



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

Report Nos.: 50-259/91-42, 50-260/91-42, and 50-296/91-42

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
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: December 9-13, 1991

Inspector: Rich C. Chou
R. C. Chou

1-13-92
Date Signed

Approved by: J. J. Blake
J. J. Blake, Chief
Materials and Processes Section
Engineering Branch
Division of Reactor Safety

1/17/92
Date Signed

SUMMARY

Scope:

This routine, unannounced inspection was conducted in the areas of Control Rod Drive (CRD) piping, Heating Ventilating Air Conditioning (HVAC), cable tray, conduit; small bore piping, and torus attached piping programs for Unit 3 restart activities.

Results:

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

The licensee demonstrated better performance in conducting walk-down inspections of the various systems during this inspection when compared to the observations during previous inspections. Therefore, fewer discrepancies were found. In addition, the licensee's engineers were eager to resolve the discrepancies found before the inspector left site.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- R. Baird, Unit 3 Principal Engineer - Civil
- *P. Baron, Licensing Manager
- *R. Cutsinger, Lead Civil Engineer - Unit 2
- *J. Davenport, Licensing Engineer
- S. Haider, Civil Engineer
- *R. Miller, Quality assurance
- *J. Scalice, Plant Manager
- *J. Valente, Project Civil Engineer - Unit 3

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

Bechtel Power Corporation

- *R. Abele, Mechanical Walkdown Lead Engineer
- *R. Montgomery, Mechanical Construction Manager

NRC Resident Inspectors

- C. Patterson, Senior Resident Inspector
- *E. Christnot, Resident Inspector
- W. Bearden, Resident Inspector
- *R. Bernhard, Project Engineer for Browns Ferry Plant

*Attended exit interview

2. Restart Activities on Piping Systems and Civil Structures - Unit 3

Tennessee Valley Authority (TVA) has successfully completed the modification of Unit 2 and has decided to follow the Unit 2 special programs and procedures for CRD piping, HVAC, cable tray, conduit, small bore, and torus attached piping. Most programs for each area will include walkdown procedures and attributes; walkdown inspection and conceptual proposal; engineering evaluation of the walkdown records; stress analysis of the systems or structures; design changes, and modifications. The work in each stage will be controlled by appropriate procedures and acceptance criteria. The licensee submitted a letter to the NRC, dated December 12, 1991, to supply additional information in response to NRC's request for small bore piping program, tubing, and conduit support plans for Units 1 and 3.



a. CRD Piping

The licensee had walked down and inspected the systems including piping and supports. As expected, the field condition for Unit 3 is similar to Unit 2 before its restart. The purpose of the licensee's walkdown was to verify Unit 3 field conditions and compare them to Unit 2. No as-built records were taken during the walkdown since the licensee expected to remove all supports, currently using Unistrut and replace them with tube steel and a new design. All field walkdowns for CRD piping have been completed. The stress analyses and new design for modification of CRD piping from the drywell have been started. The field modification will start in October 1992. The licensee currently is developing procedures for the evaluations and modifications. The estimated number of new supports for the approximately 370 lines, will be about 40 since each support will carry multiple lines. The licensee currently is designing 13 of 25 frames.

b. HVAC

All HVAC located in the Unit 3 area, except a 15-foot section of 18-inch diameter duct, at penetration X-26, had been analyzed and qualified for Unit 2 restart based on the common area requirements for Unit 2 restart. The walkdown of this 15-foot HVAC section with the required extension up to a three-way restraint or one restraint at each load direction had been completed. The stress analysis based on the field walkdown had been completed too. The support design change will be completed shortly. A Design Change Notice (DCN) will be issued around January 1992 and the field modification will be scheduled. In accordance with the new stress analysis which compared to Unit 2, the vertical support at elbow away from penetration X-26 will be removed and the two-way, boxed type, lateral restraint will be modified.

