Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

William J. Museler
Site Vice President
Watts Bar Nuclear Plant

OCT 13 1992

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

Gentlemen:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) - RESPONSE TO NRC CIVIL INTEGRATED DESIGN INSPECTION (IDI) ISSUES (50-390/92-201)

References: 1. TVA letter to USNRC Document Control Desk, September 21, 1992, WBN Category I Pipe U-Bolt Support Arrangements

2. TVA letter to USNRC Document Control Desk, September 22, 1992 - WBN Supplemental Discussion of Civil Design Calculations

Enclosed are TVA's responses to the WBN Civil IDI issues as identified in NRC Inspection Report 50-390/92-201 dated September 21, 1992. Enclosure 1 contains comments regarding the most significant concerns described in the subject inspection report. Enclosure 2 responds to each of the 21 deficiencies and the 3 unresolved items for Watts Bar Unit 1.

Where appropriate, additional clarification is provided following the NRC description of deficiency. This is intended to supplement the statement of concern for better understanding, or to clarify potential misinterpretations expressed within the staff's summary.

Corrective actions are defined for each item, and where efforts are ongoing, a schedule is provided for item completion.

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Generic implications of these findings have been assessed for applicability within the civil engineering discipline. As discussed in each applicable response, the extent of condition was determined and corrective actions implemented.

It is requested that NRC review this information for timely closeout, in that, field implementation of the described modifications is presently in progress.

TVA is available as required to discuss these issues further and requests prompt communication if necessary to achieve issue resolution.

If any questions exist relative to this information, please contact P. L. Pace at (615) 365-1824.

Very truly yours,

W. J. Museler

William J. Museler

Enclosure
cc (Enclosure):
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ENCLOSURE 1

CIVIL INTEGRATED DESIGN INSPECTION
GENERAL COMMENTS

TVA has completed the assessment of all findings described in NRC's Report 50-390/92-201 dated September 21, 1992. In addition to the specific responses contained in Enclosure 2 of this transmittal, the following comments regarding the more significant concerns described in the report are provided:

Use of U-Bolts to Support and Restrain Piping

TVA's letter of September 21, 1992 (Reference 1), defined the corrective actions which have been taken. Material in Enclosure 2 (92-201-09) provides details of the methodology and procedures being followed to ensure the design and installation of the total U-bolt population provides for stable configurations.

Design Change Notices (DCNs) have already been issued for System 70 and field work will be commencing soon.

Missing and Loose Support Hardware

The utilization of work requests and tagging of problem areas has been an integral part of all the walkthroughs and walkdowns performed to the civil commodities. Specific problem area punch lists were developed for Modifications use in ensuring these issues are resolved.

As a result of the IDI team comments in this area, TVA is taking additional steps to ensure that the identification and correction of these problems continue to take place on an ongoing basis. The system turnover process currently includes several walkdowns at different stages in the process to identify and correct these items.

As-Built Weld Sizes of Commodity Supports

TVA has performed additional reviews of the work performed and has determined that the specifics in each of the three areas were not properly communicated to the IDI team during the audit.

Specific details are provided in Enclosure 2 (92-201-16) for the staff's review. Weld size consideration has received more than adequate attention in each of the three areas through the integration of Weld CAP results, critical case evaluation walkthroughs, load rating reductions of typical designs, and walkdowns performed for bounding and worst case supports.

Concrete Capacity for Anchor Bolt Pullout

This issue arose as a result of a misunderstanding of the application of TVA's Design Standard. Where the provisions of the standard (anchor size, embedment, spacing, etc.) are followed, an explicit check for concrete pullout is not necessary. Specific details of TVA's additional reviews are reflected in Enclosure 2 (92-201-17).

Conduit Support Not Installed

This problem was caused by the failure of the responsible field engineer to follow the DCN procedures and obtain Nuclear Engineering (NE) approval for the deletion of the support in question. A review of other workplans in the same functional area showed that other changes in the same workplan and an additional workplan were not properly coordinated with NE. Specific details are reflected in Enclosure 2 (92-201-24). Corrective actions to reexamine the two workplans and reconcile with NE's design output is in progress and will be completed by System 290 turnover.

Advance Authorized Field Changes

In addressing the concerns expressed by the IDI team relative to the backlog of advanced authorization field changes, WBN has recently restructured the handling of Modifications field support and field engineering. This coincides with TVA's increased emphasis on production completion, field/test support, and closure. To achieve this objective, dedicated resources have been identified for each of the functional areas including closure of Field Design Change Notices (FDCNs). This restructuring to functional areas provides additional emphasis and resources for field completion and cycle time for (FDCN) closure without compromise to product quality.

Summary

In summary, TVA has completed extensive extent of condition reviews for each of the findings identified by the IDI team. TVA has determined that the findings with the exception of the U-bolt issue are limited in scope to a small number of products and do not have significantly adverse generic implications on the adequacy of the civil programs.

TVA is prepared to support any additional interactions which the staff may need to achieve resolution and closure of all findings in the report.

Enclosure 2

Response to Individual Items
NRC Civil IDI
50-390/92-201

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-01

TITLE: Combination of Seismic Category I(L) and Non-Seismic Piping Loads for Boundary Anchor Design (Section 2.1)

DESCRIPTION OF CONDITION:

Category I(L) piping is piping whose failure could jeopardize the functioning of safety-related equipment. TVA's design criteria for piping (WB-DC-40-31.7 Section 3.1.1.4) specifies that the loads from seismically-analyzed section of the piping and the plastic moment design load from the non-seismically analyzed side of a boundary anchor be combined absolutely. Design criteria contained in document WB-DC-40-31.9, Section 3.16.2.5(d), allowed these loads to be combined by the square root of the sum of the squares (SRSS) method at the boundary between Category I(L) piping and non-seismically analyzed piping. The use of an SRSS load combination required a justification in accordance with criteria referenced in the Standard Review Plan (SRP). The Watts Bar FSAR does not explicitly address the method used to combine loads from two sides of a boundary anchor. However, guidance is provided in the SRP for justifying the use of the SRSS load combination. TVA did not follow the guidance in the SRP and did not have a technical justification to support the SRSS load combination method. TVA has agreed to revise the design criteria WB-DC-40-31.9 to require the subject loads to be combined using the absolute sum method.

CLARIFICATION:

None

RESOLUTION:

Revise Design Criteria WB-DC-40-31.9 and review calculations performed prior to the criteria revision to ensure compatibility.

STATUS: Complete

Design Criteria has been revised and 3 calculations were revised to reflect the criteria requirements. No field work resulted from this change.

REFERENCES:

1. Design Criteria WB-DC-40-31.9 Revision 15 (T29920806857)
2. Calculation Pipe Support 47A431-14-1 (B18920829764)
3. Calculation Pipe Support 47A910-2-3 (B18920812759)
4. Calculation Pipe Support 47A920-05-001 (B18920819772)

T29 920806 857

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DIVISION OF NUCLEAR ENGINEERING

NE NUCLEAR ENGINEERING

QA Record

DESIGN CRITERIA

NUMBER WB-DC-40-31.9

WATTS BAR NUCLEAR PLANT

TITLE: CRITERIA FOR DESIGN OF PIPING SUPPORTS AND SUPPLEMENTAL STEEL IN CATEGORY I STRUCTURES

AUG 1992 RECEIVED EBASCO DOCUMENT CONTROL

See previous revisions for original signatures

	REVISION 0	R14	R15	R16
EFFECTIVE DATE	08-29-75	07-06-92	AUG 0 6 1992	
PREPARED	K.G. FRAZIER	W. R. BIBB	WRBibb	
CHECKED	T.C. CRUISE	H. A. CUSICK	Howard A. Cusick	
REVIEWED	E.D. MYSINGER	S. E. AZZAZY	S.E. Azzazy	
APPROVED	W.A. ENGLISH	E. W. KANT	[illegible]	
ACCEPTED	R.G. DOMER	W. L. ELLIOTT	W L Elliott	

Total 56 Pages

b. The design of the anchor considers load from both sides of the anchor.

3.16.2.5 Anchor Design Load Determination

a. Rigorous/Rigorous

Static load cases, such as deadload and thermal, from each side of the anchor shall be combined algebraically. The dynamic load cases shall be combined from each side of the anchor by SRSS (square root of the sum of the squares), except for axial force components which shall be combined by absolute sum.

b. Rigorous/Alternate

Same as item a.

c. Rigorous (Alternate)/Category I(L)

Loads from the rigorous (or alternate) side of the anchor shall be combined (absolute sum) with loads from the Category I(L) supported piping as defined in design criteria document WB-DC-40-31.7.

d. Category I(L)/Non-Seismic

Loads from the Category I(L) side of the anchor shall be combined (absolute sum) with loads from the non-seismic supported piping as defined in design criteria document WB-DC-40-31.7. 15

3.16.2.6 Special Design Requirements

All pressure boundary welds on ASME Classes 1, 2, 3 and ANSI B31.1 pipe shall be designed per ASME Section III. Eighteen ksi (E-60 electrode) allowable weld stresses should be used unless E-70 electrodes can be verified. When evaluating the stress in the base material, the yield strength of the attachment or pipe (whichever is less) shall be reduced for temperature considerations.

3.16.2.7 Stiffness Requirements

3.16.2.7.1 Pipe Anchor Separating Two Analyzed Piping Sections

a. All structural steel will be designed to have a maximum deflection of 0.0625" (based on the seismic/dynamic load components of the upset or faulted condition) and 0.125" (based on the total design load). This analysis shall be performed independently for each direction (axis), at either, the point of load application or, for Load Transfer Units (LTU), at the centerline of the pipe and LTU.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-02

TITLE: Anchor Bolt Factor of Safety for Feedwater Check Valve Slam Load Case

DESCRIPTION OF CONDITION:

Revision 14 of WB-DC-40-31.9, "Criteria for Design of Piping Supports and Supplemental Steel in Category I Structures," added support design requirements for the main feedwater check valve slam load case. Part of the criteria allowed a safety factor of 3 to be used for concrete expansion anchor bolt design. However, this factor of 3 was not in compliance with the factors of safety required in Civil Design Standard DS-C1.7.1. This criterion is designated as Outstanding Issue 20 (a) in SSER 6, and the NRC staff has not yet approved this factor of safety. TVA stated that the safety factor of 3 had not been used for Category I support designs at Watts Bar, and TVA agreed to delete this factor from the design criteria.

CLARIFICATION:

A lower factor of safety was considered appropriate for the extreme load combination and Appendix F design limits. If a lower factor of safety is considered essential, approval will be sought on a case-by-case basis.

RESOLUTION:

Revise the design criteria to eliminate the use of a factor of safety of 3 for the main feedwater check valve slam load case.

STATUS: Complete

Design Criteria has been revised.

REFERENCES:

1. Design Criteria WB-DC-40-31.9 Revision 15 (T29920806857)

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TVA
TENNESSEE VALLEY AUTHORITY

TENNESSEE VALLEY AUTHORITY
DIVISION OF NUCLEAR ENGINEERING

NE NUCLEAR ENGINEERING

QA Record

DESIGN CRITERIA

NUMBER WB-DC-40-31.9

WATTS BAR NUCLEAR PLANT

TITLE: CRITERIA FOR DESIGN OF PIPING SUPPORTS AND SUPPLEMENTAL STEEL IN CATEGORY I STRUCTURES

See previous revisions for original signatures

	REVISION 0	R14	R15	R16
EFFECTIVE DATE	08-29-75	07-06-92	AUG 0 6 1992	
PREPARED	K.G. FRAZIER	W. R. BIBB	WRBibb	
CHECKED	T.C. CRUISE	H. A. CUSICK	Howard A. Cusick	
REVIEWED	E.D. MYSINGER	S. E. AZZAZY	S.E. Azzazy	
APPROVED	W.A. ENGLISH	E. W. KANT	[illegible]	
ACCEPTED	R.G. DOMER	W. L. ELLIOTT	W L Elliott	

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APPENDIX C

SUPPORT DESIGN REQUIREMENTS FOR MAIN FEEDWATER CHECK VALVE SLAM LOADINGS(1) | 15

This appendix provides the design requirements for evaluation of the pipe supports associated with the loadings from the Main Feedwater Check Valve Slam evaluation. The allowables below are only to be used in conjunction with the loadings generated by the analysis techniques presented in WB-DC-40-31.7, Appendix D.

ALLOWABLES:

Concrete Anchorages

The design of anchorages will be in accordance with DS-C1.7.1. | 15

Stiffness/Deflection Requirements

The are no deflection requirements for this evaluation, provided that the actual pipe support stiffness is modeled into the piping analysis.

Structural Members and Baseplates

Structural members and Baseplates will be designed to the stress limits defined in reference 5.1-11.

All other components will be designed in accordance with the allowables presented in section 3.0 (Design Information) of this criteria.

(1) See source note 3 | 15

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-03

TITLE: Criteria for Equipment Rigidity Frequency

DESCRIPTION OF CONDITION:

Design Criteria WB-DC-40.31.7, Section 1.3.6, specifies that equipment should be considered rigid if its frequency was greater than 33 Hz. This criteria also allows equipment with frequencies lower than 33 Hz to be considered rigid depending on the rigid range of the applicable design response spectra. FSAR Section 3.7.3.3 specified that equipment was only considered rigid if the frequency was greater than 33 Hz. TVA agreed to revise the design criteria to be consistent with the FSAR criteria, and identified only one calculation that had used this provision.

CLARIFICATION:

An extent of condition review has been completed which identified 12 calculations for which additional review has been performed to ensure compliance with the revised criteria.

RESOLUTION:

1. Revise design criteria to permit only case-by-case exceptions to the criteria with proper technical justification.

2. Review stress calculations and provide additional technical justification as required.

STATUS: Complete

Design criteria has been revised and the referenced calculations were reviewed. Technical justifications contained in the calculations are compatible with the criteria provisions.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-03

REFERENCES:

1. Design Criteria WB-DC-40-31.7 Revision 17 (T29920817864)

Stress calculations reviewed:

1. N3-62-4A
2. N3-62-5A
3. N3-62-8A
4. N3-62-9A
5. N3-70-31A
6. N3-70-32A
7. N3-70-38A
8. N3-70-39A
9. N3-74-01A
10. N3-74-03A
11. 0600200-09-01 (B18 920919 788)
12. 0600200-09-02 (B18 920919 790)

The above referenced calculations refer to equipment as being flexible, though modeled as rigid. Each calculation provides technical justification for this approach (i.e., nozzle is close to equipment support). Two revisions to the calculations were required.

