

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

6N 38A Lookout Place

**MAR 16 1990**

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Gentlemen:

In the Matter of )  
Tennessee Valley Authority )

Docket Nos. 50-260

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - RESPONSE TO NRC INSPECTION REPORT  
50-260/89-44

Reference: NRC Inspection Report No. 50-260/89-44 dated December 11, 1989

This letter is in response to the open items of NRC Inspection Report No. 50-260/89-44 dated December 11, 1989. This inspection reviewed design criteria documents, implementing procedures, and calculations associated with the Inspection and Enforcement Bulletin 79-14/79-02 program for safety-related piping at BFN Unit 2.

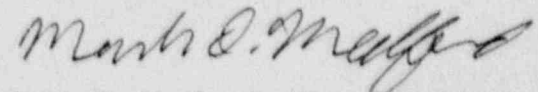
Fourteen open items were summarized in the conclusion of the referenced inspection report. Enclosure 1 addresses those items for which TVA input was required. One open issue, Engineering Mechanics Group (EMG)-028, deals with A-46 interfaces with 79-14 piping. No TVA action is currently required for this item. NRC has indicated that they will internally review this subject and define their position to TVA.

TVA commitments are summarized in Enclosure 2.

If further questions exist, please telephone Patrick P. Carrier at (205) 729-3570.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



Mark O. Medford, Vice President  
Nuclear Technology and Licensing

9003230131 900316  
PDR ADUCK 05000260  
Q PDC

Enclosures  
cc: See page 2

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U.S. Nuclear Regulatory Commission

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cc (Enclosures):

Ms. S. C. Black, Assistant Director  
for Projects  
TVA Projects Division  
U.S. Nuclear Regulatory Commission  
One White Flint, North  
11555 Rockville Pike  
Rockville, Maryland 20852

Mr. B. A. Wilson, Assistant Director  
for Inspection Programs  
TVA Projects Division  
U.S. Nuclear Regulatory Commission  
Region II  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

NRC Resident Inspector  
Browns Ferry Nuclear Plant  
Route 12, Box 637  
Athens, Alabama 35609-2000

ENCLOSURE 1

RESPONSES TO NRC OPEN ITEMS

EMG-005 EMERGENCY CONDITION ALLOWABLES

ISSUE: Design Criteria BFN-50-C-7107 restricts the use of load capacity data sheet allowables to Level 'C' for both the emergency and faulted load cases.

In reviewing the application of this criteria, the NRC inspection team noted that support calculation CD-Q1067-892499 lists Level 'D' capacities. Level 'D' capacities exceed the maximum allowable permitted by the design criteria.

TVA agreed to review all support calculations with standard components to ensure the emergency and faulted allowables used were consistent with the design criteria.

RESPONSE: Three engineering groups have prepared calculations for pipe supports in the 79-14 program. Calculations have been prepared by Bechtel North American, TVA's Knoxville based design group, and by TVA's Browns Ferry Project Group.

A review of calculations from the three groups indicated that only calculations performed by the Bechtel Group listed Level 'D' allowables. All Bechtel calculations with standard components will be reviewed and revised as necessary to be consistent with the design criteria. Calculation revisions will be completed by April 13, 1990.

EMG-013 Code Consistency

ISSUE: TVA needs to provide either verification that furnace welded pipe has not and will not be used in safety-related applications in the plant or provide acceptable evidence that all such piping has been identified and acceptable criteria has been defined and applied.

RESPONSE: The following BFN Unit 2 systems were determined to contain furnace welded piping.

<u>System Number</u>	<u>Title</u>
18	Fuel Oil
39	CO <sub>2</sub> System
70	Reactor Building Closed Cooling Water
86	Diesel Starting Air

CAQR BFP890758 was written to document this discrepancy and to track corrective action.

On the four systems, furnace welded process piping has been evaluated for operability and found to be capable of maintaining the pressure boundary consistent with the interim criteria of BFN-50-C-7303. Some of the furnace weld process piping may not meet the long term pipe stress criteria of design criteria BFN-50-C-7103 and post-restart modifications may be required.

