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

Report Nos.: 50-321/94-07 and 50-366/94-07

Licensee: Georgia Power Company
P. O. Box 1295
Birmingham, Al. 35201

Docket Nos.: 50-321 and 50-366 License Nos.: DPR-57 and NPF-5

Facility Name: Hatch 1 and 2

Inspection Conducted: March 25 - April 1, 1994

Inspector: J. L. Coley, Jr. 4-22-94
J. L. Coley, Jr. Date Signed

Approved by: 4/25/94
J. J. Blake, Chief Date Signed
Materials and Processes Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

This routine, announced inspection was conducted to observed the licensee's augmented inservice inspection and repair work activities associated with NUREG 0619 (Recommendations for Crack Mitigation and Schedule for Feedwater Nozzle Examinations); NUREG 0313 and Generic Letter 88-01 (Recommendations for Crack Mitigation and Schedule for Piping Examinations); NRC Information Notice 93-79 and General Electric (GE) Service Information Letter (SIL) No. 572, Revision 1, (Core Support Shroud Cracking); and NRC Information Notices 88-03 and 92-57 (Cracks in Shroud Support Access Hole Cover Welds). Specific areas examined included: review of ultrasonic examination procedures, observation of automated ultrasonic work activities, evaluation of automated ultrasonic examination data, and review of the replacement program and replacement activities for the shroud manway access hole covers.

Results:

In the areas inspected, violations or deviations were not identified.

Georgia Power's decision to use a fully-automated ultrasonic system to examine the reactor shroud welds proved to be an excellent decision. Cracking revealed by the ultrasonic system, in the heat affected zone on the inside plate surface of the shroud weld designated H-2, could not have been detected by visual inspection due to its inaccessibility. Other decisions made by the licensee during the ultrasonic examination of the core shroud included: (1) expanding the previous limited ultrasonic examination of designated shroud welds from 180 degree to 360 degree examinations of the designated shroud welds; and, (2) re-scanning weld areas where errors in positioning of the scanning fixture could have resulted in mis-information regarding the length of some indications. These decisions to acquire an accurate base line inspection of ultrasonic indications should be beneficial for future reference.

Strengths observed in vendor activities included: GE's automated ultrasonic systems (GERIS 2000 and Smart 2000) operated very effectively, with only very minor maintenance required, and GE's data analysts were observed making very sound decisions when interpreting and sizing the acquired ultrasonic data. One weakness was also observed: the GE examiners who positioned the transducer scanning fixture on the shroud welds completed the assigned work without recognizing that the fixture was mis-positioned. This is an indication that they may have needed additional supervision and/or training to ensure equipment setup objectives were obtained.

REPORT DETAILS

1.0 Persons Contacted

Licensee Employees

*E. Burkett, Acting Manager, Engineering Support
**M. Googe, Manager, Outages and Planning
*T. Moore, Assistant General Manager, Plant Support
*D. Read, Assistant General Manager, Operations
*L. Summer, General Manager
*S. Tipps, Manager, Nuclear Safety and Compliance
*C. Willyard, Supervisor, Engineering

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

Southern Nuclear Company

**O. Fraser, Site Supervisor
***J. Garvin, Nuclear Specialist
**R. Healey, Senior Nuclear Specialist
**A. Zabala, Senior Engineer

NRC Resident Inspector

*B. Holbrook, Resident Inspector

*Attended exit interview on March 31,1994
**Attended exit interview on March 31 and April 1, 1994
***Attended exit interview on April 1, 1994

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

2.0 Augmented Inservice Inspection and Repair Activities Unit 2 (73051) (73052) (73753) and (73755)

Unit 2 is currently in the 3rd, 40-Month period of the 2nd, 10-Year interval. This the 2nd outage of the period for Unit 2.