R17-T29 920817 864

QA Record R16-~~T29 920706 821~~

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NE NUCLEAR ENGINEERING

DESIGN CRITERIA

NUMBER WB-DC-40-31.7

WATTS BAR NUCLEAR PLANT

TITLE: ANALYSIS OF CATEGORY I AND I(L) PIPING SYSTEMS

* See previous revisions for original signatures

	REVISION 0	R15	R16	R17
EFFECTIVE DATE	1-30-76	8-12-91	JUL 06 1992	AUG 17 1992
PREPARED	K.G. FRAZIER	*	WRBibb	WRBibb
CHECKED	T.C. CRUISE	*	S.E. Abbott	[illegible]
REVIEWED	P.A. EVENS	*	[illegible]	S.E. Abbott
APPROVED	W.A. ENGLISH	*	[illegible]	[illegible] for [illegible]
ACCEPTED	R.G. DOMER	*	WL Elliott	WL Elliott

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1.3.6 Rigid/Nonrigid Valves and Equipment[1] - Valves (including operators) and equipment that have fundamental vibratory modes (either bending, torsion, or combined) under 33 Hz. are nonrigid for seismic analysis. If all the modal frequencies are greater than or equal to 33 Hz, the valves/equipment are considered to be rigid. 17

1.3.7 Deleted

1.3.8 Secondary Load - Refers to a load which produces stresses which are self-equilibrating.

1.3.9 Seismic/Nonseismic - All Seismic Category I or I(L) piping is designated as "seismic" piping. All other piping is "nonseismic". Nonseismic piping is in general excluded from Category I buildings.

1.3.10 Stress Index (SI) - Ratio of maximum or peak stress in a component to nominal stress. Used in Code stress equations for Class 1 piping.

1.3.11 Stress Intensification Factor (SIF) - A factor applied to stresses in Code stress equations for Classes 2 and 3 piping which represents the reduction of endurance strength of a particular piping component over that of a straight pipe with a girth butt weld.

1.3.12 Stress Range - The algebraic difference between stress levels in a piping component as the system goes from one load set to another.

1.3.13 Support Type

These definitions are given for piping analysis purposes. More detailed definitions are given in WB-DC-40-31.9.

a. AN (Anchor) - A piping support which restrains all degrees of freedom.

b. B001 Support - A type of tieback support which is governed by TVA's engineering design drawing series 47B001.

[1] - Refer to Appendix C, note 8 17

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-04

TITLE: Use of ASME Code Mean Section Modulus

DESCRIPTION OF CONDITION:

Piping analysis problem N3-03-05A contained the analysis of the AFW pump turbine steam supply line from the main steam line to the turbine stop valve including the associated vent and drain lines. The team noted that the stress summary sheet of this calculation had identified 4 node points where the specified allowable stress had been exceeded in the computer summary printout. The stresses at these node points had been adjusted by a hand calculation to show that the stresses were within the allowable. This adjustment was based on the ratio of the exact section modulus which is used in the TPIPE program to an approximate modulus based on the mean radius of the pipe wall. However, the use of this approximate formula to calculate the section modulus resulted in about a 10% increase in the allowable load on the pipe. TVA used this approximate formula to calculate the section modulus because it was included in the 1974 Edition of the ASME Code. However, the team pointed out that the FSAR Section 3.7.3.8.1 specified the use of the 1971 edition (up to and including the Summer 1973 Addenda) of the ASME Code. TVA agreed to amend the FSAR to include this reference to the 1974 Edition of the ASME Code. The team also noted that this adjustment had been used in other piping analyses.

CLARIFICATION:

Section NC-3652.1 and the Winter 1972 Addenda to the 1971 Code identifies the section modulus per Section NC-3654. Since Section NC-3654 could not be found in the 1971 Code (including addenda) the requirement (i.e., $Z=\Pi r^2 t_n$) from Section NC-3652.4 (Winter 1972 Addenda) was applied to the components identified in item (a) of section NC-3652.4. The r value was not defined and was taken to be the mean radius. This approach is consistent with Section NC-3652.4 of the 1974 Edition of the Code. The FSAR will be revised to use Section NC-3652.4 of the 1974 Edition of the Code.

RESOLUTION:

Revise FSAR to denote use of Section NC-3652.4 of the 1974 Edition of the ASME Code.

STATUS: Complete

FSAR revision developed for inclusion in upcoming amendment number 72.

REFERENCES:

Revised FSAR Section 3.7.3.8.1 (T31920818853)

4. Stress Qualification

   a. 1980 Edition - up to and including Winter 1982 Addenda, Section III, Subsection NB; May be used for the stress qualification of Class 1 piping (NB-3600).

   b. 1974 Edition - Summer 1976 Addenda, Section III, Paragraph NB-3630 (d); used for Class 1 piping which can be analyzed per requirements of Subsection NC.

   c. 1974 Edition - Winter 1976 Addenda, Section III, Paragraph NC/ND-3611.2.

   d. 1977 Edition - Section III, Paragraph NC/ND-3652.3.

5. Welded Attachments

   a. 1980 Edition - Winter 1980 Addenda, Section III, Paragraph NB-4433 which permitted the use of continuous fillet or partial penetration welds for welded structural attachments (Lugs) to the pipe.

6. Flange Qualification

   a. 1983 Edition - up to and including Winter 1983 Addenda, Section III; Used for Class 1 Flange qualification per NB-3658; Used for Class 2 and 3 Flange qualification per NC-3658 and ND-3658.

7. Relief and Safety Valve Thrust

   a. 1977 Edition - Winter 1978 Addenda, Section III, Paragraph NC/ND-3622.5 and Appendix O.

B. CODE CASES

1. Half-Coupling Branch Connections

   a. Code Case N-313, November 28, 1986; Alternate Rules for Half Coupling Branch Connections, Section III, Division 1, Class 2.

2. Response Spectra

   a. Code Case N-411-1, February 20, 1986,; Alternative Damping Values for Seismic Analysis of Classes 1, 2, and 3 Piping Systems, Section III, Division 1; may be used.

ADDED BY FSAR CHANGE PACKAGE 0742

e. 1974 EDITION - SUMMER 1975 ADDENDA, SECTION III PARAGRAPH NC/ND-3651.

f. 1974 EDITION - SECTION III, PARAGRAPH NC/ND-3652.4

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-05

TITLE: Socket Weld Stress Intensification Factor

DESCRIPTION OF CONDITION:

During review of pipe stress calculation N3-03-05A, the team noted that a 3/4-inch socket-welded fitting in the TVA Class C section of the auxiliary feedwater steam supply line exceeded the ASME Code allowable stresses for secondary stresses (WB-DC-40-31.7, Equations 10 and 11) if the Code-specified stress intensification factor for a fillet-welded joint was used. TVA performed a finite element analysis of the socket-welded joint in order to demonstrate compliance with the Code-allowable stresses. However, since the Code stress intensification factor (SIF) was based on tests and not on analysis, the team questioned the adequacy of using the finite element analysis to supersede the Code stress intensification factor. As part of its response, TVA produced the field walkdown dimensions of the welded joint. The team noted that the 1/8-inch leg shown on the walkdown sketch did not meet the ASME Code minimum fillet-weld size specified in Figure ND-3661.1-1 of the Code.

The team pointed out that the fillet weld does not meet the Code requirements for minimum leg length and that the use of a finite element analysis to reduce a stress intensification factor that was based on testing was not appropriate.

CLARIFICATION:

Upon further review of all the pipe stress calculations we find that this approach was only used in the identified calculation, therefore the subject socket weld will be reworked to meet figure NC-3673.2 (b)-3 sketch (d) of the 1974 code and the corresponding SIF of figure NC-3673.2 (b)-1 will be used in the evaluation of the stress in the piping analysis.

RESOLUTION:

1. Revise socket weld design to meet ASME Code requirements.

2. Verify that calculation meets corresponding SIF.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-05

STATUS: Engineering complete

Field engineering work will be completed as part of the Auxiliary Feedwater System completion schedule.

REFERENCES:

1. Calculation N3-03-05A Revision 11 (B18920919792)

2. ASME, Section III, 1971 Edition through Summer 1973 Addenda and 1974 Edition

3. DCN M-20592-A (T56920925826)

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-06

TITLE: Use of Certified Material Test Reports (CMTRs) for Pipe Stress Analysis

DESCRIPTION OF CONDITION:

FSAR Section 3.6A.2 provides the criteria for postulating pipe ruptures and specifies that the ruptures be based on Code-calculated stresses.

The team noted that pipe stress calculation PR-0600200-05-01, Table 5.2-1, identified four data points for which the allowable stress criteria for postulating pipe breaks had been exceeded. These data points had been dispositioned by TVA in calculation PR-0600200-05-01. For two of the nodes, C13B and C14B, TVA had adjusted the ASME Code allowable stresses by using the CMTR for the material. According to TVA this adjustment was allowed in TVA procedure EAI-8.08. However, the team noted that the ASME Code did not contain provisions for adjusting the allowable stresses based on CMTRs and that no mention was made in the FSAR regarding such use of CMTRs.

CLARIFICATION: None

RESOLUTION:

1. Revise Design Criteria WB-DC-40-31.50 and EAI 8.08 to disallow the use of CMTR's in pipe rupture evaluations without a criteria exception and case-by-case evaluations and an FSAR change.

2. Revise the pertinent calculations which have utilized CMTR provisions to be compatible with the criteria.

STATUS: Complete.

Revisions to the design criteria and engineering instructions have been completed. The referenced calculations have been revised to be compatible with the design criteria provisions.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-06

REFERENCES:

1. Design Criteria WB-DC-40.31-50 Revision 8 (T2992031875) (attached)

2. Engineering Administrative Instruction (EAI) 8.08 Revision 1 (T29920831874) (attached)

3. PR-0600200-05-01, Revision 5, "Pipe Rupture Crack Evaluation of the Aux. Feedwater Problem 0600200-05-01" (B26920915101)

4. PR-N3-72-01A, Revision 2, "Pipe Rupture Crack Exclusion Evaluation of Problem N3-72-01A" (B26920915104)

5. PR-N3-01-03A, Revision 2, "Pipe Rupture Evaluation of the Main Steam Bypass Problem N3-01-03A" (B26920915102)

6. PR-0600200-02-12, Revision 2, "Pipe Rupture Evaluation of the Feedwater System Problem 0600200-02-12" (B26920915100)

7. PR-0600200-07-02, Revision 2, "Pipe Rupture Evaluation of the SGBD Problem 0600200-07-02" (B26920915105)

8. PR-0600200-07-04, Revision 2, "Pipe Rupture Evaluation of the SGBD Problem 0600200-07-04" (B26920915103)

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TENNESSEE VALLEY AUTHORITY

QA Record

DESIGN CRITERIA
NUMBER WB-DC-20-32
WATTS BAR NUCLEAR PLANT

TITLE:

INTEGRATED INTERACTION PROGRAM
SCREENING AND ACCEPTANCE CRITERIA

	Revision 0	R1	R2	R3
Effective Date	04/12/91	07/16/92	10/8/92	
Prepared	Stephen J. Eder *	R. D. Hookway *	Robert D. Hookway	
Checked	Gayle S. Johnson *	M. L. Thompson *	ML Thompson	
Reviewed	Thomas R. Kipp *	T. R. Kipp *	Thomas R. Kipp	
Approved	James G. Adair *	J. G. Adair *	[illegible]	
Accepted	J. K. McCall *	W. L. Elliot *	W L Elliott	

* Original signed by

Total 21~~2~~3 Pages LMB 10-8-92

Revision Number	Description of Revision	Date Approved
0	Original Issue	04/12/91
1	This revision includes general changes to bring criteria into conformance with NRC commitments pertaining to Category I(L) piping and to incorporate provisions of TVA criteria for screening and acceptance of anchorage. Other changes consist of general editorial revisions. All changes are indicated by revision bars in the right hand margin.	07/16/92
2	This revision incorporates commitments identified during the NRC Integrated Design Inspection of Civil/Seismic issues in July 1992. Weld allowable stresses have been revised in Section 4.2.1.1.C.1. All changes are indicated by a revision bar in the right hand margin.	10/8/92

to establish whether cracks in the vicinity of an anchor actually pass through the installation. Inspections for crack width should be visual (i.e., detailed measurement of crack widths is not necessary).

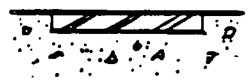
RC_p	=	Pullout capacity reduction factor for cast-in-place anchors in cracked concrete	
	=	1.0	for no cracks and for CS < 0.01 in.
	=	1.08 - 8CS	for 0.01 in. ≤ CS ≤ 0.06 in.
	=	Outlier for CS > 0.06 in.	
CS	=	Crack size (approximate size based on visual observation)	

b.5 Shear-tension Interaction. For existing cast-in-place bolts subjected to simultaneous shear and tension, the combined effects of shear and tension may be evaluated using the following equation:

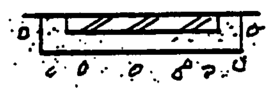
$$(P/P_{all})^{1.7} + (RV/P_{all})^{1.7} \leq 1.0$$

Where:

R = 1.10 for embedded plates with the exposed surface of the steel coincidental with the concrete surface. (If free concrete edge less than 4 inches from edge of embedded plate, use R = 1.5)

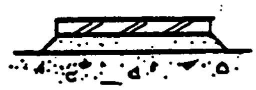


R = 1.25 for plates with recessed grout pads with exposed surface of the plate coincidental with the concrete surface



R = 1.5 for surface mounted plates

R = 1.85 for plates supported on a grout pad with the contact surface exterior to the concrete surface



c. Welds to Embedded or Exposed Steel. The acceptance criteria for anchorage consisting of welds to embedded or exposed steel are provided in the following paragraphs.

c.1 Allowable Loads for Typical Welds. Allowable loads for weld connections is based on the shear stress criteria specified in Table B-1 of Reference 36 where shear stress for welds using E70 electrodes is 29.4 ksi.

35. EQE Engineering Calculation 50052-C3-074, RIMS B18 910524 011, "Welds, Unistrut Pipe Clamps, U-Bolts and Threaded Rod Screening Capacities", Revision 0, March 01, 1991.

36. Tennessee Valley Authority, Watts Bar Nuclear Plant Design Criteria WB-DC-40-31.9, RIMS T29 920806 857, "Criteria for Design of Piping Supports and Supplemental Steel in Category I Structures", Revision 15.

37. Tennessee Valley Authority, Watts Bar Nuclear Plant, Final Safety Analysis Report (FSAR).

38. EQE Engineering Calculation 50052-C2-030, "Watts Bar Median Centered Structural Response, Auxiliary Building and Reactor Building".

CIVIL IDI
TVA RESPONSE TO UNRESOLVED ITEM 92-201-19

TITLE: Potentially Unconservative Seismic Load in HVAC Duct Support Evaluations

DESCRIPTION OF CONDITION:

TVA Calculation WCG-1-1238 evaluates 55 HVAC duct supports located at Elevation 729' of the control building. The calculation used zero period acceleration (ZPA) to compute the seismic loads when the fundamental frequency of the supports were 33 Hz or higher. The amplified response spectra (ARS) for the control building, especially in the vertical direction, showed a peak around 48 Hz. The magnitude of the peak was about three times the ZPA value. TVA indicated that they were committed to use ZPA for computing seismic loading for supports having structural frequency higher than 33 Hz as indicated in FSAR 3.7.3.5.1. Further discussion with TVA revealed that the ARS curves were never submitted to the NRC staff for review.