In addition, since pipe supports sometimes use pipe as a structural element in the support (e.g., stanchions), a review has been initiated on pipe supports in the 79-14/02 and small bore programs. Although BFN-50-C-7107 accounts for the fact that certain material used in pipe supports is not always known, it does not address furnace welded pipe. This criteria will be revised to require the use of A53 Type F material allowables when actual material cannot be identified for supports using piping as a structural element. A two phase approach was established to address this issue. First, a review of 300 large bore supports and 300 small bore supports was initiated. This sample has identified 15 stanchions and no other structural elements. These supports will be evaluated to the lower allowables of Type F material. This review and the criteria revision is scheduled for completion by March 26, 1990. At that time, any further action required will be determined based on the results of the review. Standard support catalog items are unaffected.

All the outstanding items associated with the subject CAQR are being worked and will be dispositioned by June 15, 1990.

EMG-016 HORIZONTAL SLICE PACKAGE N1-274-18R

- ISSUE: A particular interference was identified in a previous audit. TVA had agreed to conduct a separate program to evaluate interferences identified during the piping analysis effort. The team asked TVA to provide details (scope, schedule, procedures, etc.) regarding this program.
- RESPONSE: Field inspection for potential interferences with piping movements was included as part of the walkdown procedure WDP-SWEC-003 and 005 utilized to collect field data for the IE Bulletin 79-02/14 Program. These potential interferences were based on identifying plant components within an envelope around the piping cold configuration. Many of the potential interferences have been dispositioned by the piping analyst by confirmation that actual piping movement was less than the available clearance such that contact would not occur or that the contact was not detrimental to the piping system or its supports. The remainder of the items, including the evaluation of the contacted component, have been coordinated with a multi-discipline group chartered with reconciling the issues. TSD S095 and S101 have been written to Bechtel North American Power Corporation (BNA) and Stone and Webster Engineering Corporation (SWEC) for disposition of these issues. This work is currently in progress with a scheduled completion date of March 30, 1990. To date, one DCN has been issued to implement design changes to eliminate the interferences.

EMG-018 EA REVIEW

- ISSUE: Inspection Report 50-260/89-15 stated that TVA's design criteria documents BFN-50-C-7103, Revision 2, and BFN-50-C-7107, Revision 0, had been issued on January 20, 1989. TVA's Engineering Assurance (EA) had reviewed previous revisions of these design criteria documents as part of its oversight function under the Design Baseline Verification Program (DBVP). The NRC requested that EA provide an assessment of the impact of the new criteria documents. TVA stated that EA would review the new criteria documents. This item remained open pending verification that an adequate review had been performed.
- RESPONSE: The former TVA EA organization responsible for the audits was transferred intact, including responsibilities, to the technical audit section of the TVA nuclear quality assurance and evaluation group. On January 30, 1990, Nuclear Quality Audit and Evaluation (NQA&E) completed Audit BFA90015 which included a review of changes to civil general design criteria. During this review, changes to Design Criteria BFN-50-C-7100, Civil Structural; BFN-50-C-7102, Seismic; BFN-50-C-7103, Pipe Stress; and BFN-50-C-7107, Pipe Supports were evaluated. The audit team concluded that the changes to the design criteria are technically adequate and consistent with BFN licensing requirements. The formal audit report was issued on February 28, 1990 and is available for NRC review.

EMG-023 TORUS CRITERIA REVISION

ISSUE: TVA, in Employee Concerns Subcategory Report 21800, committed to revise the Plant-Unique Analysis Report (PUAR) to incorporate one of the design criteria changes in Design Criteria BFN-50-C-7103 and submit it to the staff for review. This item is still open pending TVA's completion of the employee concerns commitment and further staff review of the criteria change pertaining to the torus attached piping.

RESPONSE: TVA is revising the employee concern corrective action plan to eliminate the design criteria statement which allowed stress limits 1.05 times the code allowable for thermal stresses. All designs are required to meet the code limits. TVA will revise Design Criteria BFN-50-C-7103 to eliminate the 5% over code allowable acceptance. Calculations will be revised to qualify the piping to the code allowables. Since the criteria change has been retracted, no revision to the PUAR is required. This work will be complete by May 31, 1990.