The applicable code for 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. Although all Nondestructive Examination (NDE) work was conducted in accordance with the intent of ASME Section XI, augmented examinations performed in accordance with NUREG 0619 (Recommendations for Crack Mitigation and Schedule for Feedwater Nozzle Examinations), NUREG 0313 and Generic Letter 88-01 (Recommendations for Crack Mitigation and Schedule for Piping Examinations), and GE SIL No. 572 (Core Support Shroud Cracking) required enhanced inspection techniques to be utilized. These enhanced techniques have been demonstrated to NRC on mockup specimens at GE's San

Jose, California facility or on performance test specimens at the Electric Power Research Institute in Charlotte, North Carolina.

The inspector reviewed documents, observed work activities, and examined evaluations made by ultrasonic data analysts, as indicated below, to determine whether inspection and repair/replacement activities were being conducted in accordance with the applicable procedures, regulatory requirements and licensee commitments to NRC/industry initiatives (including NUREG 0619, NUREG 0313, Generic Letter 88-01, NRC Information Notice 93-79, GE SIL No. 572 Revision 1, and NRC Information Notices 88-03 & 92-57).

The licensee's Engineering Support organization is responsible for administering the ISI NDE program and plans. Southern Nuclear Operating Company (SNC), working through the site Engineering Support organization, implements the inspection program and plans using SNC QA controls and contractor inspection personnel. For the current outage, GE was the contractor for the ISI inspection and shroud manway access hole cover (AHC) replacement activities. GE's examination procedures were approved through the GPC Plant Review Committee (PRC) and were consistent with procedure qualification and performance demonstrations results.

2.1 Review of NDE Procedures (73052) Unit 2

The inspector reviewed the GE ultrasonic procedures listed below to determine whether these procedures were consistent with regulatory requirements, licensee commitments, or procedure qualification and performance demonstrations results. The procedures were reviewed in the areas of approval, requirements for qualification of NDE personnel, compilation of required records, and for appropriate technical content.

- UT-HAT-703V0, Revision 0, Procedure for the GERIS 2000 Ultrasonic Examination of RPV Nozzle Inner Radius and Bore Regions

- UT-HAT-209V0, Revision 0, Procedure for Automated Ultrasonic Examination of Dissimilar Metal Nozzle to Safe End Welds

- UT-HAT-212V0, Revision 0, Procedure for Automated Ultrasonic Examination of Weld Overlaid Austenitic Piping

- UT-HAT-311V0, Revision 0, Procedure for Manual Ultrasonic Examination of Nozzles Inner Radius and Bore

- UT-HAT-309V0, Revision 0, Procedure for Manual Ultrasonic Examination of Planar Flaw Sizing for Nozzle Inner Radius and Bore Regions

- UT-HAT-300V0, Revision 0, Procedure for Manual Examination of Reactor Pressure Vessel Assembly Welds

- UT-HAT-208V0, Revision 0, Procedure for Automated Ultrasonic Examination of Similar and Dissimilar Metal Piping Welds

- UT-HAT-213V0, Revision 0, Procedure for Automated Ultrasonic Examination of Ferritic Piping Welds

- UT-HAT-702V0, Revision 0, Procedure for GERIS 2000 Ultrasonic OD Examination of RPV Assembly Welds

- UT-HAT-503V0, Revision 0, Procedure for Automated Ultrasonic Examination of the Shroud Assembly Welds

- GE-ADM-1017, Revision 0, Procedure for Installation and Removal of Shroud OD Tracker UT Inspection Tool

- GE-ADM-1018, Revision 0, Procedure for Installation and Removal of Shroud Suction Cup Inspection Tool

- GE-ADM-1019, Revision 0, Procedure for Installation and Removal of Shroud Vertical Seam UT Inspection Tool

The inspector's review of the above procedures revealed that they had been approved; required proper certification for examiners; were well organized; delineated the records required; and described the correct methods for calibration, examination, recording, evaluating and dispositioning of findings.

2.2. Observation of ISI Work and Work Activities Unit 2 (73753)

The inspector reviewed the licensee's current ISI outage plan and held discussions with the cognizant ISI supervision concerning specific details of the planned inspections. All GE examiner and equipment certifications were also reviewed. The inspector observed calibrations and data acquisition activities for the volumetric examination of welds in the reactor core shroud (GE SIL No. 572, Revision 1 and USNRC IN 93-79) using GE's Smart 2000 automated ultrasonic system. Data acquisition activities for the volumetric examinations of feedwater nozzle (NUREG 0619) inside radius examinations and the reactor vessel to nozzle welds using the GERIS 2000 automated system were audited by the inspector on a periodic basis because each examination took approximately 10 hours to complete.