CLARIFICATION:

ARS curves were reviewed by the staff during extensive audits in 1989 and 1990. Reference 4 describes the reviews performed.

RESOLUTION:

Document the reasoning and justification for the adequacy of work performed to date.

STATUS: Complete

Additional justifications are attached which demonstrate the adequacy of the existing design approach.

REFERENCES:

1. Calculation WCG-1-1238, "Evaluation/Modification of Duct and Duct Supports at Control Building Elevation 729'-0," Revision 0

2. Calculation WCG-1-345, "Auxiliary-Control Building Seismic Analysis," Revision 0

3. Watts Bar FSAR Section 3.7.3.5.1

4. NRC Inspection Report 50-390/89-21 and 50-391/89-21

ATTACHMENT TO UNRESOLVED ITEM 92-201-19

Background

Prior to calculation of the floor response spectra, time-histories were developed to envelope the site specific ground response spectra for WBN. A computer program that matches time-history spectrum at (Watts Bar Site Specific Ground Motion) four different damping values was used. Development of synthetic time-history is an iterative process; adjustments are made in the time-history until the calculated spectra reasonably match the target spectra. As a result, and especially when using four different damping values, matching of the spectra will not be perfect and there will be some differences between the calculated and target spectra.

On the WBN project, the synthetic vertical time-histories exhibited secondary peaks at around 48 Hz after many iterations. Attempts to eliminate those artificial peaks were not successful, filtering of the high frequency response was affecting the response at lower frequencies, sometimes the calculated response falling unacceptably below the target spectra. Therefore, a decision wa made to stop the iteration process and use the conservative peaks beyond the range of design requirements.

Methodology

The horizontal and vertical design ground time histories were rerun to obtain the acceleration response from 33 to 100 Hz at 3 Hz intervals. Plots of the response acceleration were compared to the target spectra which are site specific response spectra.

The comparison of the 2%, 5%, and 7% damping plots of the target and calculated response spectra are attached.

Discussion

Earthquake Records

It is well known that real earthquakes do not have significant energy content at higher frequencies. The cutoff frequency is normally considered to be 33 Hz although energy content of many earthquakes becomes negligible even at lower frequencies. In fact, the SRP states that checking of Power Spectral Density (PSD, which is a measure of energy content of an earthquake record or a synthetic time history) above 24 Hz is unnecessary (Appendix A to SRP Section 3.7.1).

If there is no significant energy in the earthquake motion, there will not be any amplification through the structure and thus the floor response spectra will be flat beyond the cutoff frequency. For this reason, the Regulatory Guide design spectra are flat beyond 33 Hz, anchored to peak ground acceleration.

Synthetic Time-Histories

Considering the real time-history records and spectra obtained from these records, the amplification in the vertical spectra at 48-50 Hz for the WBN auxiliary building is an artificial issue and does not reflect any real phenomena. The decision to use the synthetic time-history that was developed as described above was for expediency; the matching below 33 Hz frequency was rather remarkable at four different damping values (comparison at three damping values, 2%, 5%, and 7% are attached) and it was desirable to keep it that way. It is noted that the synthetic time history 2% damping response is about 50% greater than the target response around 50 Hz.

The time-histories developed for WBN may be further refined to eliminate the secondary peaks. However, as noted earlier this may cause other problems in the calculated response. A better match may be obtained at a single damping value; however, this may not give adequate results at other damping values. In short, it is extremely difficult, if not impossible, to develop a time-history that will satisfy all the criteria. Therefore, loss of accuracy is some aspect, where such a loss will not be significant, becomes inevitable.

Even though the use of time-histories would implicitly include the effects of the peak at 48 to 50 Hz, the inclusion of this peak for response spectra analysis is totally unnecessary.

Structural Characteristics

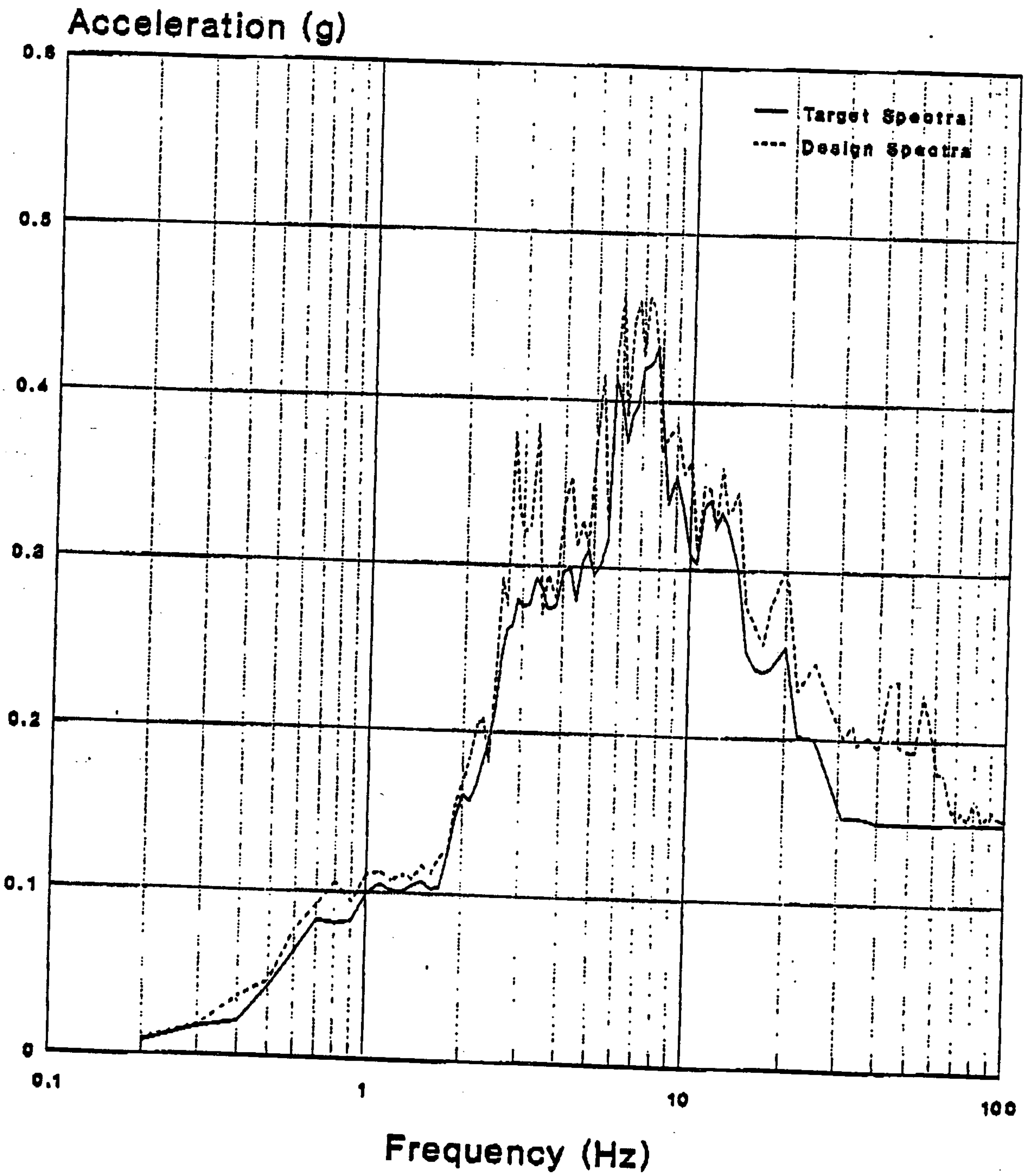
The auxiliary building is relatively rigid, with fundamental vertical frequency of about 23 Hz. The higher modes are beyond 33 Hz. These higher modes would not be excited if the synthetic time history used in analysis did not have high frequency content.

Thus, the secondary peaks in the ARS result from the secondary peaks in the input motion that are visible in the synthetic time history spectra shown in attached plots.

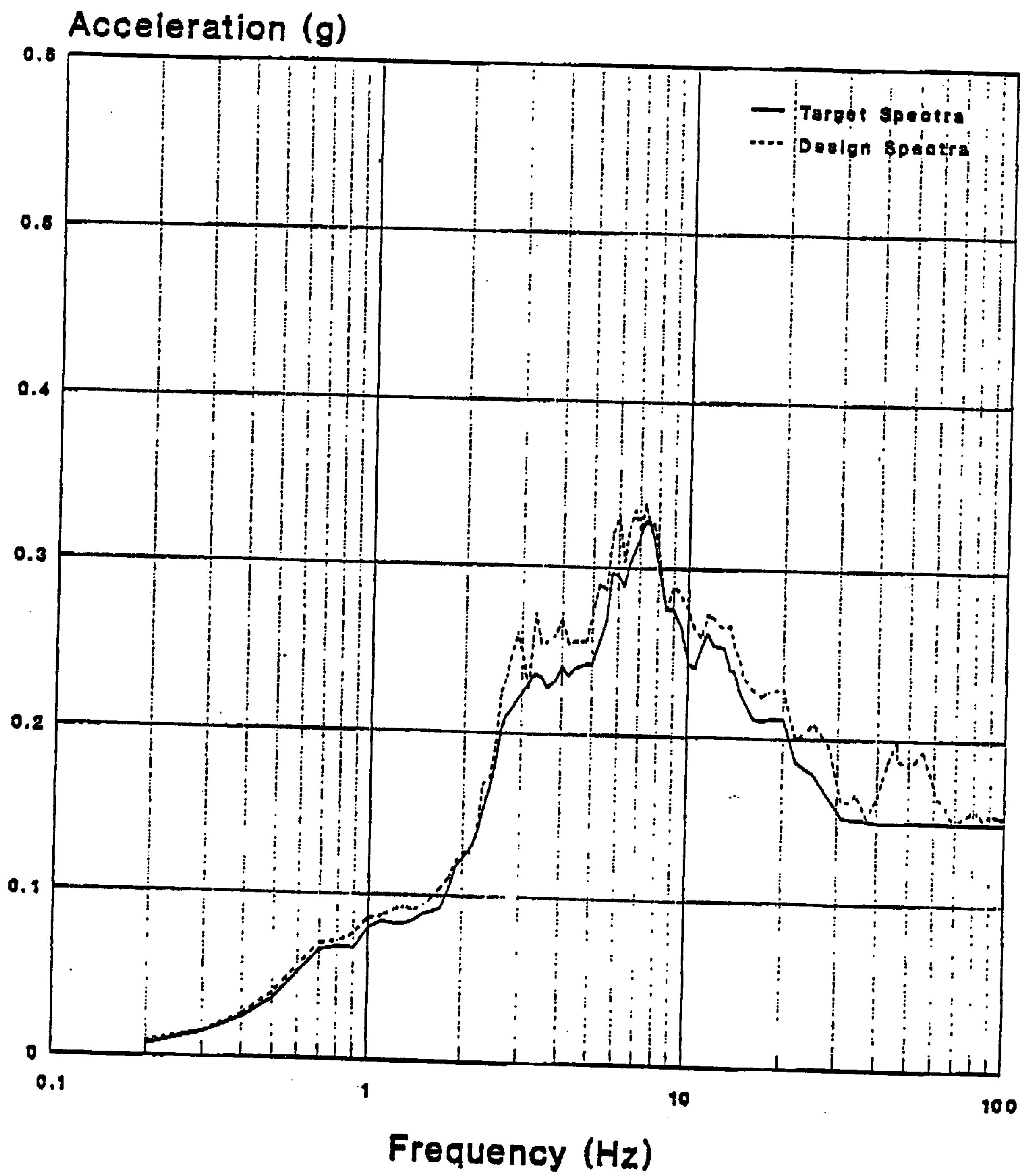
Conclusions

Secondary peaks in the ARS beyond 33 Hz do not reflect the behavior of structures under earthquake loads. These peaks are generated by the numerical difficulties that are encountered in generating the synthetic time-histories. Thus, such peaks should not be used in design; use of the ZPA as indicated by the ARS at 33 Hz (or lower) is adequate.

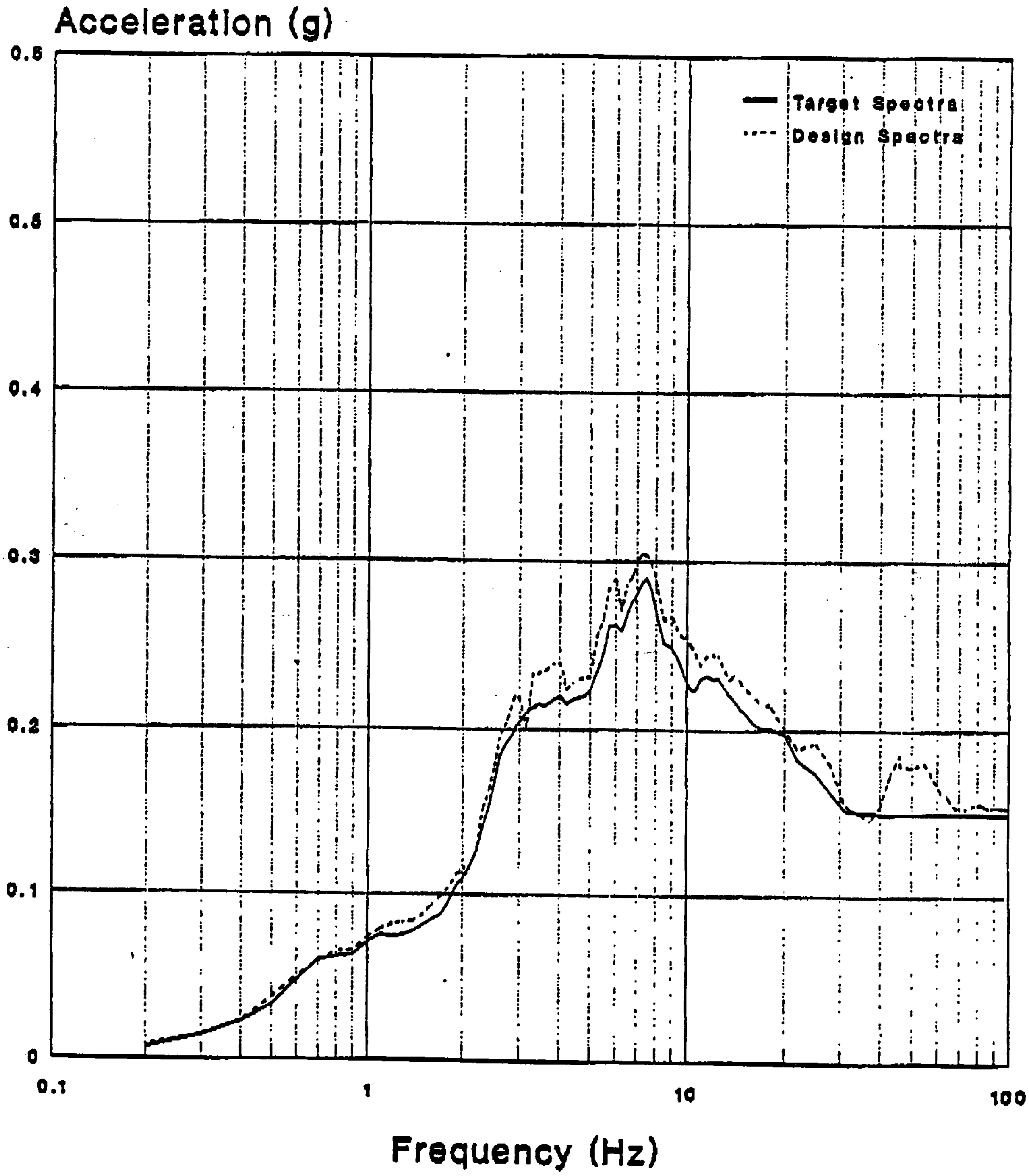
Response Spectra for Watts Bar
Vert (v) direction 2% damping



Response Spectra for Watts Bar
Vert (v) direction 5% damping



Response Spectra for Watts Bar
Vert (v) direction 7% damping



CIVIL IDI
TVA RESPONSE TO UNRESOLVED ITEM 92-201-20

TITLE: Load Carrying Capacity of Plate on Steel Platform

DESCRIPTION OF CONDITION:

In the STRUDL model, equipment was modeled as rigidly attached to the structural members to account for eccentricity and torsional effects. The six pieces of equipment on the checker plate weighed approximately 1000 pounds each. In addition, six smaller pieces of equipment were mounted on the same checker plate. The equipment was designated as drive assemblies and classified as Category I(L). A floor plate of 3/8" thickness was placed on the platform and part of the weight of the drive assemblies were supported by the plate. Equipment anchor bolts were attached to this plate and the plate carried this load to the adjacent supporting structural members.

