



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

Report Nos.: 50-259/88-15, 50-260/88-15, and 50-296/88-15

Licensee: Tennessee Valley Authority  
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1101 Market Street  
Chattanooga, TN 37402-2801

Docket Nos.: 50-259, 50-260 and 50-296

License Nos.: DPR-33, DPR-52,  
and DPR-68

Facility Name: Browns Ferry 1, 2, and 3

Inspection Conducted: May 6-10, 1988

Inspector:

*J. L. Coley*  
J. L. Coley

*5/31/88*

Date Signed

Approved by:

*J. J. Blake*  
J. J. Blake, Section Chief  
Materials and Processes Section  
Division of Reactor Safety

*5/31/88*

Date Signed

SUMMARY

Scope: This special, announced inspection was conducted in the areas of ultrasonic examination of Unit 2 reactor vessel shroud access covers as referenced in NRC Information Notice No. 88-03 and Unit 3, licensee event reports.

Results: The licensee and their vendor (General Electric GE) performed outstandingly, during this inspection. Comprehensive corrective action had been taken on the inspector's previous finding (Violation 50-260/88-06-01, Failure To Follow Procedure for Prevention of Foreign Material in Reactor Vessel Cavity). A procedure had been written for the inspection and accountability of parts for the ultrasonic scanner. The ultrasonic procedure had been revised to specifically address the immersion examination and sizing methods. The examination personnel had successfully conducted a performance demonstration for the licensee in San Jose, California, on known reflectors using the new procedures. Maximum efficiency was demonstrated by the new fully automatic scanner and associated equipment. Pre-job briefings were informative and allowed personnel to ask questions concerning any uncertainty as related to their job responsibilities. Evaluation of test data were sound: level III examiners were professionally and technically adequate in responding to the inspector's inquiries concerning the recorded data. During the 48 hours that

the examinations were in process, all personnel associated with the examinations (operations, craft, in vessel workers, supervisors, quality assurance, nondestructive examination personnel, crane operators, health physicist, and equipment accountability personnel) performed in an outstanding manner. No violations or deviations were identified.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

- \*D. Coston, Supervisor, Quality Control
- \*F. Hartwig, Project Manager
- \*F. Leonard, Level III, Nondestructive Examination Engineer
- \*C. Madden, Regulatory Compliance
- \*R. Seals, Level III, Nondestructive Examination Engineer
- \*J. Savage, Regulatory Compliance
- \*J. Walker, Plant Manager

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

#### Other Organization

- \*T. Brinkman, Level III, Nondestructive Examination Engineer  
General Electric

#### NRC Resident Inspector

- \*E. Christnot

- \*Attended exit interview

### 2. Ultrasonic Examination of Unit 2 Reactor Vessel Shroud Access Covers (57080)

GE aborted their March 14-20, 1988, ultrasonic examination of the Unit 2 reactor vessel shroud manway covers due to continuous equipment problems and personnel failure to follow TVA's established quality assurance program controls (see NRC Inspection Report No. 259, 260, 296/88-06 for problem details and background material). On April 29, 1988, TVA notified the inspector that GE would re-attempt to perform the ultrasonic examination of the shroud access covers on May 7, 1988, and May 8, 1988. The inspector arrived at the Browns Ferry facility on May 6, 1988 to pursue the following inspector objectives:

- ° Determine if corrective actions taken by GE/TVA as a result of the problems encountered during the March 14 - 20, examination attempt of the shroud access covers were effective.
- ° Determine through direct observation whether the current ultrasonic examination was conducted by qualified personnel in accordance with

approved procedures and to the close tolerance necessary to ensure accurate characterization of ultrasonic reflectors .

- ° Review the recorded data and geometrical plots on the data to determine the correct position of ultrasonic reflectors in order to ensure that interpretation and evaluation of the data is accurate.

The above listed objectives were completed as follows:

- a. Corrective Actions taken by GE/TVA as a result of equipment and quality assurance programmatic problems encountered during the March 14-20, ultrasonic examination attempts of the reactor vessel shroud manway covers.

(1) GE's corrective actions consisted of the following:

- (a) To correct problem of no spare parts and delays in shipment.
  - Three new second generation scanners were built. Two of the scanners were on site for the Browns Ferry - Unit 2 examinations.
  - A standard spare part list was developed for the 2nd generation equipment.
  - Personnel responsible for sending spare parts to the site were counseled and recounseled prior to job performance.
- (b) To correct equipment performance problems related to lack of maintenance of equipment.
  - Scanners used in inspections at other plant sites were refurbished at Vallecitos before being sent to the Browns Ferry Plant site. An uncontaminated scanner was on hand at each job.
  - Sufficient respirator qualified personnel were on - site to facilitate any necessary site maintenance.
- (c) To correct problems associated with inadequate design control of equipment and potential loose parts.
  - New scanners had required hardware security design provisions (lockwire, locktite, etc.).
  - Any modifications done in the field were to be reviewed through channels with engineering prior to use.
  - A pre-immersion inspection procedure was developed by the engineering design personnel.