2.2.1 Background (Core Support Shroud Cracks)

In October 1990, GE's Rapid Information Communication Service Information Letter (RICSIL) No. 054 reported that cracking was found near the circumferential seam weld at the core beltline area of the shroud in a GE BWR/4 located outside the United States. The crack indications, initially observed at three locations on the inside surface of the shroud, were confined to the heat affected zone of a circumferential seam weld. In July, 1993, while performing examinations in accordance with the recommendations of RICSIL No. 054, Revision 1,

cracking was found in the stainless steel core shroud assembly of a GE BWR/4 located in the United States. A 360 degree circumferential crack was confirmed near the top guide support ring weld, designated the H-3 weld at this plant. Circumferential and axial cracking was also detected to a lesser degree in the heat affected zone of other shroud circumferential welds.

Based on the above two shroud observations, GE issued Service Information Letter (SIL) No. 572, Revision 1, to provide an overview of the situation and to provide recommendations on suitable inspection techniques, and frequency, to detect cracking that could lead to structural integrity concerns. With the issue of SIL No. 572, Revision 1, GE Nuclear Energy recommended that BWR licensees visually examine the accessible areas on both inside diameter (ID) and outside diameter (OD) surfaces of the shroud at the next refueling outage for all plants with type 304 stainless steel shrouds, with six or more years of power operation; and for all plants with L-Grade stainless steel shrouds with eight or more years of power operation. The SIL recommended that the inspections should be done with an enhanced VT-1 system that can resolve a standard one mil wire on the inspection surface. As an acceptable alternative to the visual examinations the SIL also recommended that a qualified ultrasonic examination of accessible shroud welds from the outer shroud surface could be used.

2.2.2 Observation of the Hatch Unit 2 Core Shroud Ultrasonic Data Acquisition Activities.

The licensee's preliminary plan this outage for ultrasonic examination of the core shroud was to perform a 0° to 180° examination of the entire weld thickness on welds No. H-1, H-2, H-3, and H-4. This would have given the licensee an overview of crack potential for welds from the shroud upper ring to the middle core region. Materials used for the construction of the Unit 2 shroud consisted of forged stainless steel rings and low carbon 304L stainless steel plates. In addition hydrogen chemistry had been used intermittently by the licensee and radiation fluence levels were low for welds H-1, H-2, and H-3. Therefore, the licensee had concluded that the potential for intergranular stress corrosion cracking and irradiation assisted stress corrosion cracking should be very low.

The inspector observed select portions of the system calibrations and data acquisition activities for the Smart 2000, automated ultrasonic system, and for examinations on shroud welds H-1, H-2, and H-3. These ultrasonic examinations were conducted from the OD surface of the reactor core shroud utilizing GE's new shroud OD-tracker ultrasonic inspection tool. Data acquisition activities started with examination of the H-3 weld and was to proceed to the H-2 and H-1 welds. However, after examining 0° to 180° on weld H-3, the licensee elected to expand the ultrasonic examinations of the shroud welds to 360° since ID-connected indications had been detected in this weld.

During the acquisition activities, the Smart 2000 ultrasonic system with the OD-tracker inspection tool operated very effectively, with only minor maintenance required. However, as the result of an analysis of the data for 0° to 180° on H-2, problems were identified in the positioning of the scanner on the shroud, which required this portion of the weld to be re-scanned. At the conclusion of the inspector's visit H-4 had not been scanned and H-1 was being re-scanned because of positioning problems with the scanning fixture.