The structural adequacy of the plate was not evaluated in the calculation. During the inspection, TVA performed a calculation and indicated that the stresses in the plate were below allowable. The team pointed out that a point load would create a stress singularity on the plate and that the stress at or near the load point would approach infinity. TVA then performed a finite element analysis and hand calculations, where the point load was replaced by line loads or a narrow band of line loads. The team stated that the line load also created a stress singularity which indicated that either the plate was not suitable for supporting concentrated loads or the wrong analytical methodology was employed. TVA stated that the legs of the inverted equipment channels had a finite width of approximately ¼ inch and thus qualified as narrowly distributed loads. The team did not agree with TVA's responses.

CLARIFICATION:

The qualification of the Seismic Category I platform was the scope associated with the reviewed calculation. The qualification of the plate supporting the Category I(L) equipment was under a different scope as well as a different criteria. (Category I(L) Equipment). The ¼ inch width of the inverted equipment channels represents the configuration in the plant.

RESOLUTION:

The attached documentation delineates the additional analyses which have been performed. These analyses show that significant margins exist to demonstrate that the I(L) equipment will not adversely affect any Category I features.

CIVIL IDI
TVA RESPONSE TO UNRESOLVED ITEM 92-201-20

STATUS:

Completed as described in the attachment.

REFERENCES:

1. Study on the effects of I(L) Equipment on platform El. 736'-1½", (T30920804881)

ATTACHMENT TO UNRESOLVED ITEM 92-201-20

Reactor Building Platform at Elevation 736'-1½" North and South, consists of structural steel framing and steel plate. The drive assembly equipment is supported by the steel plate which is supported by the framing, with steel members directly under the plate where equipment is located. The platform steel framing was analyzed, considering all loads with the equipment weight applied directly on the structural steel framing members. This approach was taken due to the considerations that the plate (which is designed for 100 psf load) is locally adequate to support the equipment distributed weight of 91 psf (925/4.4 x 2.3 = 91 psf), and local effects due to moment from lateral seismic loads on relatively small height (35 inches total) are not significant.

To further demonstrate the adequacy of the plate to transmit the equipment loads, a finite element analysis of the plate was performed and is attached. In this calculation total equipment load was conservatively applied on a large plate panel, and calculated stresses (15.0 ksi for the governing SSE loads) were shown to be well below the allowable limits of 32.4 ksi.

A review of the population of platforms has identified that only the above two Reactor Building Platforms at Elevation 736'-1½" North and South support equipment on floor steel plates. This review also identified not only the two Auxiliary Building Hot Sample Room Exhaust Fan Platforms at Elevation 722"-9" support equipment on steel grating. These two exhaust fan platforms and the grating which supports the exhaust fans are evaluated in calculation WCG-1-133 Revision 4.

A second finite element analysis has been performed with a more refined mesh to demonstrate the accuracy of the finite element analysis mentioned above. The initial analysis determined maximum stress at a centroidal location of 1/3 the plate thickness from the face of the channel. The second finite element analysis determined maximum stress at a centroidal location just inside the face of the channel. The second finite element's maximum stress was only 3% greater than the initial analysis. In addition, calculations are provided to incorporate other stresses from diaphragm action and concentrated horizontal bolt forces. For each load combination calculated, stresses are well below the allowable limits.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-21

TITLE: Damping Values for Structural Steel Platforms

DESCRIPTION OF CONDITION:

In calculation WCG-1-770, TVA analyzed two steel platforms as a coupled model, and indicated that a majority of the connections were bolted in the combined structure. Therefore, using higher damping values for the bolted structure was justified. However, Drawings 48W903 and 48W902 showed that a significant number of the platform connections were welded and using higher damping values (for bolted connections) for this platform was not warranted. TVA later indicated that a new analysis was performed based on lower damping values, and that the results indicated that the stress increment was less than five percent of the original. TVA also stated that the use of lower damping values was limited to platforms located at elevations 730' and 736' in the reactor building. The team did not review this calculation.

CLARIFICATION: None

RESOLUTION:

Refer to the enclosed description of efforts performed and the specific disposition of the subject platform.

STATUS:

Completed as described in the attachment.

REFERENCES:

1. NUREG/CR-0098, "Development of Criteria of Seismic Review of Selected Nuclear Power Plants," N. M. Newark and W. J. Hall, May 1978

2. NUREG/CR-1161, "Recommended Revisions to Nuclear Regulatory Commission Seismic Design Criteria," Lawrence Livermore Laboratory, May 1980

3. Calculation WCG-1-770, "Evaluation of the Drive Assembly and 5 Path Transfer Support Platform at elevation 736'-1½, South Reactor Building," Revision 1, (B18 920805 291)

ATTACHMENT TO DEFICIENCY 92-201-21

The WBN seismic analysis of the structural steel platforms consistently utilized damping values that are in compliance with Regulatory Guide 1.61. First, the design layout drawings were examined to establish the type of connections in the primary load carrying path from the source excitation to the base of the equipment supported on the platform. If most of the connections are welded, then the platform seismic analyses were performed using Regulatory Guide 1.61 damping of 2% OBE and 4% SSE corresponding to "Welded Steel Structures." Similarly, if most of the connections are bolted, then the platform seismic analyses were performed using Regulatory Guide 1.61 damping of 4% OBE and 7% SSE corresponding to "Bolted Steel Structures." For a design with both welded and bolted structures, a judgment was made as to which set is more appropriate based on the platforms predominate behavior. This is a conservative approach and is consistent with current industry practice. The attached list and drawings show that nine out of the twenty-one worst case platforms were evaluated using the more conservative damping values of "Welded Steel Structures" (for example see Calculations WCG-1-881 and WCG-1-907).

In mid 1980, studies performed for the NRC recommended revisions to seismic design criteria in References 1 and 2. The recommendations relative to structural damping of "Welded Steel Structures" defined a range of values from 2% to 3% for working stress and 5% to 7% for stresses near yield. The lower values are "...highly conservative and suitable for design" and the upper values are "...acceptable for evaluation of existing structures." By comparison of these recommended damping values for welded construction with those used for WBN platform seismic analyses for bolted construction, it is concluded that the damping values are appropriate and provide conservative results.

The following explains the judgment for the specific platform at Elevation 736'-1½" South. The platform evaluated in calculation WCG-1-770 is located directly over the larger platform at Elevation 730"-10½". These two platforms are connected by structural support framing. The two platforms and the integral support framing are included in the same STRUDL computer model to account for the structural interaction of the platforms. These platforms do not have rigid moment connections characteristic of welded frame structures. The larger lower platform (a major load path) contains mostly bolted connections. Although most connections in the smaller upper platform are welded, the cope connections are not considered rigid moment connections, because only the web is welded. In addition, the platform structures exhibit inherent structural damping from numerous attachments, floor plate, a ladder with bolted connections, removable hand rail post, and an attached staircase. Damping results from conditions such as these contribute to the loss of energy associated with non-platform elements. Because the larger platform is expected to dominate the damping characteristics for the combined analysis, the damping values were selected to evaluate this platform based on "Bolted Steel Structures."

In addition, it should be noted that a companion platform at Elevation 736'-1½" was evaluated based on damping valves of 2% OBE and 4% SSE for "Welded Steel Structures" without need for modification. This provides additional assurance that the platform is structurally adequate. It should also be noted that the damping level used for the combined platform model is unquestionably appropriate for all of the members and connections of the lower large platform since most of connections are in fact bolted.

TVA has revised the calculation which evaluated the subject platform using the Regulatory Guide 1.61 damping for "Welded Steel Structures" (2% OBE, 4% SSE) and found the forces increased 2% to 5%.

DAMPING OF WORST CASE PLATFORMS

PLATFORM ID	DESCRIPTION	CALCULATION	DAMPING
48W937-01PF01U1	Pipe Supp Frame,	WCG-1-881 RO	Welded 2% & 4%
48W937-01PF02U1	EL 728 & 734	WCG-1-881 RO	Welded 2% & 4
48W914-01PF04U1	MK4 EL 745, RCP HOOD	WCG-1-687 RO	Bolted 4% & 7%
48N1210-07PF01U1	EL 747	WCG-1-876 RO	Bolted 4% & 7%
48W902-00PF03U1	EL 730	WCG-1-769 R1	Bolted 4% & 7%
48W902-00PF02U1	EL 736 (N)	WCG-1-809 RO	Welded 2% & 4%
48W902-00PF01U1	EL 736 (S)	WCG-1-770 R1	Bolted 4% & 7%
48W901-00PF02U1	EL 806	WCG-1-907 R1	Welded 2% & 4%
48N905-00PF01U1	Loop 3	WCG-1-879 RO	Bolted 4% & 7%
48W914-01PF01U1	MK1, EL 745, RCP HOOD	WCG-1-788 RO	Bolted 4% & 7%
49N901-00PF01U1	EL 778	WCG-1-751 RO	Welded 2% & 4%
48N968-00PF01U1	EL 783	WCG-2-50 R1	Welded 2% & 4%
48N1210-06PF01U1	EL 728 & 724	WCG-1-865 RO	Bolted 4% & 7%
48N1210-06PF02U0		WCG-1-865 RO	Bolted 4% & 7%
48N1210-07PF02UO	EL 744.9	WCG-1-899 R1	Bolted 4% & 7%
48N1210-10PF01U1	EL 799	WCG-1-866 RO	Bolted 4% & 7%
48N407-00PF06U1	EL 763-9 SCV	WCG-1-908 R1	Welded 2% & 4%
48W904-02PF02U1	EL 745	WCG-1-789 RO	Bolted 4% & 7%
48N1210-03PF01UO	EL 721	WCG-1-961 R1	Welded 2% & 4%
48N1210-16PF01U1	EL 713	WCG-1-898 RO	Welded 2% & 4%
48N1210-24PF02U1	EL 726 (N)	WCG-1-962 RO	Bolted 4% & 7%

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-22

TITLE: Use of Unconservative Approach for Anchor Analysis

DESCRIPTION OF CONDITION:

TVA performed Calculation 48W0930A107 to evaluate two embedded plates (plates 48W0930A118 and 48N091305A022) for concrete anchor pullout capacity. The calculation only addressed the individual anchor capacity without addressing the interaction load among anchors. This approach was unconservative and deviated from design standard DS-C1.7.1. The design standard considered the interaction in anchor loads within a group of anchors and had been so implemented in computer code CONAN.

During the inspection, TVA provided sample evaluations of three anchor groups using CONAN. These three groups had two, three and four anchors, respectively. The factor of safety for the most heavily loaded anchor against pullout from concrete in each group was 2.34, 2.16, and 2.00, respectively. The team noted that the factor of safety decreased with increasing number of anchors. Since there were 16 anchors each in plates 2 and 3, it was conceivable that, when the CONAN code was applied to these plates, the factor of safety for the anchor in question might be less than the required minimum factor of 1.94. The value 1.94 was derived by dividing the required factor of safety for embedded plate with the faulted load factor, i.e., 3.1 + 1.6 = 1.94.

CLARIFICATION:

The study calculation referenced above was prepared to help demonstrate the various methods that can be used in the evaluation of concrete pullout and their relative results. Calculation 48W0930A107 is the calculation which qualifies the embedded plate. In all cases, this calculation shows that the minimum factor of safety for pullout is 1.97 which is greater than the required 1.94.

RESOLUTION:

Calculation 48W0930A107 evaluated an embedded plate with 16 Nelson studs. The evaluation methodology used was iterative and did evaluate all studs which are in tension (9 studs). This methodology is in compliance with TVA Design Standard DS C1.7.1. The following outlines this process:

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-22

a) Evaluate the most highly loaded anchor based upon the concrete pull out value of DS C1.7.1 for a full concrete cone area. (Sht 32 of 48W930A107)

$Pallow = 3.4 \sqrt{f'c} \quad Ac$

P = Pull out capacity
f'c = Compressive strength of the concrete
Ac = Pull out cone area

If $\frac{Pactual}{Pallow} \geq 1.94$ go to next adjacent anchor.

b) Evaluate the most highly loaded anchor and the most highly loaded adjacent anchor based upon the combined concrete cone area for both anchors and the load from both anchors, again using the pull out capacity based upon DS C1.7.1 requirements. (Sht 33 of 48W930A107)

$Pallow = 3.4 \sqrt{f'c} \quad Ac$

where Ac = Total area of cone for both anchors
Pactual = P(1) + P(2)

If $\frac{Pactual}{Pallow} \geq 1.94$ go to next adjacent anchor.

c) Evaluate the third most highly loaded adjacent anchor along with the previous two loaded anchors based upon the combined concrete cone area for all three anchors and the load from all three anchors, again using the pull out capacity based upon DS C1.7.1 requirements. (Sht 35 of 48W930A107).

$Pallow = 3.4 \sqrt{f'c} \quad Ac$

where Ac = Total area of cone for all three anchors
Pactual = P(1) + P(2) + P(3)

If $\frac{Pactual}{Pallow} \geq 1.94$ go to next adjacent anchor.

d) Continue with this process until all studs with tension loads are evaluated. In each of these steps the safety factor must be greater than or equal to 1.94. This methodology ensures that each anchor along with the entire group meets or exceeds the design requirements of DS C1.7.1. (Shts 34, 36, 37 of 48W0930A107).