EMG-026 UNCONTROLLED SOURCE DOCUMENT USED FOR ZPA AND SAM LOADS

ISSUE: Although TVA's initial corrective action in response to EMG-026 was adequate, its implementation of the corrective action was not. EMG-026 remains open pending receipt and review of information from TVA describing the details and results of its planned review of the fourteen (14) remaining SWEC piping calculation packages.

RESPONSE: A review of the fourteen (14) piping analysis calculations is being performed to identify and revise the inaccurate references within the calculations and confirm that the latest source documents have been used. A checklist of items from various TVA audits and reviews has been developed to document this review. This work is scheduled for completion March 23, 1990. To date, no modifications have resulted indicating this to be a documentation deficiency rather than a design deficiency.

## EMG-032 USE OF ACTUAL MATERIAL PROPERTIES PIPING ANALYSIS

**ISSUE:** In calculation CD-Q2074-89173, node point R832, the actual wall thickness was used in the qualification of the pipe rather than the nominal wall thickness. TVA should revise the pipe stress calculation to correct the stress calculation. TVA should also determine if actual properties instead of nominal properties were used for any other pipe stress calculations. This item is open pending TVA's completion of the corrective actions and submittal of the results to the NRC staff.

**RESPONSE:** On sheet 70 in Stress Problem N1-274-17R Rev. 0, the analyst incorrectly used the actual measured wall thickness of the tee (0.295") instead of the pipe nominal wall thickness (0.280") to derive the mean section modulus. This resulted in a larger value than that normally permitted. This larger section modulus was used in the qualification of the piping component for code equation 11 (secondary plus sustained primary). Use of actual wall thickness properties is in disagreement with sections 119.6.4 and 119.7.3 of the USAS B31.1.0-1967 code of record.

This stress problem contains piping which is overlapped with LTTIP Stress Problem N1-273-5R up to and including valve 2-74-529B. The restraint boundaries per the guidelines of BFN-RAH-203, Rev. 2, extend up to the 30" branch connection on the RHR suppression pool suction piping. The equation 11 overstress condition at data point R832 in Stress Problem N1-274-17R is a result of the conservative application of the thermal anchor movements (TAMs) applied at this 30" header connection. The analyst conservatively applied the plus and minus (+) Z-directional movement since the actual signed directions were unknown to the analyst at the time of the 79-14 analysis.

The overstress data point (R832) in Stress Problem N1-274-17R has been qualified by LTTIP Stress Problem N1-273-5R using more realistic TAM pipe movements. N1-274-17R has been revised to document that the piping stress at data point R832 is within the code allowables based on the nominal wall thickness of the tee and the actual TAM header movements.

To determine the extent of this condition (e.g., the use of actual instead of nominal values), a review of 72 additional stress problems was performed. From this review, no additional occurrences of the use of actual pipe properties were found; therefore, TVA concludes that the cited example was an isolated case.



EMG-033 IE BULLETIN 79-14/79-02 PROGRAM SCOPE

**ISSUE:** Ten (10) pipe stress problems originally identified by SWEC had been eliminated from the Browns Ferry Unit 2 program scope. The 10 identified pipe stress problems were associated with the containment atmospheric dilution (CAD) system, the raw cooling water (RCW) system, and the reactor building closed cooling water (RBCCW) system. The CAD lines have been capped to eliminate the cross-tie with Units 1 and 3. The RCW lines were eliminated because of the rerouting of the emergency equipment cooling water (EECWS) system in response to the clay pipe issue. It is TVA's position that the RBCCW lines do not have to be seismic class I for Browns Ferry Unit 2 operation. However, these RBCCW lines are designated as seismic class I in the Browns Ferry FSAR. Because of TVA's decision to change the classification of these lines from that in the FSAR, this item is open pending TVA's submittal of the proposed change in seismic classification and further NRC staff review of the proposed change. TVA's submittal should identify all cases in which the FSAR classification was changed and provide the basis for the change.