The inspector walked down this HVAC duct section and measured dimensions to verify the drawing shown on page 2 of 7 of the response to Request for Information (RFI) No. C-1004, isometric sketch. One dimension was measured 8 1/4 inches in field and the drawing showed 16 inches. The licensee's engineers showed a walkdown sketch to the inspector to indicate that a 8 1/2 inch was recorded and a mistake was made during the information transfer from the walkdown sketch to the final as-built drawing. The licensee quickly issued RFI No. W-40373 to correct this mistake. The inspector also found that a two-way U-bolt restraint was



misidentified as a three-way restraint on a 2-inch diameter pipe at west of valve no. 3-FCV-64-31 by the licensee's walkdown inspectors. Therefore, the licensee's walkdown inspectors stopped the inspection instead of continuing the inspection to the next axial restraint as required by the stress analysis. The licensee explained that the walkdown inspectors felt that the restraint was tightened without a gap between the pipe and the U-bolt; and therefore considered it as a three-way restraint. But per TVA design guideline, a U-bolt can be used only as a two-way restraint. The licensee is currently researching other information to determine the condition and will continue the walkdown inspection to the next axial restraint if the 2 inch diameter small bore is not decoupled and is required for the stress analysis.

c. Cable Tray Supports

The licensee is currently preparing procedures for the walkdown. The cable tray system is estimated to have 800 feet of cable tray and 95 supports. The field walkdown may start in the Fall 1992.

d. Conduit Supports

Per the letter to NRR, the licensee described Unit 2 experience and Unit 3 planning. The Unit 2 and common restart effort for the conduit system qualification utilized Design Criteria DC-50-C-723 which has been consolidated into DC-50-C-7104, Design of Structural Supports, as the current criteria. Unit 2 and common utilized the seismic experience data base information by having EQE Inc. perform the review of these systems in all three units. The EQE review was able to show that the Browns Ferry Nuclear Plant (BFN) rod hung conduit systems were bounded by the seismic experience data base. In order to resolve the NRC reviewers concerns, TVA performed a rigorous analysis for five rod hung systems as bounding cases for the seismic experience data base information. This analysis validated the use of seismic experience data base information for BFN.

The Unit 3/Unit 1 programs will utilize the Unit 2 and common results for the evaluation of the rod hung conduit systems. TVA conduit program for Units 1 and 3 conduit and conduit supports will consist of walkdown and engineering evaluation on the attributes which resulted in modification in the Unit 2 and common program. The justification for a conduit program for Units 3 and 1 based on Unit 2 and common conduit pro-



gram are that all were the same in specification, conduit materials, support span, support type and materials, and seismic response spectra.

TVA estimated that there would be 40,000 feet of conduit and 3,000 supports. TVA currently prepares procedures for the field walkdown which will be started in January 1992. The stress analysis and design change will be started shortly after the field walkdown in some systems have been completed. The modifications may be started in October 1992.

e. Small Bore and Tubing

The Unit 2 and common small bore program developed the attributes for field walkdown by rigorously analyzing 31 problems which consisted of approximately 1,500 feet of piping and 137 supports. A walkdown procedure was written and established a set of minimum requirements based on the attributes obtained from the walkdown. Per NRC request, these attributes were confirmed based on the rigorous analyses of 45 additional problems, which contained approximately 2,200 feet of piping and 200 supports. The total analyzed piping and supports exceeded ten percent of the total population. Implementation of the procedure was accomplished by training experienced pipe stress and support design engineers or engineering associates. The walkdown team evaluated the small bore piping and supports for functionality and adherence to the design criteria. Field judgments and evaluations were based on conservative assumptions, which assured qualification to the design criteria for the accepted, repaired, or modified plant configuration. During the course of the walkdown, configurations in the field that could not be accepted by engineering judgment were further evaluated. In order to perform these further evaluations, generally as-built data was obtained and rigorous analysis performed. Modifications or repairs were performed for all small bore piping and supports in Unit 2 and common to meet the operability criteria.

Prior to the completion of the Unit 2 and common program, a confirmatory analysis was performed. This analysis included 12 additional problems which consisted of approximately 1,100 feet of piping and 169 supports. The purpose of the confirmatory analysis was to demonstrate the adequacy of the judgments made in the field. The results of this analysis demonstrated that all 12 problems met the long term pipe stress and pipe support criteria. The confirmatory analysis did



not result in any additional attributes or programmatic concerns.

The Unit 2 and common restart tubing program began as an as-constructed program consisting of 66 tubing installations and approximately 250 tubing supports. The generic tubing attributes were developed from the as-built analysis of the original 66 tubing installations. A walkdown procedure established inspection attributes to be used in the field and was implemented by using engineering judgment. Qualified engineers were trained and performed the walkdown and evaluations similar to those of the small bore program. No confirmatory analysis was performed.

