reference level DAC curve be investigated to the extent the examiner could characterize and report data relevant to the shape, orientation, location, and possible source of the indication producing area. This 75% DAC recording and evaluation level further increased the equivalency of the Westinghouse refracted longitudinal wave transducer calibrated on a cast block to the shear wave transducer normally calibrated on the wrought calibration block and used with normal code DAC and reporting requirements.

As a result of the demonstration, the inspectors concluded that the licensee's refracted longitudinal wave (RL) procedure (calibrated on a cast block) was essentially as satisfactory for detecting discontinuities in wrought stainless steel as the normally used shear wave procedures. It was noted, however, that the refracted longitudinal wave procedure did not contain suitable criteria for locating and sizing flaws. The RL transducer detected the notch in the calibration block at an angle of approximately 20° rather than at the 41° angle specified for the transducer - indicating potential problems in flaw location. Also, when sizing flaws in accordance with ASME characterization requirements, the refracted longitudinal wave transducer examinations would indicate smaller flaw size than if the shear wave transducer were used. The licensee indicated that no reportable flaws had been detected in its examinations and that, therefore, no location or sizing had been necessary

The inspectors, however, opened inspector followup item 395/82-13-03, "Criteria for locating and sizing and indications detected by refracted longitudinal wave scanning." This item was opened to identify and provide followup on the sizing and location criteria used for any

indications detected by the RL procedure in future inservice inspections. This item subsequently became part of a licensing condition as described in paragraph 1 of Section 5.2.4 of the Summer SSER #3.

b. In addition to the licensing condition described above, SCE&G Company was also required by Section 5.2.4 of the Summer SSER #3 to respond to the following actions in conjunction with the first inservice examination:

(1) The regulations require that the Virgil C. Summer Nuclear Station inservice inspection program be based on either the 1977 Edition or the 1980 edition of Section XI, depending on the operating license issuance date. The entire volume of the welds were examined during the preservice inspection. These documents reduce the volume subject to examination to the inner one-third of the pipe wall. In the event that one-third thickness semi-circular reference flaws cannot be detected and discriminated from inherent anomalies, SCE&G would be required to examine the entire volume of the weld during the inservice inspection.

(2) The reporting of the inservice inspection examination results shall be documented in a manner to define qualitatively whether the weldment and the heat affected zone and adjacent base metal on both sides of the weld were examined by ultrasonic angle beam techniques.

Paragraph 7.1.6, of SCE&G Company procedure T-NQCP-10, Revision 3, implements the licensee commitment to Item 2 above. The licensee has committed to revised procedure T-NQCP-10 to implement their verbal commitment for complete volume examinations of all welds (item 1). This revision will be implemented prior to Summer's first refueling outage.

3. Meeting Conclusions

During the technical meeting at the Region II Office, SCE&G Company successfully demonstrated the ability of their ultrasonic examination procedure and equipment (which included a new design transducer) to detect, locate, and size actual flaws and artificial reflectors in the volume subject to examination (to the acceptance standards of paragraph IWB-3500 of ASME Code, Section XI) in weldment's representative of the design and material of construction (CCSS).

Program procedures were reviewed and it was determined that SCE&G's procedure for manual ultrasonic inspection did not require SCE&G to examine the entire volume of accessible weld during the inservice inspection. However, SCE&G verbally committed to inspect the entire volume and agreed to revise T-NQCP-10 before Summer's first refueling outage. The licensee, however, met the requirements of SSER in that they were able to demonstrate that their procedure could inspect the bottom third of the weld.

The procedure also required that examination results shall be documented in a manner to define qualitatively whether the weldment and heat affected zone and adjacent base metal on both sides of the weld were examined by ultrasonic angle beam techniques. The demonstration and procedure review resolves inspector followup items 395/82-13-03: Criteria for locating and sizing any indications detected by refracted wave scanning and 395/82-41-05: Inservice inspection and testing (Section 5.2.4, SSER 3).

4. Other Issues Discussed

In addition to the technical issues discussed above, Region II was informed by SCE&G that the PWR owners group is presently meeting with Westinghouse concerning a Westinghouse proposal to develop test specimens of centrifugally cast stainless steel. These test specimens will be used to train and certify PWR examiners to discern cracks in cast stainless steel. A similar performance demonstration was required by IE Bulletins 82-03 and 83-02 in wrought stainless steel for BWR examiners as a result of the intergranular stress corrosion cracking problems experienced in BWRs. Results of the performance demonstrations revealed this training was necessary in order to establish an acceptable level of confidence in the examination results provided by these examiners. It is reassuring to discover that since ultrasonic technologically now allows cast stainless steel to be examined for all types of discontinuities, PWR owner's are insuring that examiner proficiency and qualifications are keeping pace with the ultrasonic technology.