STATUS: Complete

REFERENCES:

1. Calculation 48W0930A107 (B18 920509 261)

EBASCO SERVICES INCORPORATED

BY M.S DATE 5-8-92 | BRANCH/PROJECT ID: 48W0930A107 | SHEET 32 OF 66

CHKD. BY G. Ahmed DATE 5/9/92 | OFS NO. NR | DEPT. NO. NR

CLIENT TVA

PROJECT WBNP UNIT 1

SUBJECT CALCULATIONS FOR UNIQUE EMB. PL 48W930-A-107

11.6.2 CONT.)

MAXIMUM SINGLE STUD PULLOUT AREA = $10^2\pi = 314\ IN^2$

ULTIMATE CONCRETE STRENGTH = $3.4\sqrt{6200}\,(314)$

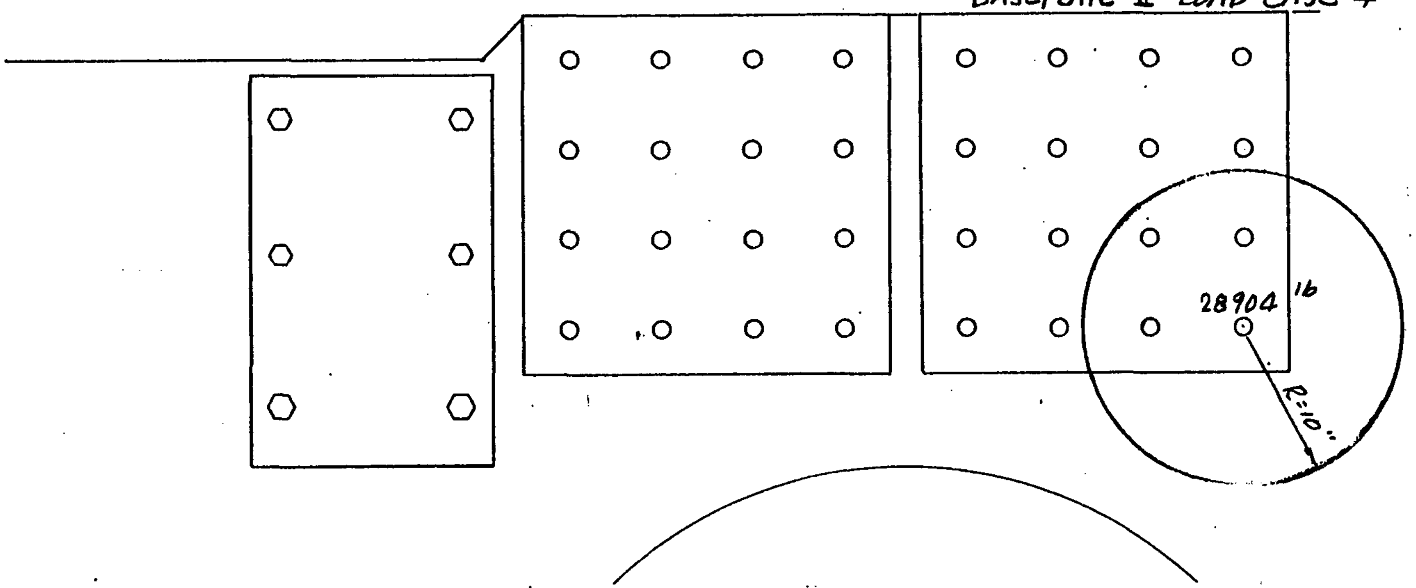
= 84063^{lb}

MAXIMUM PULLOUT FORCE = 28904^{lb}

$F.S = \dfrac{84063}{28904} = 2.91 > \dfrac{3.1}{1.6}^{*} = 1.94$ - OK.

* $1\frac{1}{2}$"ϕ BOLT IS ASTM A108 WHICH SAME AS STUD.

BASEPLATE II LOAD CASE 4



REF.

ATTACH "C" PG 28

DS-C1.7.1 R5

QIR-CEB WBN 91009 Rev.0

581 2-88

EBASCO SERVICES INCORPORATED

BY M.S DATE 5-8-92 BRANCH/PROJECT ID: 48W0930A107 SHEET 33 OF 66

CHKD. BY G. Ahmed DATE 5/9/92 OFS NO. NR DEPT. NO. NR

CLIENT TVA

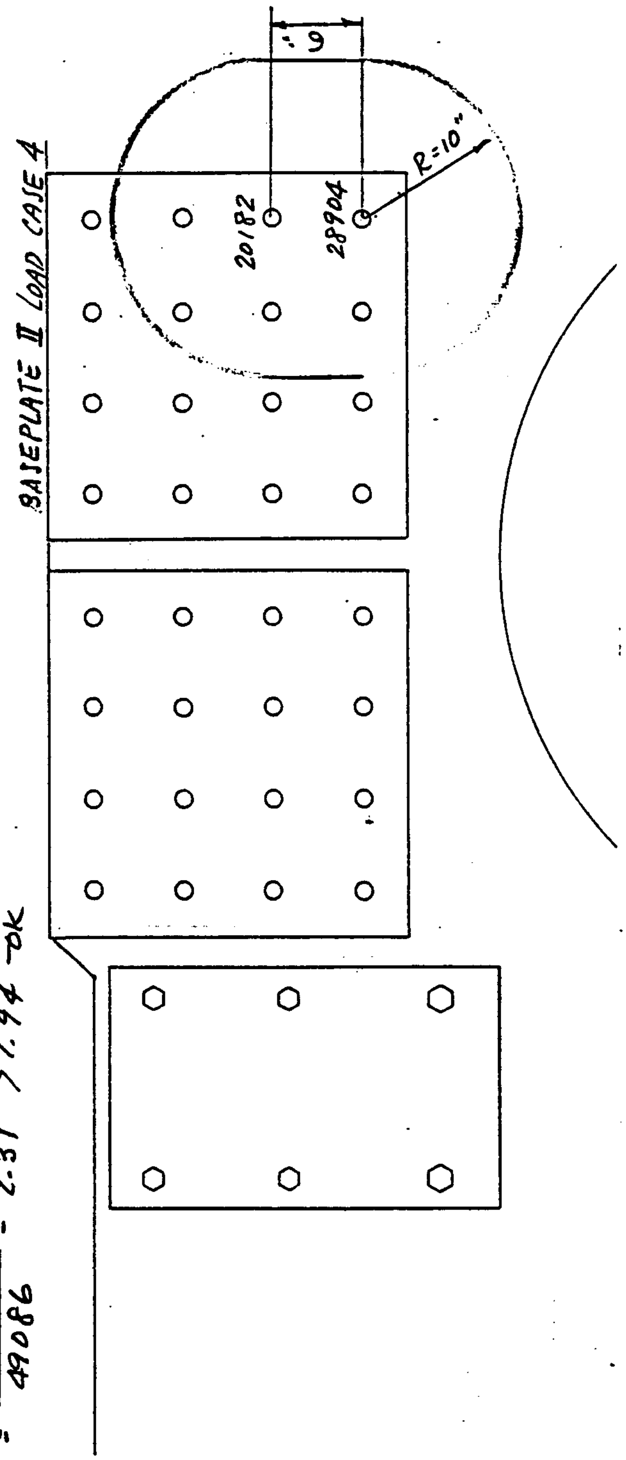
PROJECT WBNP UNIT 1

SUBJECT CALCULATIONS FOR UNIQUE EMB. PL 48W930-A-107

REF.

11.6.2 CONT.)

ATTACH "C" PG 28



TWO STUD PULLOUT AREA $= 10^2\pi + 6 \times 20 = 434 \text{ IN}^2$

ULTIMATE CONCRETE STRENGTH $= 3.4 \sqrt{6200}\,(434)$

$= 116189 \text{ lb}$

PULLOUT FORCE $= 28904 + 20182 = 49086 \text{ lb}$

$F.S = \frac{116189}{49086} = 2.37 > 1.94$ OK

EBASCO SERVICES INCORPORATED

BRANCH/PROJECT ID: 48W0930A107

BY M.S DATE 5-8-92 SHEET 34 OF 66

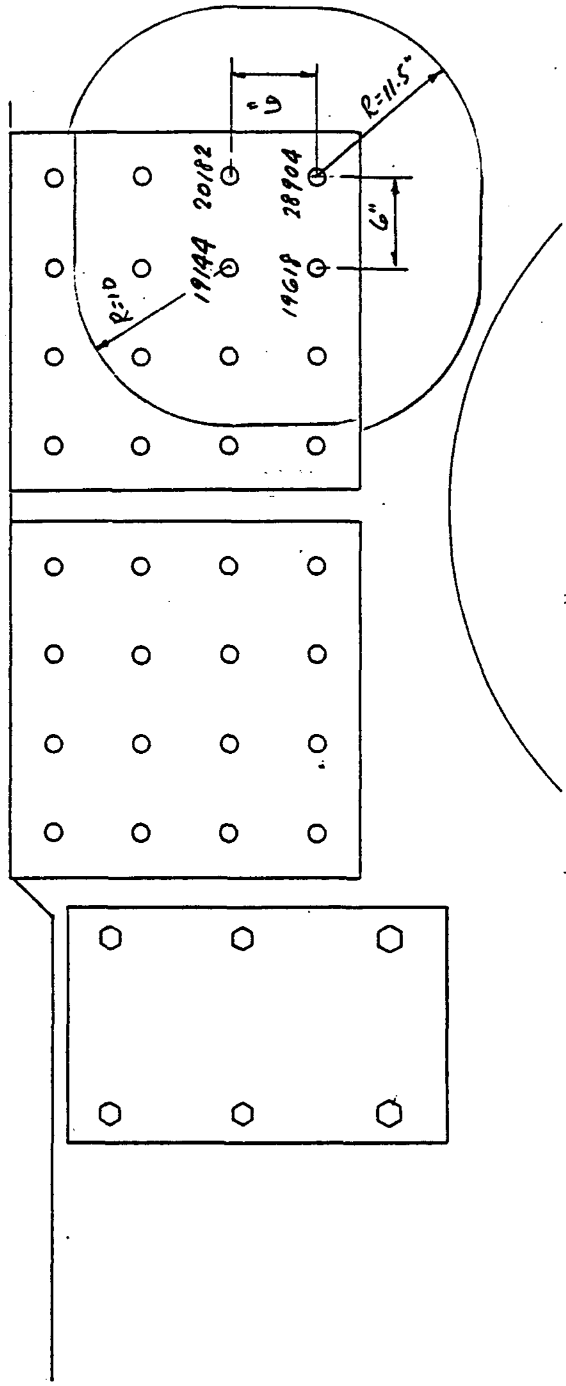
CHKD. BY G. Ahmed DATE 5/9/92 OFS NO. NR DEPT. NO. NR

CLIENT TVA

PROJECT WBNP UNIT 1

SUBJECT CALCULATIONS FOR UNIQUE EMB. PL 48W930-A-107

	REF.
11.6.2 CONT.)	ATTACH "C" PG 28



$$\text{STUD PULLOUT AREA} = \tfrac{1}{2}(10^2\pi) + \tfrac{1}{2}(11.5^2\pi) + 6(10+6+11.5) + 6(10+11.5)$$

$$= 659 \text{ IN}^2$$

$$\text{ULTIMATE CONCRETE STRENGTH} = 3.4\sqrt{6200}\,(659) = 176425 \text{ lb}$$

$$\text{PULLOUT FORCE} = 19144 + 19618 + 28904 + 20182 = 87848 \text{ lb}$$

$$F.S. = \frac{176425}{87848} = 2.01 > 1.94$$

EBASCO SERVICES INCORPORATED

BY M.S DATE 5-8-92 BRANCH/PROJECT ID: 48W0930A107 SHEET 35 OF 66

CHKD. BY E. Ahmed DATE 5/9/92 OFS NO. NR DEPT. NO. NR

CLIENT TVA

PROJECT WBNP UNIT 1

SUBJECT CALCULATIONS FOR UNIQUE EMB. PL 48W930-A-107

REF.

ATTACH "C" PG 28

11.6.2 CONT.)

THREE STUD PULLOUT AREA $= 10^2\pi + 12 \times 20 - 6 = 548\ IN^2$

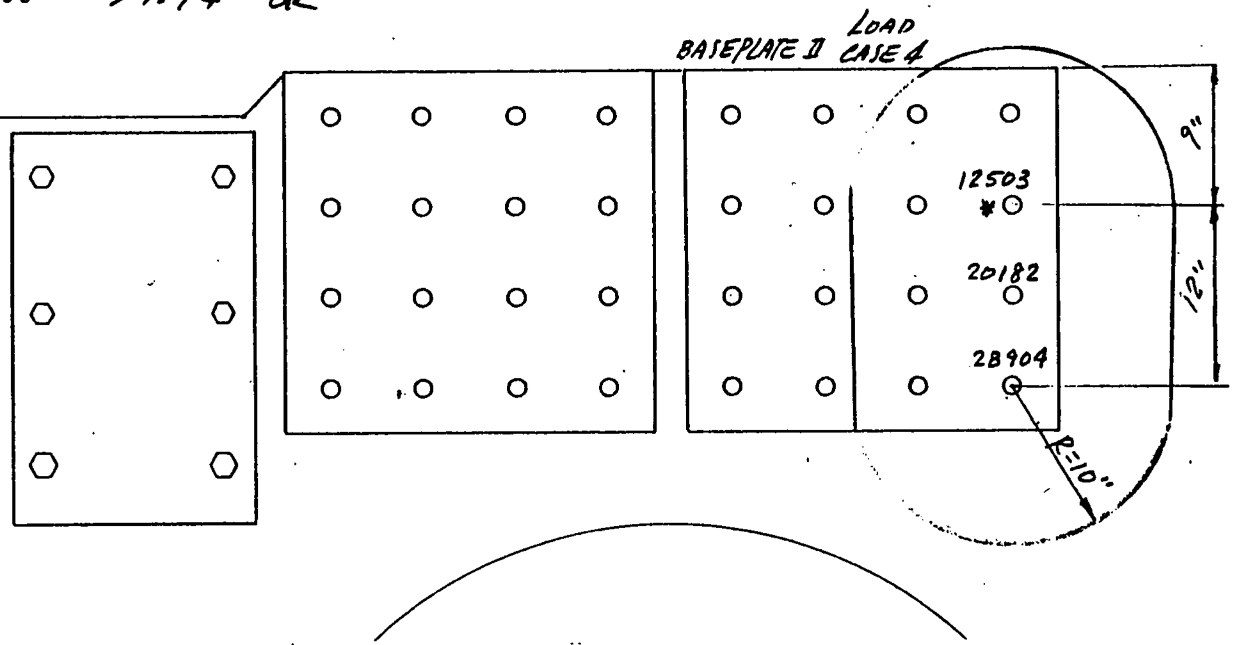
ULTIMATE CONCRETE STRENGTH $= 3.4\sqrt{6200}\ (548)$

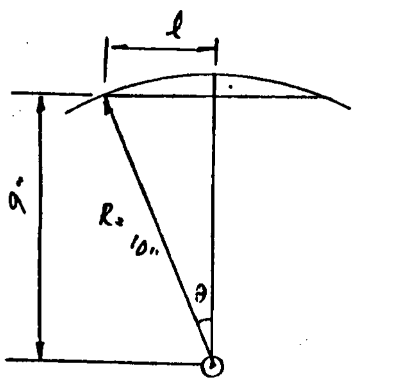
$= 146709\ lb$

PULLOUT FORCE $= 28904 + 20182 + 12503 = 61589\ lb$

$F.S = \frac{146709}{61589} = 2.38 \quad > 1.94$ – ok

* 60% OF STUD LOAD
REST OF 40% WILL BE
RESISTED BY MISSILE LEDGE.