- (d) To establish a clear understanding of project responsibilities.
- A prejob briefing was held with all GE and TVA personnel.
  - Refueling floor procedures and requirements were reviewed.
  - A single point of contact was established for all site work
- (e) A process control sheet (traveler) was developed and implemented to specify work activities in sequential order.
- (f) GE provided the experienced underwater technicians as part of the reinspection effort.
- (g) To correct problems associated with poor judgement on the part of project personnel, the following was done:
- Communicated job priorities to personnel
  - Increased level of training and indoctrination
  - Better work practices were observed to reduce fatigue of personnel
- (h) To address, the inspector's concern that neither the ultrasonic procedure nor the examination personnel had been demonstrated effective in using the immersion method to detect and size intergranular stress corrosion cracking
- GE demonstrated the revised ultrasonic procedure (UT-57F-2) capabilities on known reflectors in specimens in the San Jose, California experiment reactor vessel. TVA witnessed this qualification effort.
  - Eleven examiners received specific training in the use of GE procedure UT-57, R-2 "Remote Ultrasonic Examination Procedure for Detection of IGSCC in Shroud Support Accesses Cover Plates." This training included instruction technique and in the operation of the remote examination equipment and fixtures.

(2) TVA's Corrective Actions Consisted of the following:

- (a) Site Quality Organization (SQO) and Nondestructive Examination Branch (NDEB) assumed full responsibility for

all aspects of NDE performed by Division of Nuclear Quality Assurance (DNQA) and contractors, NDEB was responsible for technical content of contracts, approval of contractor certification program, review of personnel certifications and approval of NDE procedures. The Site Quality Organization was responsible for overall coordination of site activities and compliance with site generated documents .

- (b) SQO coordinated a briefing with all involved parties before performing the NDE work. The meeting assigned responsibilities and task to be completed.
- (c) Site inservice inspection (ISI) personnel conducted a baseline inspection for any loose articles in the control area before performing work.
- (d) NDEB examined GE's equipment prior to coming onsite. An instruction was also developed requiring all items that may come off during operation to be secured by locking devices.
- (e) NDEB developed an instruction and attribute checklist for inventory control of TVA and GE equipment. This instruction required an inventory of all items that may come loose during the operation of the device, Sign/holdpoints were installed for verification.
- (f) NDEB coordinated all information with the SQO representative as the "stop work" decisions could be made by the site QA manager.
- (g) The site ISI unit supervisor was responsible for briefing all offsite personnel in the instruction and implementation of site specific procedures.

The licensee's initiatives went far beyond minimum regulatory requirements and significantly enhanced the programmatic effectiveness. During the 48 hours, the inspector observed each activity in process as a result of the shroud access covers examinations. The inspector was favorably impressed not only with the stated corrective actions by GE/TVA listed above, but also with the clear thinking and quick response of personnel on the refueling floor to fulfill their appointed responsibilities. The adequacy of the licensee's corrective action initiatives and the enhanced program effectiveness was demonstrated by actions in response to an inadvertent "lost item in reactor vessel event which occurred at the end of the ultrasonic examinations. Camera's were focused in on the 180° access cover in order to re-establish the visual baseline and metal parts and bearings

were discovered on the cover. The senior reactor plant operator on the refueling floor immediately took charge. The scanner was ordered removed from the vessel to determine if the loose parts in the vessel came from this equipment. Thorough inspection of the scanner using drawings and accountability records quickly identified that the the parts in the vessel were the remains of a pressed bearing on the scanner guide arm mechanism. Disassembly of this item could not have been foreseen in the most remote critical review of the scanner. The senior reactor plant operator informed all parties involved, that a procedure of recovery of the items would have to be written. However, in the mean time, he directed GE to disassemble one of the bearings from the spare parts inventory and determine exactly how many ball bearings and bearing sleeves were associated with the damaged bearing in order that, every part in the vessel could be accounted for. When the inspector left the site on May 10, 1988, all bearing sleeves and 83 of 84 ball bearings had been accounted for with recovery still in process.

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

- b. Review of Ultrasonic Procedure, Observation of Work Activities and Review of Personnel Qualification Records - Unit 2 (57080)
- (1) The inspector reviewed GE's revised ultrasonic examination procedure (GE-UT-57, Rev.2) to determine whether the procedure contained information and instructions sufficient to assure that all parameters are specified and controlled within the limits permitted by the applicable code and/or additional specification requirements resulting from licensee commitments or initiatives which use approved enhanced instructions for unique inspection application.