**RESPONSE:** As part of the 79-14 Program, the CAD lines will be capped to eliminate the cross-tie with Units 1 and 3. These lines are supported off the Units 1 and 3 RHR Service Water lines which have already been capped and temporarily removed from service. Three Raw Cooling Water (RCW) lines were eliminated due to the reroute of the EECW for the clay pipe issue.

In addition to the ten stress problems, the piping in the control air system between valve FCV 32-63 and valves 32-321A and B will no longer be class I because the equipment which attaches to this piping has always been classified as non-seismic, therefore the piping to the valves can also be non-seismic. The drywell control air system changes to the FSAR have been PORC approved and will be incorporated into the upcoming FSAR Revision 17.

The change in class of RBCCW outside of the primary containment isolation boundary has been made under the provision of 10 CFR 50.59. The portion of the RBCCW system that provides primary containment isolation/integrity is the piping inside the drywell out to and including the isolation valve. These portions of the system are not affected by this change.

Postulated failure of this reclassified piping has been evaluated for impact on nuclear safety for pipe whip, jet impingement, flooding, and water spray. The conclusion for each of these individual items is that this change has no adverse impact on safety. An unresolved safety question (USQ) was determined to not exist. Failure of the RBCCW system outside containment will not cause or increase the severity of an accident which would endanger the public health and safety and is not required for safe shutdown and isolation of the reactor. It, therefore, does not meet the definitions of seismic class I given in BFN FSAR Section C.2.1. The 10 CFR 50.59 evaluation has been completed and is available for NRC review.

EMG-034 CONTROL OF DESKTOP PROCEDURES

**ISSUE:** The NRC Inspection Team's review of BNA Project Engineering Guidelines (PEG) -001 and -002 identified discrepancies between PEGs and other procedures. It was also noted that the PEGs were not QA controlled documents.

**RESPONSE:** An investigation by the Site Quality Group was performed to address the audit issue. Details can be found in Quality Surveillance Report OBF-S-89-1830.

The study concluded that the PEGs contained technical data and that the use of the PEGs without formal technical review and document control is unacceptable. At the direction of Site Quality, BNA performed a review of the two PEGs and determined that the PEGs contained no guidance or criteria that deviated from the TVA established criteria. The PEGs are no longer in use and are being removed from distribution in accordance with BNA procedures.

EMG-035 PIPING ANALYSIS DEFICIENCIES IN CALCULATIONS PERFORMED BY TVA

ISSUE: TVA technical audit BFN-CEB-89-05 identified numerous deficiencies in stress problem N1-167-3RB. The calculation associated with this problem was performed at TVA's offices in Knoxville, Tennessee. TVA initiated a review of a sample of pipe stress calculations it had performed at its Knoxville office and the Browns Ferry site to determine if the deficiencies observed signaled a more generic problem. The review included 15 percent of calculations performed at the site and all calculations performed at the Knoxville office. The inspection team asked TVA to supply the details and current status of these reviews. TVA indicated that the review of the calculations performed at the Browns Ferry site had been completed and no deficiencies had been found. However, the review of calculations performed at Knoxville was still ongoing as of October 26, 1989. This item remains open pending TVA's submittal of a response that includes (1) verification of TVA's completion of its review activities, (2) detailed information regarding the procedures governing the review activities and the attributes reviewed, and (3) descriptions of any follow-up actions.

RESPONSE: The Knoxville production staff has had meetings with the Lead Engineer to discuss root causes, corrective actions and the recurrence control responses to ten of the TVA Technical Audit 89-05 deficiencies which were generic. The root cause was determined to be a lack of careful checking and a lack of detailed documentation of the analyst's thought process/judgment logic in the calculation. A memorandum was issued to each individual reemphasizing the importance of careful checking and the need for the detailed documentation of engineering judgments in the calculation package. The checklist was developed based on the audit findings for the 89-05 audit. A checklist review was made on the Knoxville stress calculations and incorporated in the subsequent revision to these design calculations. These are available for NRC review. Two problems required reanalysis due to numerous support relocations outside the installation tolerances and one also had a boundary condition problem. The remaining stress problems required documentation changes.