The small bore piping and tubing for all three units were field routed utilizing the same design criteria and construction methods. The seismic response spectra is the same for all units and the operating modes are the same. For the Unit 3 restart effort, the small bore and tubing programs have been combined into one program for efficiency. The Unit 3 scope is approximately as follows:

	<u>Total</u>	<u>Small Bore</u>	<u>Tubing</u>
Problems	375	275	100
Footage (ft)	19,000	16,000	3,000
Supports	2,500	2,000	500

The Unit 3 small bore and tubing program is utilizing Unit 2 developed attributes and the same technical walkdown procedure. Walkdown personnel are experienced in piping and tubing stress analysis and support design. The Unit 3 teams (a team consists of a stress analysis engineer and a support design engineer) walk the plant down and make conservative judgments of the acceptability of the piping, tubing and their associated supports in the field. Items, which are judged as possibly not being acceptable, are further evaluated, which generally includes collection and evaluation of as-built data. The acceptability is based on the piping and support design criteria which will meet the long term design requirements. Modifications and repairs are made to any item which is determined to be unacceptable.

Unit 3 small bore and tubing program will include performance of rigorous analysis throughout the walkdown period, which will consist of ten percent of



the piping and tubing and ten percent of the supports. The confirmatory analysis is contained in the ten percent. The licensee has performed the field walkdown for small bore piping on 139 out of 375 stress problems and the evaluation on 1,072 out of 2,500 supports. Procedure No. BC-012, Revision 2, "Engineering Attribute Walkdown Instructions for Seismic Class 1 Small Bore Piping, Tubing and Associated Supports," is used for the small bore piping walkdown. To verify the performance and adequacy of the licensee walkdown reinspection for the small bore piping systems on Unit 3, the inspector randomly selected approximately 255 feet of piping and 46 supports which had previously been walked down and accepted by the licensee. The 255 feet of piping and 46 supports were for four different systems located both inside and outside of the drywell. The drawings used by the NRC inspector for the walkdown reinspection were the drawings generated and compiled by Bechtel after their walkdown reinspection. The walkdown reinspection was completed with assistance from Bechtel's walkdown inspectors and TVA engineers. The piping was checked for configuration, identification, dimension, pipe size, fitting, valve, support location, support load direction, support type and interference. The supports were checked for configuration, identification, fastener/anchor installation, weld and member adequacy. The licensee did not record as-built condition in the walkdown sketch during the walkdown inspection. In most cases, the Bechtel walkdown inspectors walked down the lines and recorded deficiencies in piping and supports based purely on the procedure attributes and their own experiences and judgment. The field sketches might or might not be generated dependant on the walkdown inspectors' own judgment. The walkdown inspectors also provided the conceptual sketches to the evaluation engineers. The small bore piping and supports reinspected during the current inspection are listed below.

Table 1

Walkdown Reinspection on Small Bore Piping
and Supports

<u>Problem No.</u>	<u>System Calculation No.</u>	<u>Rev. No.</u>	<u>Total Supports Insp.</u>	<u>Total Length Insp.</u>	<u>Discrepancies/ Comments</u>
NI-301-74R	CD-Q3001-910292	0	13	67 ft	
NI-332-65R	CD-Q3032-910297	0	8	30 ft	
NI-368-53R	CD-Q3068-910304	0	13	83 ft	Note
NI-373-60R	CD-Q3073-910308	0	12	75 ft	



Note: Heavy rust was found on two large pipe lines. They were identified as lines NI-370-2R-02 at Support No. R-60 and NI-370-1R-02.

The inspector walked down the lines and recorded possible deficiencies for the piping and supports inspected. These deficiencies included weld size and shape, member size, support span, configuration of support, loose parts, and other irregularities. These deficiencies were compared to the licensee walkdown records and conceptual designs to see if the licensee walkdown inspectors recorded deficiencies and proposed the adequate resolutions. After the inspector reviewed the walkdown information and conceptual design in the primary line supports and secondary line, the inspector determined that the information recorded and the conceptual designs proposed by the licensee walkdown inspectors provided adequate resolutions for the small bore piping program.