The inspector's technical review of GE's procedure revealed that GE had performed a commendable job in enhancing this procedure. The procedure now was written specifically for automatic remote examination and sizing of intergranular stress corrosion cracking using the immersion ultrasonic method. Previous inspector's comments (RPT.No. 88/06) regarding data recorded on the floppy disc were incorporated. Examination personnel now are required to conduct performance examinations using the revised procedure to locate and size known reflectors. The inspector also verified the following essential procedure variables:

- (a) Type of apparatus used including frequency range, linearity, and signal attenuation accuracy requirements, are specified.



- (b) Extent of coverage as well as the scanning technique are specified.
  - (c) Calibration requirements, methods, and frequency including the type, size geometry, and material of calibration blocks as well as location and size of reflectors are specified.
  - (d) Size, frequency and wave mode of search units are specified.
  - (e) Beam angles are specified.
  - (f) Level for monitoring discontinuities and gain settings and specified.
  - (g) Methods of demonstrating penetration, coverage, and accomplishing calibration block to component transfer attenuation adjustments are specified.
  - (h) Levels or limits for evaluation and recording of indications are specified.
  - (i) Recording significant indications are established and reporting requirements are in accordance with applicable ASME Code and contract provisions.
  - (j) Acceptance limits are specified.
- (2) The inspector observed work activities associated with the automatic remote ultrasonic examination of the reactor vessel shroud access covers to determine if these examinations were performed and documented in accordance with the GE traveler and the examination procedure. The inspector also verified the following:
- (a) Examination personnel were qualified to perform their assigned task. This attribute was affirmed by observing the system's calibration then comparing the system's presentations on the access cover welds to that of the calibration block. The examiner was then questioned of the similarities or differences in the presentations and on any noted difference in the processes involved.
  - (b) Calibration Records for the following equipment were verified:



<u>Component</u>	<u>Serial Number</u>
UI 3210 Pulser	203468302
UI 3220 Receiver	205468301
UT 3230 Gate	206178503
3/4" Dia. x 2.25 MHZ Transducer	80260
3/4" Dia. x 2.25 MHZ Transducer	80256

- (c) Specific location of the scanner was verified and the extent of examination clearly define.
- (d) Indications were evaluated by plotting their coordinates during the examination so that the examiner could accounts for signal presentations on the A-scan.
- (e) Scanner operation was fully automatic and very smooth, allowing data to be recorded on the C-scan in a very consistent manner.
- (3) Review of Personnel Qualification Records:

The following personnel had received specific training in the use of General Electric procedure UT-57, "Remote Ultrasonic Examination Procedure for Detection of IGSCC in Shroud Support Access Cover Plates." This training included instruction in the associated examination techniques and in the question of the remote examination equipment and fixtures.

<u>Name of Examiner</u>	<u>Level of Certification</u>	<u>Area of Qualification</u>
T. Brinkman	III	Ultra Image and Scanner Operation
B. Newell	III	Ultra Image and Scanner Operation
D. Watlington	II	Scanner Operation
G. Romano	I	Scanner Operation

In addition to the above performance qualification using the specific procedure and equipment involved in the examination of the shroud access covers, the Level III individuals are qualified to the requirements of SNT-TC-1A and to the Electric Power Research Institute (EPRI) Boiling Water Reactor Owners Group (BWROG) NRC training coordination plan.

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

c. Review of Recorded Data and Geometrical Plots of Reflector

On May 10, 1988, GE's Level III examiner, two TVA Level III examiners and the inspector met to review GE's evaluation of the recorded data and plots of the data. The GE examiner fielded all questions from TVA and the inspector. The conclusion was that all indication observed during the examination were not due to cracking but were due to discontinuities in the root of the weld or component/weld or geometry. The Level III examiner's conclusion agreed with signal combinations observed by the inspector in the A-scan instrument and of preliminary plots made of C-scan data during inprocess examination efforts.

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

3. Licensee Event Report (LER) Unit 3 (92700)

(Closed) LER 50-296/83-026, the licensee report dated November 25, 1983, and subsequent corrective action, dealt with a defective heat exchanger head on the 3ED emergency diesel - generator cooler. Associated documents were reviewed by the inspector. In addition cognizant personnel were interviewed concerning this event and the corrective actions. The inspector concluded the licensee actions were adequate to resolve any NRC concern. This item is considered to be closed.

4. Exit Interview

The inspection scope and findings were summarized on May 10, 1988, with those persons indicated in paragraph 1 above. Dissenting comments were not received from the licensee. Proprietary information is not contained in this report.