$\theta = \cos^{-1}\frac{9}{10} = 25.8°$

$l = 10 \sin 25.8° = 4.35"$

$A = \frac{51.6}{360} 10^2\pi - 4.35(9)$

$= 5.88\ IN^2$

EBASCO SERVICES INCORPORATED

BRANCH/PROJECT ID: 48W0930 A107

BY M.S DATE 5-8-92

CHKD. BY G. Ahmed DATE 5/9/92

SHEET 36 OF 66

OFS NO. NR DEPT. NO. NR

CLIENT TVA

PROJECT WBNP UNIT 1

SUBJECT CALCULATIONS FOR UNIQUE EMB. PL 48W930-A-107

11.6.2 CONT.)

REF.

ATTACH "C" PG 28

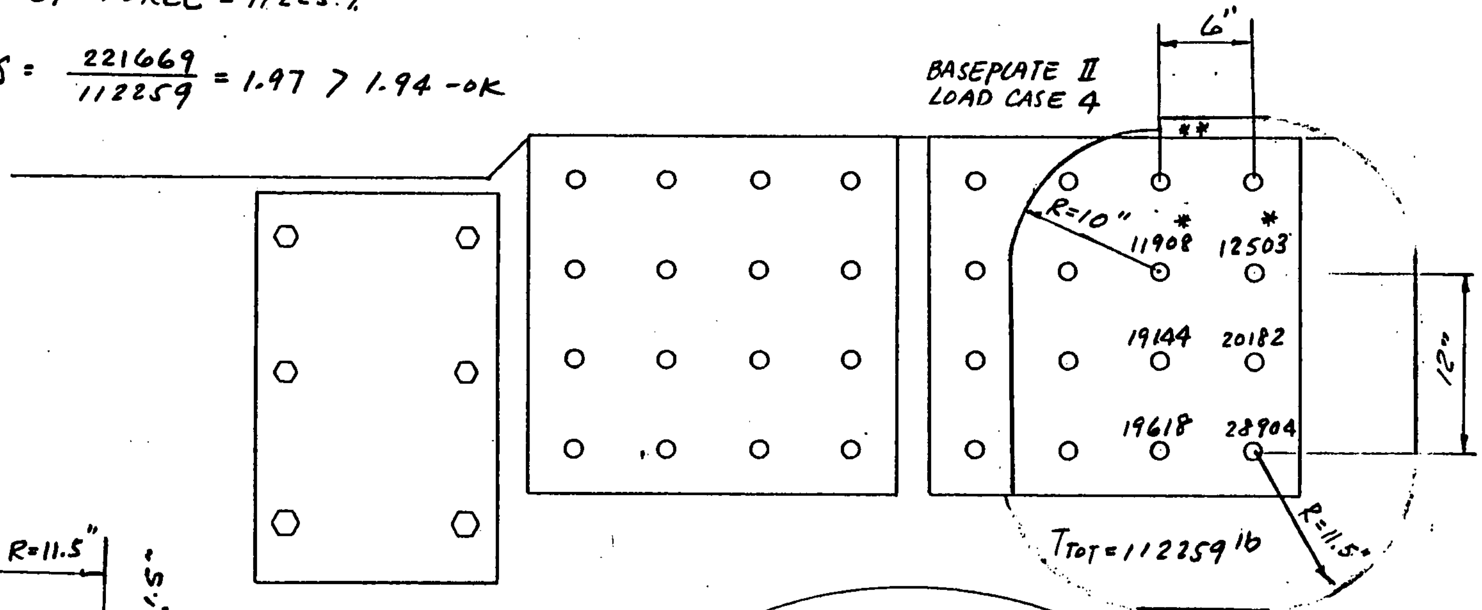
* 60 % OF STUD LOADS
REST OF 40 % WILL BE
RESISTED BY MISSILE LEDGE

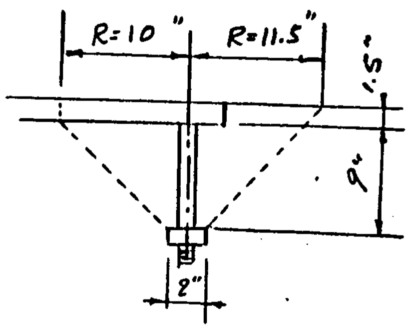
SIX STUD PULLOUT AREA $\cong \frac{(10)^2\pi}{4} + \frac{3(11.5)^2\pi}{4} + 12(10+6+11.5) + 6(23) - 30 = 828\ IN^2$

ULTIMATE CONCRETE STRENGTH $= 3.4\sqrt{6200}\,(828)$
$= 221669\ ^{lb}$

PULLOUT FORCE $= 112259\ ^{lb}$

$F.S = \frac{221669}{112259} = 1.97 > 1.94$ -OK





** REDUCTION AREA

$\theta = \cos^{-1}\frac{9}{11.5} = 38.5^\circ$

$\ell = 11.5 \sin 38.5 = 7.16"$

$A = 2.5(6) + \frac{38.5}{360}(11.5)^2\pi - \frac{1}{2}(7.16)(9) + \frac{5.88}{2}$

$\cong 30\ IN^2$

11.6.2 CONT.)

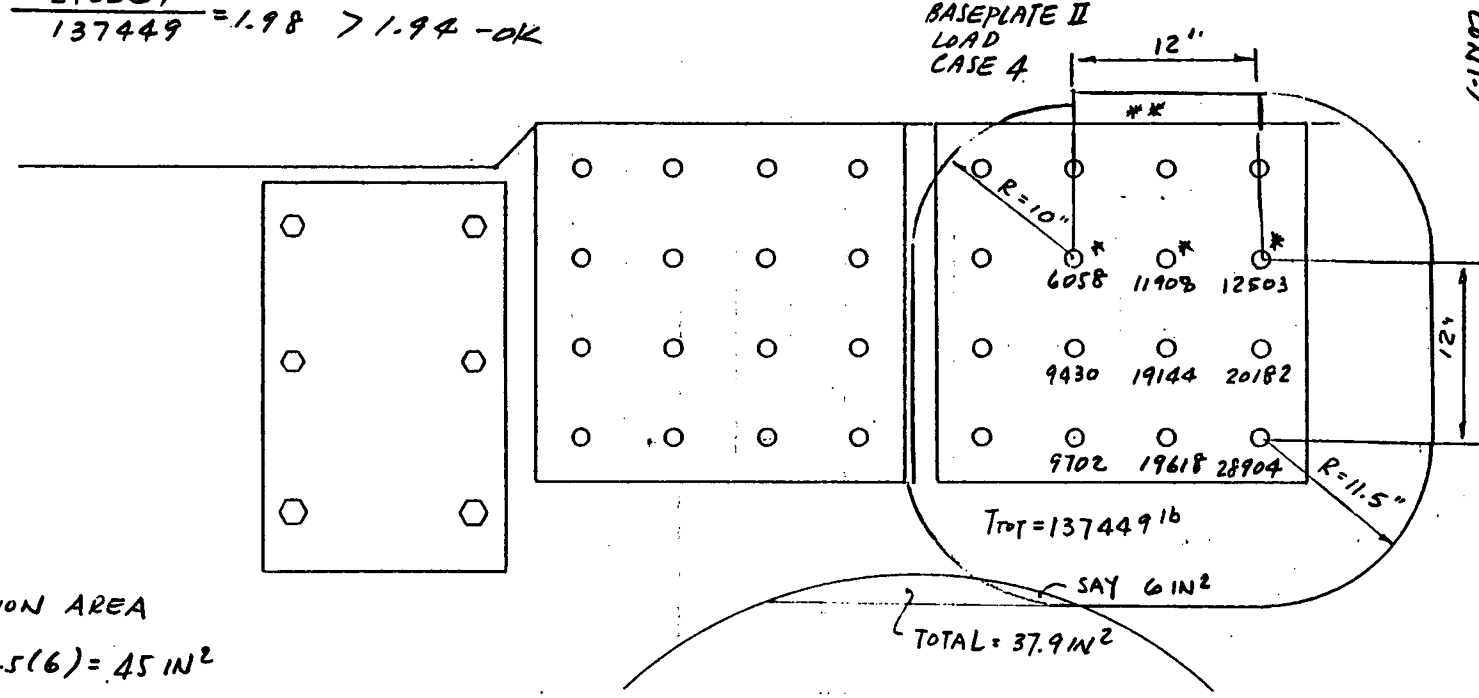
* 60 % OF STUD LOADS
REST OF 40 % WILL BE
RESISTED BY MISSILE LEDGE.

NINE STUD PULLOUT AREA $= \frac{10^2\pi}{4} + \frac{3(11.5)^2\pi}{4} + 12(10+12+11.5) + 12(23) - 6 - 45 = 1017\ IN^2$

ULTIMATE CONCRETE STRENGTH $= 3.4\sqrt{6200}\,(1017) = 272267\ lb$

PULLOUT FORCE $= 137449\ lb$

$F.S = \frac{272267}{137449} = 1.98 > 1.94$ -OK



** REDUCTION AREA
$A = 30 + 2.5(6) = 45\ IN^2$

REF.

ATTACH "C"
PG 28

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-23

TITLE: Use of Incorrect Factor of Safety for Anchors and Plates

DESCRIPTION OF CONDITION:

A surface mounted plate was partially welded to an embedded plate and partially anchored with six ductile anchors. The minimum computed factor of safety for anchors was 2.23, which was less than the required factor of safety of 2.50 as specified in DS-C1.7.1. TVA misapplied the factor of safety 1.94 (which was for welded studs on embedded plate), due to the vagueness in DS-C1.7.1 in specifying the required factor of safety for various types of plate anchorage. TVA committed to review other embedded plate calculations involving surface mounted plates to correct this deficiency if it occurred. The values of 2.50 and 1.94 were derived by dividing the required factors of safety of 4.0 and 3.1 for surface mounted plates and embedded plates, respectively, with faulted load factor of 1.6.

CLARIFICATION: None

RESOLUTION:

The factor of safety used in the calculation was incorrect. A review of pipe whip restraint embedded plate calculations has been completed. The results show this was an isolated problem due to its unique configuration. Calculation 48N091305A022 has been revised to show the proper factor of safety. No field work resulted from this change.

STATUS: Complete.

Design calculations have been revised and the extent of condition review has been completed showing this was an isolated problem.

REFERENCES:

1. Calculation 48N091305A022 (B18920806251)

2. Problem Evaluation Report WBPER920186

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-24

TITLE: Missing Conduit Support in Field

DESCRIPTION OF CONDITION:

Engineering walkthrough AB-B2-028 identified the need to install conduit support 1-CSP-290-N0582 for conduit run IPM-7565K. Workplan (WP) KP05955A-1 was issued to install the support in accordance with DCN P-05916-A and FDCN 07654A. The WP was signed off indicating the hardware was installed. Calculation WB-EC-AB-B2-082 confirmed the adequacy of the conduit. However, the conduit support was missing in the field, despite engineering documents indicating that it was installed. When notified by the team of the failure to install the support, TVA instituted Problem Evaluation Report WB-PER-920183 to address this problem.

CLARIFICATION: None

RESOLUTION:

1. Review the implementation of the Workplan to establish the root cause of the problem.

2. Perform extent of condition assessment to ensure problem is corrected if it has occurred elsewhere.

STATUS: Completion of field activities are scheduled to coincide with System 290 turnover.

DCN has been reopened to install the support and the extent of condition review has been completed. Refer to the enclosure.

REFERENCES:

1. Calculation WB-EC-AB-B2-028, "Calculation for Conduit Support 1-CSP-290-N0582," Revision 2
2. Design Change Notice DCN P-05916-A "Additional Support for Conduit," Revision A
3. Walkthrough Package AB-B2-028 "Conduit and Conduit Support Engineering Walkthrough," Revision 0
4. Work Package WP KP05955A-1 "Installation of New Conduit Supports in Accordance with Design Criteria," Revision 20
5. Problem Evaluation Report WB-PER-920183 "Conduit Support," Revision 0
6. Field Design Change Notice FDCN 07654A, "Weld Revisions," Revision A

PROBLEM EVALUATION REPORT (PER)

PER No. WBPER920183

Revision 0

Page 1 of

RIMS No.

PART A: INITIATOR

1A Component ID 1-CSP-290-N0582 and Description CONDUIT SUPPORT

2A Plant(s) Orgs. Affected WBN
System(s) 290
Units Affected 1

3A ASME Sec. III ☐
ASME Sec. XI ☐
Non-ASME ☑

4A Building CONTROL
Elevation 751' 4 3/4"
Room No. SPREAD RM EL 741'

5A Ref. Documents
W.P. KP05955A-1
DCN P05916A

6A Requirement Violated WORK REQUIRED BY DCN P05916A WAS NOT COMPLETED BEFORE THE DCN WORK COMPLETION NOTICE WAS ISSUED TO THE DCN COORDINATOR.

7A Source of Requirement Violated AI 8.14 SECT 6.1.24

8A Description of Condition DCN P05916A WAS ISSUED BY NE TO INSTALL CONDUIT SUPPORT 1-CSP-290-N0582 ON CONDUIT 1PM7565K. THE DCN WAS PUT IN W.P. KP05955A-1 TO DO THE REQUIRED INSTALLATION, WORKPLAN WAS FIELD COMPLETED AND CLOSED WITHOUT SUPPORT 1-CSP-290-N0582 BEING INSTALLED. ALSO WORK COMPLETION NOTICE WAS ISSUED TO THE DCN COORDINATOR

Date of Occurrence: 6-28-90 Method of Discovery: NRC IDI WALKDOWN

9A Initiator Michael Baines MICHAEL BAINES Organization WBN-FEM-WFM MODS Date 7-30-92 Phone No. 8665

SUPERVISOR

10A Confirmed Adverse Condition: Yes ☒ No ☐ If no, a justification must be attached.

Potentially Affects Operability: Yes ☐ No ☒

Potentially Reportable: Yes ☐ No ☒

Meets SCAR Criteria Yes ☐ No ☒ If yes, SCAR No.