The TPIPE geometry models from two of the 12 79-14 program stress analyses performed at BFN site were completely rechecked. Both models were found to be consistent with the walkdown data. All analysis dimensions were within  $\pm 1/2$ " well within installation tolerances, and all materials and fittings were properly modeled.

WMC-036 REDUCING ELBOW SIF VALUES

**ISSUE:** TVA's Rigorous Analysis Handbook (RAH), Section BFN-RAH-311, Rev. 0, states "The reducing elbow stress intensification factor (SIF) is calculated the same as for a standard elbow with the dimensions of the larger end." The team's review of stress problem N1-274-1R (TVA Revision 1) found that the RAH-311 instructions were not followed for four reducing elbows. Reduced SIF's were used to lower code stress results below allowable limits for two 6-inch by 4-inch and two 24-inch by 20-inch reducing elbows. Attachment 4 of the calculation contained a finite element analysis for an 8-inch short-radius elbow that was used to justify reduced SIFs for the four components mentioned above. Footnote 6 in Appendix D of USAS B31.1.0-1967 indicates that full-sized-elbows SIFs should be used until more precise data are available. Since precise calculations addressing the specific component sizes were not considered, SIFs as directed by BFN RAH-311 and USAS B31.1.0-1967, Appendix D, should have been used. This item remains open pending receipt, review, and approval by the NRC staff of TVA's proposed corrective action.

**RESPONSE:** TVA has developed a finite element analysis of a 24-inch by 20-inch reducing elbow and is comparing the result with that of the 8 inch short radius elbow. Both finite element analysis show that the maximum intensification factor occurs near the crotch and decreases toward the ends (tangent point). Using the RAH procedures, the analysis qualified the elbows in the crotch region but exceeded allowable at the tangent point. By applying the lower intensification factor at the tangent points, our intent is to show that the tangent region of the elbows are also qualified to the B31.1 code. The engineering work for this open issue will be completed by March 30, 1990.

EMG-037 GANG HANGER DEFLECTION CRITERIA

ISSUE: The NRC inspection team determined that the gang hanger deflection criteria provided in Design Criteria BFN-50-C-7107 Rev. 3 is inadequate in that the loads used to evaluate rigidity are different than those used in Section 1.4.2.5 to calculate member stress.

COMMENTS: TVA will revise BFN-50-C-7107 Section 1.4.2.13(e) to ensure consistency with Section 1.4.2.5.

The revision will require gang supports, except CRDH frames, to check rigidity at each pipe restraint point using maximum load combinations applied simultaneously. Design criteria for the CRDH frames was submitted separately, via letter December 11, 1989. The effects of dynamic loads may be combined per the provisions of Section 1.4.2.5. Alternatively, the provisions of Section 1.4.2.13c and d may be used for gang supports as determined necessary by the piping and/or support analyst.

A review of gang hanger designed under the 79-14/02 Program has been completed. It was found that the "one load at a time" provision of section 1.4.2.13(e) was used in a limited number of calculations. A total of 8 gang hangers required re-evaluation. A deflection check consistent with the proposed criteria documented that the supports meet the deflection requirements. No modifications were required.

A study of gang supports evaluated in the Small Bore Program indicate that like the 79-14/02 gangs, the "one load at a time" provision was used in a limited number of support qualifications. A total of 44 gang supports were found to have used the provision, of these 4 have been reviewed to date and found acceptable under the proposed criteria.

The criteria revision and calculation reviews confirming compliance to the revised criteria will be completed by April 13, 1990.

EMG-038 RECIRCULATION PIPING TIME HISTORY ANALYSIS

ISSUE: Two concerns were developed as a result of the case-by-case review of the recirculation water piping system time history analysis, CD-Q2068-871118, Revision 4 (B04 890811 201).