2.2.3 Background of the Hatch Unit 2 NUREG 0619 Activities

As a result of reactor vessel feedwater nozzle inside radius and bore cracking experienced in the period of 1974 through 1980, the NRC issued NUREG-0619 dated November 13, 1980. The NUREG described the appropriate actions to minimize or eliminate feedwater nozzle cracking concerns. NUREG-0619 concluded that implementation of the recommended actions was considered by the NRC to satisfactorily resolve the issue, with the exception of the development of improved nondestructive examination (NDE) techniques. Because of the ultrasonic testing (UT) techniques in use at the time NUREG-0619 was issued, the NRC required periodic liquid penetrant (PT) examinations at a frequency determined by the feedwater sparger design.

In a letter dated January 22, 1981, Georgia Power Company (GPC) committed to compliance with the inspection schedule prescribed in NUREG-0619, Section 4.3.2, Table 2. This table specified inspection frequencies for the visual inspection of the sparger, and the PT and UT examination of the feedwater nozzle inside radius and bore regions. These requirements replaced the ASME Code requirements with more stringent requirements.

In a letter dated October 19, 1992, GPC informed NRC that they had determined that reliable technology is now available to ultrasonically inspect the feedwater nozzle inside radius and bore region. Consequently GPC requested relief from the PT examination requirements and the ultrasonic examination schedule contained in NUREG-0619.

On July 28 and 29, 1993, the NRC staff, including the inspector, met with GPC representatives and their consultants from GE at San Jose, California. The purpose of the meeting was to discuss GPC's request for relief and to observe laboratory demonstrations of manual and automated UT (GERIS) techniques used to detect notch reflectors on several GE feedwater nozzle mockups. GE personnel also demonstrated manual UT sizing techniques on a mockup which had implanted crack flaws in the nozzle. GE's new GERIS 2000 ultrasonic system and their Smart 2000 ultrsonic system were also demonstrated.

2.2.4 Observation of Data Acquisition Activities for the Hatch Unit 2 Feedwater Nozzle to Shell and Nozzle Inside Radius Examinations

The inspector observed portions of the OD calibrations, and the data acquisition activities for the zone 1 and 2A areas of feedwater nozzles 2N4C, and 2N4D. In addition to observing the nozzle inside radius examinations, the inspector also observed portions of the 2N4D nozzle-to-shell examinations. The GERIS 2000 ultrasonic system was performing the data acquisition activities in a timely manner and no problems were experienced with the system other than maintaining the tracks for the scanner during surveillance by the inspector.

2.3 Review of Ultrasonic Data Analysis and Evaluations for the Smart 2000 Core Shroud Examinations, the GERIS 2000 NUREG 0619 Examinations and the Smart 2000 Pre-Mechanical Stress Improvement Process (Pre-MSIP) Examinations (73755)

The inspector observed GE examiners analyze acquired data, including the evaluation and sizing of indications for the core shroud, the feedwater nozzles, and the recirculation system Pre-MSIP examinations. Ultrasonic data for the following welds and nozzles were reviewed:

2.3.1 Data Analysis of the Reactor Vessel Shroud Welds

Weld and Area Evaluated	Comments
H-3, 0° to 180°	27" of ID Connected Planar Flaw Detected in Weld H-3 (Maximum Depth of 0.68"), 5.2" of IGSCC was also observed in the HAZ Below the Weld (Maximum Depth 0.23")
H-2, 180° to 360°	33.8" of Intermittent IGSCC in HAZ Above Weld (Maximum Depth 0.34")

Note: Data was also analyzed for H-2, 0° to 180° which had IGSCC in the HAZ above the weld. However, due to errors in positioning the scanner this portion of the weld was scheduled to be re-scanned in order that indications could be verified from two directions of the weld.

2.3.2 Data Analysis of the Feedwater Nozzles

The inspector observed data analyst evaluations of the GERIS 2000 data for zones 1 and 2A on nozzles 2N4D, 2N4B, and 2N4A. No recordable indications were noted in the inside radius areas of these nozzles. The inspector also observed the preliminary analysis of the nozzle to shell weld for nozzle 2N4D. This data revealed an indication at mid-plate which would not meet the Section XI volumetric acceptance criteria delineated in IWB 3500. Since the indication had been scanned with a 1

MHZ transducer whose beam spread tends to enlarge the size of an indication, GE had elected to re-examine the indication using a 2 MHZ transducer. At the end of the inspector's visit this weld had not been re-examined.