Assign Responsible Organization WBN-~~FEE~~ SFM -W.FM MJB 08-03-92 Coordinated with W.F. MELVIN Date 8-3-92

Supervisor's Approval W.F. Melvin Date 8-3-92

Thomas R. Raley 8-13-92

NRC IDC 8-13-92

TVA 40210 (NP 3/91) (op-WBN-2/92)

PROBLEM EVALUATION REPORT (PER)

PER No. WBPER920183
Revision 0
Page 2 of ___

PART B: RESPONSIBLE ORGANIZATION

1B Generic Review Required: Yes ☐ No ☒ Locations Affected ___

Interim Measures required: Yes ☐ No ☒

Disposition: Rework ☐ Repair ☐ Scrap ☐ Accept–As–Is ☐ Other ☒

Reportable: Yes ☐ No ☒ If yes, specify LER No. ___

Affects Operability: Yes ☐ No ☐ NA BH 8-24-92
Signature

Corrective Actions: SEE CONTINUATION SHEETS.

Approval	Name	Init	Date	Concurrence	Name	Init	Date
Preparer William C. Long	WILLIAM C. LONG	WCL	8-30-92	Joe Chen NE-CE	JOE CHEN	JC	8-31-92
Supv. S.F. Tanner	S.F. TANNER	SFT	8-31-92				

PART C: CLOSURES

Verification	Name	Init	Date	Verification	Name	Init	Date
				Tags Removed			
				ANI / ANII NON-ASME	MARTHA J. SMITH	MJS	08/31/92

PROBLEM EVALUATION REPORT (PER)

CONTINUATION SHEET

PER No. WBPER920183

Revision 0

Page ___ of ___

PER CONTINUATION

Identify the information that is being continued on this sheet (For example: Description of Condition)
Note: Entries made on this sheet shall be signed and dated.

and Description ______ | System(s) ______ | ASME Sec. XI ☐

PART 1B

GENERIC REVIEW: GENERIC REVIEW IS NOT REQUIRED BECAUSE THIS IS A CASE OF A SITE SPECIFIC PERSONNEL FAILURE TO FOLLOW PROCEDURE.

INTERIM MEASURES REQUIRED: NO INTERIM MEASURES ARE REQUIRED BECAUSE THIS PROBLEM OCCURRED UNDER THE OLD WORK CONTROL PROGRAM AND THE PERSON INVOLVED IS NOW WORKING IN ANOTHER AREA.

APPARENT CAUSE: THE RESPONSIBLE ENGINEER OF THIS WORKPLAN FAILED TO VERIFY THAT A SUPPORT WAS NEEDED WHEN IN FACT ONE WAS REQUIRED PER PROCEDURES IN EFFECT AT THAT TIME. DCN P-05916-A WAS ADDED TO WORKPLAN KP05955A-1 BY REVISION 1. STEP 5 OF THE WORKPLAN ALLOWED CONDUITS TO BE ATTACHED TO THE GRID IN THE CONTROL ROOM IN LIEU OF A NEW SUPPORT. STEP 10 OF THE WORKPLAN ALLOWED THE CRAFT TO DELETE SUPPORTS NO LONGER NEEDED BECAUSE OF CONDUIT REMOVAL BY NOTING ON A COPY OF THE DCN PERTAINING TO THAT SUPPORT AND PLACING A COPY IN THE DATA SHEET SECTION FOR DOCUMENTATION. PER DISCUSSION WITH THE RESPONSIBLE ENGINEER INVOLVED, APPARENTLY THE WRONG CONDUIT WAS LOOKED AT AND A WRONG DECISION WAS MADE IN THE CASE OF SUPPORT 1-CSP-290-N0582. A STATEMENT WAS THEN WRITTEN ON THE DRAWING DCN P-05916-A PAGE 2 OF 4 IN THE WORKPLAN "NO SUPPORT IS REQUIRED" AND THE SHEET WAS INSERTED IN THE DATA SHEET SECTION OF THE WORKPLAN. IF THE SUPPORT HAD NOT REALLY BEEN REQUIRED THE DCN PROCESS SHOULD HAVE BEEN USED TO DELETE DCN P-05916-A. THIS WAS NEVER DONE; THUS, AN ERROR OF FAILING TO FOLLOW PROCEDURES WAS MADE. INDICATING THAT A SUPPORT WAS NO LONGER NEEDED AND FAILING TO FOLLOW THRU WITH FDCNs, WAS DONE IN SEVERAL CASES IN THIS WORKPLAN K-P05955A-1 AND ONE OTHER WORKPLAN (K-P03089A-1). THERE SHOULD HAVE BEEN FDCNs WRITTEN AND APPROVED BY NE PRIOR TO CLOSING THE WORKPLAN. THE RESPONSIBLE ENGINEER SHOWED LACK OF ATTENTION TO DETAIL IN FAILING TO FOLLOW PROCEDURES.

TROI CAUSE CODE: B,BW

REEVALUATION AGAINST THE SCAR CRITERIA: THIS PER HAS BEEN REEVALUATED AGAINST THE SCAR CRITERIA SSP-3.04, APPENDIX B, AND THE PER STILL DOES NOT MEET THE REQUIREMENTS FOR A SCAR.

William C. Long
8-30-92

Form STD-10.1.17-2

PROBLEM EVALUATION REPORT (PER)

CONTINUATION SHEET

PER No. WBPER920183

Revision 0

Page ___ of ___

PER CONTINUATION

Identify the information that is being continued on this sheet (For example: Description of Condition)
Note: Entries made on this sheet shall be signed and dated.

PART 1B (con't)

EXTENT OF THE CONDITION: DURING THE TIME FRAME OF THIS WORKPLAN, THE MAJORITY OF THE CONDUIT WORK GOING ON IN THE PLANT WAS CRDR. THERE WAS VERY LITTLE CONDUIT WORK, EXCEPT CRDR, GOING ON UNTIL EARLY 1990 WHEN AMPACITY AND CABLE DAMAGE ISSUES WORKPLANS WERE ISSUED. ALL OF THE AMPACITY AND CABLE DAMAGE WORKPLANS AND OTHER WORKPLANS WITH CONDUIT WORK WAS BEING HANDLED THRU A SPECIAL GROUP THAT WORKED ALL CONDUIT AND CONDUIT SUPPORTS EXCEPT CRDR. THE RESPONSIBLE ENGINEER FOR WP K-P05955A-1 PRIMARILY WORKED ON CRDR WORKPLANS. BASED ON THIS AND THE APPARENT CAUSE THE EXTENT OF THE CONDITION HAS REVIEWED ONLY THE CRDR CONDUIT WORKPLANS AS FOLLOWS:

1. ALL KNOWN WORKPLANS THAT THE ABOVE RESPONSIBLE ENGINEER WROTE AND/OR WORKED WERE REVIEWED FOR SIMILAR ERRORS. ONE OTHER WORKPLAN, K-P03089A-1, WAS FOUND THAT HAD PROBLEMS WITH DETERMINING THE STATUS OF FOUR SUPPORTS. THIS WORKPLAN SHALL BE CORRECTED BY STEPS 1, 2, AND 3 IN THE CORRECTIVE ACTION BELOW. NO OTHER PROBLEMS WERE FOUND.

2. TWENTY TWO OTHER WORKPLANS, CRDR TYPES, DEALING WITH SIMILAR CONDITIONS OF ADDITIONAL CONDUIT SUPPORT INSTALLATIONS TO BE IN COMPLIANCE WITH THE DESIGN CRITERIA WERE LOOKED AT FOR SIMILAR PROBLEMS. THERE WERE NO SIMILAR PROBLEMS. THE FOLLOWING CRDR WORKPLANS WERE REVIEWED:

KP05483A-1, KP05484A-1, KP05955A-1, KP06922A-1, KP02641A-2, KP02852A-2, KP02856B-1, KP02857A-1, KP02859A-2, KP02861A-1, KP02866A-2, KP03002A-1, KP04063A-1, KP04332A-1, KP04464A-1, KP05139A-1, KP03088A-1, KP03089A-1, KK04129A-1, KK04130A-1, KK04131A-1, KP03291B-2, KP03291B-3

3. THE OTHER SUPPORTS THAT WERE INDICATED AS NOT BEING NEEDED IN WORKPLAN K-P05955A-1 ARE BEING REWORKED BY CORRECTIVE ACTION ITEMS 1, 2, & 3.

UNIT 2 APPLICABILITY: UNIT 2 REQUIRED FOR UNIT 1 WAS CORRECTED BY THIS WORKPLAN. THERE ARE CURRENTLY NO WORKPLANS FOR DCN MODIFCATIONS BEING PERFORMED ON UNIT 2 NOT REQUIRED FOR UNIT 1 OPERATION. NO FURTHER UNIT 2 EVALUATION IS REQUIRED.

William C. Long
8-30-92

Form STD-10.1.17-2

PROBLEM EVALUATION REPORT (PER)

CONTINUATION SHEET

PER No. WBPER920183

Revision ______

Page ___ of ___

PER CONTINUATION

Identify the information that is being continued on this sheet (For example: Description of Condition)
Note: Entries made on this sheet shall be signed and dated.

PART 1B (con't)

RECURRENCE CONTROL: NO RECURRENCE CONTROL IS NECESSARY BECAUSE THERE WAS ONLY ONE PERSON INVOLVED AND THAT PERSON IS NO LONGER WORKING AS A FIELD ENGINEER. OTHER CONDUIT WORK DURING THAT TIME WAS PER PROCEDURE AND CURRENT WORK WITH CONDUIT IS BEING HANDLED PER NEW PROCEDURES WITHOUT ANY DOCUMENTED PROBLEMS AT THIS TIME.

CORRECTIVE ACTIONS:

1. NE TO PROCESS DCN(s) TO REQUIRE FIELD TO INSTALL SUPPORT 1-CSP-290-N0582, AND FOR FIELD TO INSPECT FOR AND IF REQUIRED TO PROVIDE SUPPORTS ORIGINALLY SHOWN ON DCN P-05955-A PAGES 3 THRU 13.

RESPONSIBLE ORG.	SUPERVISOR	DATE	COMP. DATE
WBP-LCE-JCC	[signature]	8-31-92	~~12-30-92~~ RHB 8-31-92 9-14-92 PER TELECON W/ROBEN HERNANDEZ 8-31-92

2. MODS TO WRITE, WORK, AND CLOSE NEW WORKPLANS TO IMPLEMENT THE DCN(s) ISSUED IN STEP 1, AND DCN P-03268-A TO REQUIRE FIELD TO INSPECT FOR AND PROVIDE DETAILS BACK TO NE FOR SUPPORTS 1-CSP-290-561, 1-CSP-290-562, 1-CSP-290-563, AND 1-CSP-290-575 THAT HAVE BEEN INDICATED AS BEING VOID IN WORKPLAN K-P03089A-1 (SEE DCN A-06399-A).

RESPONSIBLE ORG.	SUPERVISOR	DATE	COMP. DATE
WBN- FEM- PRG	Philip R. [signature]	8-31-92	9-18-92

3. MODS TO UPDATE VAULTED WORKPLANS K-P05955A-01 AND K-P03089A-1 PER SSP-2.09 TO REFERENCE THIS PER ON THE DATA SHEETS AFFECTED.

RESPONSIBLE ORG.	SUPERVISOR	DATE	COMP. DATE
WBN- SPU- TRR	S.F. Ta[signature]	8-31-92	9-23-92

4. MODS TO VERIFY THE ABOVE HAS BEEN COMPLETED AND CLOSE THIS PER.

RESPONSIBLE ORG.	SUPERVISOR	DATE	COMP. DATE
WBN- SPU-TRR	S.F. Ta[signature] S.F. TANNER	8-31-92	9-30-92

William C. Long
8-31-92

TVA 40210A (NP 12/90)

APPENDIX D
Page 1 of 2

PER Number W.B PER 920083
Page 1 of 2

Note: Entries made on this form shall be signed and dated

GUIDELINES FOR POTENTIAL REPORTABILITY DETERMINATION
10CFR50.55(e) POTENTIAL REPORTABILITY

PLANT/UNIT Watts Bar Nuclear Plant/Unit 1

DESCRIPTION OF DEFICIENCY: W.P KP05955A-1 AND DCN P-05916A WERE CLOSED WITHOUT COMPLETING CONDUIT SUPPORT 1-CSP-290-N0582

I. Does the deficiency involve the construction of a facility or activity or a basic component supplied for such facility or activity?

A. Does the deficiency involve the analysis, design, manufacture, fabrication, quality assurance, placement, erection, installation, modification, inspection, or testing of a facility or activity, or consulting services related to the facility or activity that is safety related?

✓ Yes ___No ___Indeterminate

Explain: ______

B. Does the deficiency involve any plant structure, system, component, or any part thereof, classified as:

1. Seismic Category I (FSAR Section 3.2.1)

✓ Yes ___No ___Indeterminate

2. TVA Class A, B, C, or D (FSAR Section 3.2.2)

___Yes ✓ No ___Indeterminate

3. IEEE Class IE (The safety classification of the electrical equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or are otherwise essential in preventing significant release of radioactive material to the environment. R.G. 1.75)

___Yes ✓ No ___Indeterminate

Explain: ______

If all the questions under Item I.A and I.B are marked NO, the deficiency is not potentially reportable. Otherwise, continue with Item II.

APPENDIX D
Page 2 of 2

PER Number WBPER920183
Page 2 of 2

GUIDELINES FOR POTENTIAL REPORTABILITY DETERMINATION
10CFR50.55(e) POTENTIAL REPORTABILITY

II. Does the construction of a facility or activity or a basic component supplied for such facility or activity:

A. Contain a defect?

1. A deviation in a basic component delivered to a purchaser for use in a facility or activity subject to a construction permit. ___Yes ✓ No ___Indeterminate
2. The installation, use, or operation of a basic component containing a defect as defined in Item 1 above. ___Yes ✓ No ___Indeterminate
3. A deviation in a portion of a facility subject to the construction permit. ___Yes ✓ No ___Indeterminate

Note: Deviation means a departure from the technical or quality assurance requirements defined in procurement documents, safety analysis reports, construction permits, design criteria, system description, DCNs, workplans, or other documents provided for installed basic components.

Explain: ______

B. Represent the failure of a facility or activity to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the NRC? ___Yes ✓ No ___Indeterminate

Explain: ______

C. Represent a significant breakdown in any portion of the quality assurance program conducted pursuant to the requirements of 10CFR50, Appendix B, which could have produced a defect in a basic component. Such breakdowns in the QA program are reportable whether or not the breakdown actually resulted in a defect in a design approved and released for construction or installation (e.g., incomplete or inadequate procedures, failure to follow procedures or a lack of records)? ___Yes ✓ No ___Indeterminate

Explain: ______

If any questions under Item I and any questions under Item II are marked YES or INDETERMINATE, the deficiency is potentially reportable under Section 50.55(e).