The first concern resulted from the failure to analyze a weld attaching a pipe whip restraint to the elbow adjacent to node 290 for a specific loading. The loading in question resulted from relocation of a snubber attachment point from node 290 to a point on the pipe whip restraint. TVA's commitment to ensure analysis of the weld by means of issuance of a PRD is an open item from this inspection.

The second concern resulted from differences in the piping model from the expected as-built configuration:

1. The model had not been modified to reflect the expected relocation (due to the results of a field constructibility check) of a snubber located at node 290.
2. The release in the model of stiffness in the weak axis bending direction of the plate compromising the tie-back support (nodes TB1 and TB2) did not represent the field condition.

TVA agreed to resolve this concern by thoroughly reviewing the model to ensure its accuracy, modifying it as indicated by the review (including correcting the deficiencies identified above), and reanalyzing the model. The concern will be resolved upon receipt and review of TVA's submittal verifying that the reanalysis has been performed. This includes reconciliation of the support calculations with the new loads, assurance that no new variances were created by support modifications resulting from the reanalysis, and assurance that interim criteria were not used in the reanalysis.

RESPONSE: First Concern:

TVA wrote PRD BFP890753P to identify the problem, identify corrective action, and to track to closure. The unanalyzed weld at the trunnion to elbow interface has been qualified and is documented in Calculation CD-Q2068-900042. Stress ratios are as shown below:

EQN 9U = 0.39            AND            EQ 9E = 0.42

EMG-038 RECIRCULATION PIPING TIME HISTORY ANALYSIS, cont'd

Second Concern:

TVA thoroughly reviewed the model and incorporated the variances noted by the NRC, and the other discrepancies which had been documented in the Rev. 4 calc package.

The analysis methodology and revised model have been reviewed by two outside consultants (from BNA and SWEC); no modeling inaccuracies were found.

The snubber at data point 290 was moved down to node 290C, its as-designed location.

The plate-type tie-back support in question has been eliminated from the math model by decoupling the 6-inch RWCU line from the 20-inch RHR line and qualifying it as a separate problem. This tie-back will be removed in the field.

Both the RECIRC/RHR and RWCU piping are now qualified using the ARS seismic analysis method. No interim criteria was used in these qualifications, and no new variances on pipe support locations exist between the as-designed and as-analyzed. Modifications will be made as part of the 79-14 program.

The loads from the ARS analyses have been used for the evaluation and design of required pipe support modifications.

ENCLOSURE 2

LIST OF COMMITMENTS

50-260/89-44 OPEN ITEMS

1. All Bechtel calculations with standard components will be reviewed and revised as necessary to be consistent with design criteria allowables for the emergency and faulted load cases (Level C). Calculation revisions will be complete by April 13, 1990.
2. Condition Adverse to Quality Report (CAQR) BFP 890758 addresses the furnace weld pipe condition for minimum wall thickness, and etc. Disposition of this CAQR will be completed by June 15, 1990.
3. Furnace welded support structures will be evaluated to the lower allowables of Type F material. This review is scheduled for completion by March 26, 1990. Also, the criteria revision for Browns Ferry Nuclear Plant (BFN)-50-C-7107 unknown support material allowables will be completed by March 26, 1990.
4. Task Scoping Document S095 and S101 have been issued to Bechtel North American Power Corporation and Stone & Webster Engineering Corporation for disposition of the interference issue. This review has a scheduled completion date of March 30, 1990.
5. TVA will revise Design Criteria BFN-50-C-7103 to eliminate the five percent over-code allowable acceptance for thermal stresses. Calculations will be revised to qualify the piping to the code allowables. This will be completed by May 31, 1990.
6. A review of the fourteen piping analysis calculations will identify and revise the inaccurate references for ZPA and SAM loads, and confirm that the latest source documents have been utilized. This effort will be completed by March 23, 1990.
7. Evaluation of the reducing elbow stress intensification factors for 6 by 4 inch and 24 by 20 inch reducing elbows will be completed by March 30, 1990.
8. The criteria revision and calculation reviews for gang hanger deflection criteria, confirming compliance to the revised requirements, will be completed by April 13, 1990.

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