2.3.3 Data Analysis of the Recirculation System Pre-MSIP welds

The inspector observed a data-analyst evaluate Smart 2000 data for recirculation welds No. 2B21-1FW-12BC-12 and 2B21-1FW-12BC-13. This review did not reveal any IGSCC indications.

The inspector's review of the analysis activities revealed that the GE analysts were well qualified and were using good judgement in evaluating the data.

2.4 Shroud Access Hole Cover Replacement (NRC Information Notices 88-03 and 92-57 Unit 2 (73051, 73052 and 73753)

INs 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 within the shroud plate, one at 0° and the other at 180°.

During the previous outage, GE performed UT and visual examinations of both of the access covers. The examinations of the 0° access cover did not reveal any indication of cracking; however, the UT examination of the 180° access cover revealed 2 circumferential planar indications indicative of IGSCC. One indication extended from 25° to 135° and the other from 215° to 335° around the circumference of the cover. GE evaluated the indications and concluded that the indications would be acceptable for one more cycle.

As a result of the cracking observed last outage, the licensee and GE elected to replace the welded Unit 2 access cover with a new bolted design this outage. During the inspector's surveillance of refueling floor activities, the inspector held discussions with the GE engineer responsible for the on-going replacement activities; observed the cutting operations for the removal of the 0° welded access cover; and reviewed work documents of the progression of work activities. In addition to the examination of the work activities, the inspector reviewed GE's programmatic procedure for the installation and inspection of the replacement access hole cover (AHC-REP-002 Revision 0) and reviewed material certifications for the replacement components.

The cutting operations on the 0° cover were proceeding well. Travelers were being followed and signed correctly when steps were performed. The inspector's review showed that the procedures and the material certifications were also satisfactory.

2.5 In-Vessel Visual Examination of Core Spray Brackets

Although the in-vessel visual examinations were not witnessed by the inspector, video tapes of cracks detected on four brackets for the "B" Core Spray Header piping were reviewed. At the end of the inspector's visit, GE had visually examined eight of twelve brackets core spray brackets. The brackets at 250°, 270°, 290°, and 330° had cracking in the weld heat affected zone (HAZ) of the bracket, indicative of IGSCC. The crack indications were on the same 304L plate that the Smart 2000 had detected IGSCC at the H-2 weld. Enhanced photographs of the indications were sent to GE's San Jose, California facility for evaluation and further instructions in dispositioning the welds.

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

3.0 Exit Interview

The inspection scope and results were summarized on March 31 and April 1, 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.

4.0 Acronyms and Initialisms

AHC	-	Access Hole Cover
ASME	-	American Society For Mechanical Engineers
BWR	-	Boiling Water Reactor
B&PV	-	Boiler and Pressure Vessel Code
Dia.	-	Diameter
EPRI	-	Electric Power Research Institute
FW	-	Feedwater System
GE	-	General Electric
GERIS	-	General Electric Reactor Inspection System
GL	-	NRC Generic Letter
GPC	-	Georgia Power Company
HAZ	-	Heat Affected Zone
ID	-	Inside Diameter
IGSCC	-	Intergranular Stress Corrosion Cracking
IN	-	Information Notice
ISI	-	Inservice Inspection
MHZ	-	Mega-Hertz
MSIP	-	Mechanical Stress Improvement Process
NDE	-	Nondestructive Examination
NRC	-	Nuclear Regulatory Commission
NRR	-	Nuclear Reactor Regulation
OD	-	Outside Diameter
PRC	-	Plant Review Committee
PT	-	Liquid Penetrant Testing
QA	-	Quality Assurance

RICSIL	-	GE's Rapid Information Communication Service Information Letter
RPV	-	Reactor Pressure Vessel
SIL	-	Service Information Letter
SNC	-	Southern Nuclear Company
UT	-	Ultrasonic Testing
VT	-	Visual Technique