During this small bore piping walkdown, the inspector observed that heavy rust existed at two large bore pipes identified as NI-370-2R-02 and NI-370-1R-02 as described above. The licensee will evaluate this problem, review maintenance procedures, and determine an adequate resolution.

f. Torus Attached Piping

The Torus Attached Piping is also called Long Term Torus Integrated Piping (LTTIP). The program for LTTIP is a part of the Mark I containment long term program which will resolve the torus and associated piping problems due to a discharge to torus from the containment during an emergency condition. The licensee estimated that the torus attached piping will have 20 stress problems and 600 supports. The licensee had completed the walkdown for all of the torus attached piping. The evaluation for those walkdowns will be started soon. Those piping are large bore and will be walked down, evaluated, designed, and modified based on the requirements of IE Bulletin 79-14. The walkdown procedure is BC-005, Revision 4, Walkdown Instruction for Piping and Pipe Supports (Large Bore). The design criteria will be BFN-50-C-7107, Revision 5, Design of Class 1 Seismic Pipe and Tubing Supports.

The inspector randomly selected 175 feet of piping and eight pipe supports which had previously been accepted by licensee QC inspectors. The 175 feet of piping and eight pipe supports were in two systems. The drawings used by the NRC inspector for the walkdown reinspection

were the drawings generated and compiled by Bechtel after their walkdown inspection. Some drawings may use the original TVA drawings as references. The walkdown reinspection was completed with assistance from Bechtel's walkdown inspectors and TVA's engineers. The piping was checked for configuration identification, dimension, pipe size, pipe material, fittings, valve operator orientation, support location, support load direction, support type, and interference. The supports were checked for configuration, identification, fastener/anchor installation, anchor size, anchor type, anchor marking, anchor edge distance, base plate size and thickness, plate warpage, member size, weld sizes, component identification numbers, components sizes and settings, dimensions, oxidation accumulation, maintenance, and damage protection. The piping and supports reinspected during the current inspection are listed below.

Table 2

Walkdown Reinspection for Torus Attached Piping

<u>Item No.</u>	<u>Stress Problem No.</u>	<u>Inspected Length</u>	<u>Comment/Discrepancies/ Licensee Remedies</u>
1	NI-373-1R	61 ft	Notes 1 and 2
2	NI-374-3R	114 ft	

Notes:

1. A dimension of 40 inches between TVA Support No. R48A (Bechtel I.D. 02254) and reducer was measured in the field. The drawing showed 21 1/4 inches. Bechtel stated that this error was due to the transcription from the walkdown sketch to the final as-built drawing. The licensee issued RFI No. 40374 to correct it.
2. A walkdown improperly terminated at a U-bolt support in a two inch diameter branch line which the Bechtel walkdown inspectors considered as a three-way restraint. The licensee issued RFI No. W-40375 to request a continued walkdown until the next axial restraint.

Table 3

Walkdown Reinspection for Torus Attached
Pipe Supports

<u>Item No.</u>	<u>Tag No.</u>	<u>TVA Mark No.</u>	<u>Isometric No.</u>	<u>Comment/Discrepancies/ Licensee Remedies</u>
1	02262	R86	NI-373-1R	
2	02266	R53	NI-373-1R	
3	02267	R52	NI-373-1R	
4	02270	R51	NI-373-1R	
5	04017	R99	NI-374-3R	
6	04202	H29	NI-374-3R	
7	04352	H27	NI-374-3R	
8	04361	H28	NI-374-3R	Notes 1 and 2

Notes:

1. Seven weld connections were measured to be 1/8 inch fillet weld size. The walkdown as-built drawing showed five of them with 3/8 inch fillet weld size. Further investigation by TVA QC inspected as-built drawing, it showed all of them to have partial penetration welds plus a cap of fillet weld.
2. The licensee will resolve this problem with Bechtel about who is responsible to check the Bechtel walkdown information with the established TVA QC records and provide a guideline.

g. Conclusion

The inspector was satisfied with the majority of the licensee field walkdown work with four concerns about two large dimension errors, two two-way U-bolt restraints considered as a three-way restraint, penetration weld shown on TVA QC inspected drawing not evaluated, and maintenance procedure for heavy rust on pipes. The licensee agreed to evaluate the above concerns and to take appropriate actions to resolve them. In the area inspected, no violations or deviations were identified.

3. Action on Previous Inspection Findings (92702)

The inspector listed some discrepancies and concerns in the Inspection Report No. 50-259,260,296/91-34. The licensee compiled all discrepancies, concerns, and solutions, and presented them to the inspector for review. The resolution included the revisions of procedures and drawings which were also attached for review. Therefore, all of the discrepancies and concerns listed in the above inspection report were resolved and closed except the gap concern between the base plate and the concrete surface. The

licensee is continuing to research the solution and will present it to the inspector during a future inspection.

9. Exit Interview

The inspection scope and results were summarized on December 13, 1991, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed below. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.