Prepared by: W.F. Melvin / 3751 Date 8-3-92
Name Extension

QA Record

TVA Tennessee Valley Authority

TENNESSEE VALLEY AUTHORITY
Division of Nuclear Engineering

NE NUCLEAR ENGINEERING

~~B26 '91 0219 078~~ R6

BRA 6/10/92

GENERAL ~~T29 920610 948~~ R7

DESIGN CRITERIA

T29 920831 875 R8

NO. WB-DC-40-31.50

REPLACEMENT ORIGINAL

INITIALS DCP DATE 2-14-91

TITLE: Evaluating the Effects of a Pipe Failure Inside and Outside Containment

ISSUE DATE: January 5, 1976

	REVISION RO	R 5	R 6	R 7	R 8	R 9
	DATE 1/5/76	7/7/1988	FEB 19 1991	06/10/92	AUG 29 1992	
PREPARED	K.W. LU* D.M. WILSON	*	Denny C Pheng	D.M. Wilson	D.M. Wilson	
CHECKED	B.B. NEELY	*	WLE G. Kharshadi	Denny C Pheng	Joe Chen	
REVIEWED	P.A. EVANS*	*	C.P. Boyd	Joe Chen	Joe Chen	
APPROVED	W.A. ENGLISH*	*	K.W. Call	Jan A. Odom	Jan A. Odom	
ACCEPTED	R.G. DOMER*	*	W.L. Elliott	R. Domer for WLE	W.L. Elliott	

*See Previous Revisions for Original Signatures

TOTAL PAGES = 54

TVA

Title: EVALUATING THE EFFECTS OF A PIPE FAILURE INSIDE AND OUTSIDE CONTAINMENT		REVISION LOG WB-DC-40-31.50
Revision No.	Description of Revision	Date Approved
7	Added a section for source notes. -Added source note for FSAR Section 3.6[1] -Added source note for NC0890083004, reflecting application of LBB in the primary loop.	06/10/92
8	Revised section 9.1 to emphasize that certified mill test reports (CMTRs) should not be used in the postulation of breaks and through-wall leakage cracks without the approval of the NRC, and to emphasize the need for a criteria exception request if CMTRs are used.[3]	08/29/92

WBEP-1212H

- A listing of safety-related equipment, by area, for each area containing any piping which has not been seismically qualified for pressure boundary retention.

- Conclusion reached after evaluation of the equipment, i.e., acceptable as is (and the reason for acceptability) or unacceptable with the recommended modification.

9.0 EXCEPTIONS (The remainder of this design criteria is applicable to both parts I and II).

9.1 General

It is recognized that as the design and construction of the plant progresses and the requirements of this Design Criteria are implemented, special cases may be identified that require specific analysis and consideration.

In such cases however, exceptions shall not prevent the capability of any plant feature from performing its safety-related function and shall be adequately justified and fully documented for each case.

Certified Mill Test Reports (CMTRs) shall not be used in the disposition of postulated pipe breaks; i.e., pipe rupture stress limits of section 4.2 shall not be increased using values from the CMTRs to minimize breaks or through-wall leakage cracks.[3] Approval from the NRC must be obtained before any exception to the use of CMTRs is taken. Any exception will be documented as a criteria exception request per NEP-3.2 (Reference 10.5.16).

9.2 Record of Exceptions

None

10.0 REFERENCES

10.1 TVA Drawings

None

10.2 TVA Documents

10.2.1 "Watts Bar Design Criteria for the Classification of Piping, Pumps, Valves, and Vessels", WB-DC-40-36.

10.2.2 "Watts Bar Design Criteria for Separation/Isolation", WB-DC-30-4.

QA Record

	RIMS NO.	RIMS NO.	RIMS NO.	RIMS NO.	RIMS NO.
	B26'910911086	T29 920831 874			
	R0	R1	R2	R3	R4
PREPARED / DATE	D. M. Wilson 09/09/91	D.M. Wilson 8/26/92 WL 8/26/92			
SPONSOR / DATE	J. G. Adair 09/10/91	Joe Chen for JGA 8-26-92			
DSN MGR / DATE	G. W. Mauldin 09/11/91	Gary W Mauldin 8-26-92			
ARM / DATE	W. L. Elliott 09/11/91	WL Elliott 8/29/92			
IMPLEMENTATION DATE	09/15/91	09/30/92			

Revision No.	Description of Revision	Date Approved
0	This is the initial issue of this EAI. This EAI replaces WBEP 5.47, "Documentation and Analysis Procedure For Evaluating The Effects of Postulated Pipe Ruptures", which is superseded by this EAI. This EAI may be implemented immediately, but shall be implemented by 09/15/91.	09/11/91
1	Revised section 4.1.2, item 9, to delete the use of certified mill test report data to increase the allowable pipe rupture stress. This is deleted as a result of "NRC Integrated Civil Seismic Design Inspection, Item 53, Revision 2," dated August 4, 1992 (T30 920805 805).[4] In addition, references are updated. This revision shall be implemented by September 30, 1992.	08/29/92

4.0 PROCEDURE (Continued)

4.1.2 Preparation of Break Location/Interaction Evaluation Calculations (Continued)

9. For rigorously analyzed piping, records node numbers and stresses that have been reduced by hand calculations (e.g. apply ASME III code section modulus to reduce the pipe rupture stress).

10. Documents break locations by preparing break table(s) for the respective piping analysis class, and including it (them) in the Stress Summary section of the calculation.

11. Identifies old break locations which have been eliminated by placing an 'X' after the break number.

12. Prepares an isometric sketch showing break locations, high/moderate-energy boundaries, LOCA, MS and FW boundaries, etc.

13. Determines pipe trajectory and plastic hinge formation, as required.

14. Develops zone of influence sketches as required, to indicate areas where potential targets may exist.

15. Identifies potential targets on the basis of pipe breaks postulated in step 7 or 10 above, and on the basis of likely effects (pipe whip, jet impingement, wetting, etc.) to be mitigated. Targets are shown with their relationship to the source (broken pipe) in a section of the calculation document called "Interaction Matrix." (Note: For large targets [i.e., piping, tanks, pumps, and other equipment] design drawings or field evaluations are used to identify these targets, however, for small field-routed items [i.e., conduit, sense lines, and small piping] only the field evaluation per EAI-8.09 is utilized.)

16. Screens potentially unacceptable pipe rupture interactions on the basis of separation distance criteria reports CEB-77-4, CEB-77-15, CEB-77-24, and CEB-79-12 (reference 5.1, 5.3, 5.4, and 5.7). (These reports were developed by the Civil Discipline and are primarily used as a basis for screening interactions with respect to separation distance.)

17. Conducts a post-screening evaluation of potentially unacceptable interactions by one of the following methods:

    a. The use of pipe rupture evaluation criteria, commonly referred to as "codified comments".

    b. May provide more detailed analysis, as necessary, including a field evaluation to determine the effects of natural barriers, actual support spacing, and separation space surrounding the target.

CIVIL IDI

TVA RESPONSE TO DEFICIENCY 92-201-07

TITLE: Seismic Anchor Point Movements for Reactor Coolant Loop

DESCRIPTION OF CONDITION:

The team reviewed Category I piping calculation 0600200-03-01, Revision 17, for seismic anchor movements (SAMs) of a 14-inch RHR line off the reactor coolant loop (RCL) hot leg No. 4. Westinghouse had originally analyzed the RCL using spectra A with 1% critical damping and provided TVA with seismic anchor movements for the auxiliary systems connected to the reactor coolant loops, including the RHR system. TVA used the analytical model that Westinghouse had originally prepared for the RCL to reanalyze the RCL using Code Case N-411 damping values and set B+C spectra. TVA developed SAMs and seismic response spectra at the locations of the RCL nozzles and used these loads to analyze connecting auxiliary piping systems such as the RHR system. The interface SAMs and response spectra that TVA used to analyze the RHR are lower than the interface SAMs and spectra that Westinghouse originally transmitted to TVA.

NUREG-0847, Supplement No. 6, Section 3.7.3, "Seismic Subsystem Analysis," accepted TVA's use of ASME Code Case N-411 for use at Watts Bar with regard to response spectra load set B+C. However, TVA had not reconciled the original Westinghouse calculation on the SAMs using spectra A with TVA reanalysis using spectra B+C. Westinghouse's calculation was still the design basis document for Watts Bar and is consistent with FSAR Section 5.2 and FSAR Table 3.7-24.

CLARIFICATION:

The RCL was analyzed using the original damping values and not Code Case N-411. In order to obtain a compatible analysis for the loop attached piping, N-411 damped spectra were generated for the loop attached piping, and movements obtained from the RCL coupled analysis were used to ensure compatibility. The use of Westinghouse provided models assured compatibility.

RESOLUTION:

1. Provide documentation of Westinghouse input regarding the adequacy of the work due to update the reanalysis.

STATUS: Complete

REFERENCES:

1. Westinghouse letter to TVA dated August 13, 1992 (T33920813974) (Copy enclosed)

T33 920813 971

(45)

Westinghouse Electric Corporation
Energy Systems

Nuclear Services Division
Box 355
Pittsburgh Pennsylvania 15230-0355

Mr. W. L. Elliott
Manager of Engineering
Tennessee Valley Authority
Watts Bar Nuclear Power Plant
IOB-1A, P.O. Box 2000
Spring City, TN 37381

WAT-D-8971
August 13, 1992

Ref. 1) NSSS 92-064

Attention: J. Pigott

Ans'd by Ltr # NAR

Tennessee Valley Authority
Watts Bar Nuclear Plant Units 1 & 2
Seismic Analysis

Dear Mr. Elliott:

It is Westinghouse understanding, based upon conversations with TVA, that the seismic analysis performed by TVA and their contractors to provide input to the auxiliary line analysis was done in an acceptable manner. The design basis analysis performed by Westinghouse to the original SET A seismic spectra provided seismic anchor motions (SAMs) at the interface points (the loop branch nozzles). There is an updated seismic basis for SAMs using the SET B and SET C seismic input. A four-loop system model was provided by Westinghouse to TVA for use in the SET B and SET C coupled building-loop analyses. The use of amplified response spectra (at the loop branch nozzles) enveloped from multiple loop-building coupled analyses and enveloped SAMs (at the branch nozzles) from the same coupled analyses is an appropriate method to account for the loop amplification and anchor motion effects on the branch lines. The new loop branch nozzle loads from these updated branch line analyses are the appropriate loads to be compared to the Westinghouse nozzle load allowables.

Very truly yours,

Keith Fowler for

J. W. Irons, Manager
TVA Watts Bar Project
Domestic Customer Projects

/slf

cc: W. L. Elliott, 1L
J. C. Pigott, 1L
S. L. Robertson, 1L

MLR:	DRAFT REPLY	COM. COPY	INFO COPY	DUE DATE
EEB				
CEB Joe Chen			1	
MEB				
NEB Joe Pigott			1	
Wayne Smothers			1	
IOB 1B WBN				

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-08

TITLE: Lack of Transient Analysis for RHR Pump Start Up

DESCRIPTION OF CONDITION:

The team reviewed calculations N3-63-07A, Revision 12 and N3-74-01A, Revision 15, to confirm that RHR pumps and heat exchangers had been properly modeled and that equipment nozzles had been properly qualified. The team noted that calculation N3-74-01A did not properly address fluid transient due to RHR pump start-up, primarily because the capacity of the TPIPE computer program was inadequate to handle the problem at that time. An equivalent static analysis of the fluid transient had been performed, which applied the maximum segmental load components simultaneously using a dynamic load factor (DLF) of 2.0. The team noted that this approach did not meet the requirements of Section 3.2.8, of TVA design criteria WB-DC-40-31.7, "Analysis of Category I and I(L) Piping Systems," which limited the use of an equivalent static analysis with a DLF of 2.0 to fluid transients that were predominantly single pulse. Pipe supports are generally the critical structural elements in a fluid transient analysis. In response to the team's concern, TVA performed a dynamic time history analysis during the inspection, using the current enhanced version of TPIPE. TVA reported that, based on the preliminary results of the calculation, 46 of 129 supports experienced increased loads of up to 5 percent, and one support experienced an increased load of 8 percent. However, TVA stated that the support designs had adequate margins to accommodate this increased load. The team did not review the revised calculation because it had not been formally issued.

CLARIFICATION: None

RESOLUTION:

1. Reanalyze the problem using the enhanced TPIPE version to incorporate the time-history of the transient event.

2. Evaluate the resulting pipe support load variations.

STATUS: Formal issuance of the calculation is planned as part of System 74 Engineering completion (12/6/92).

REFERENCES:

1. Calculation N3-74-01A Revision 17 (in progress)

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-09

TITLE: Use of U-bolts as Pipe Clamps

DESCRIPTION OF CONDITION:

A question of U-bolt stability was identified by TVA in Problem Identification Report PIRWBNCEB8540. However, a TVA calculation performed in 1986 concluded that the U-bolt clamps would remain stable if they were installed per TVA General Engineering Specification G-53.

TVA's Program for Assurance of Quality and Assurance of Completion (PAC/AQ) Project Report ER 91854-05, indicated that a support configuration using a U-bolt might not be stable, if the U-bolt was used as a pipe clamp in conjunction with a snubber. TVA's PAC/AQ review of pipe support 47A450-3-99 identified an open item regarding the use of a U-bolt to act as a pipe clamp. This item was written up as Finding Identification Report WBFIR91019112. However, this report finding was closed by TVA based on a memorandum stating that the issue had received an independent review by Duke Power Company.

Duke Engineering & Services, Inc. in its report, "Hanger and Analysis Update Program Technical Issues Supplement," October 1987, Technical Issue 42, stated that it had evaluated in Calculation No. 2174-1606.04-004 16 pipe supports and established minimum torque requirements required to prevent U-bolt rotation. The report concluded that the low torque requirements established by this calculation could be achieved during the routine installation of the U-bolts.

The team had concerns regarding the adequacy of the TVA and Duke evaluations with regard to U-bolt stability. In addition, when the team examined pipe support No. 63-1SIS-R109, consisting of a U-bolt on a trapeze assembly using double snubbers and supporting a 24 inch pipe, the U-bolt assembly rotated around the pipe when a minimal load was applied. The support calculation, however, indicated that the U-bolt torque necessary to prevent rotation was substantially lower than the torque value required during the installation of the support.

On the basis of the performance of this U-bolt support relative to the existing calculations and analysis performed by TVA, the team concluded that this issue of the stability of U-bolts on pin connected members had not been adequately addressed at Watts Bar. TVA agreed to perform additional testing and analysis to address the adequacy of the installed U-bolts. Further evaluations are required to determine whether replacement with clamps is required.

CLARIFICATION: None.

CIVIL IDI
TVA RESPONSE TO DEFICIENCY 92-201-09

RESOLUTION:

1. Update design methodology: Finalize the methodology to determine the proper preload force for WBN U-bolt trapeze and single strut/snubber applications considering the major controlling parameters; e.g., pipe size, U-bolt size, seismic load, swing angle of 5°, thermal and pressure effects, relaxation/seating effects, pipe and U-bolt stress and material.

2. Revise installation procedures and add Belleville washer design concept/installation requirements to control and stabilize tensile loads in the bolts.

3. Verify analytical and installation approaches by in-place testing of representative configurations and evaluation of test data.

4. Finalize design calculations to document the results from the methodology and test applications.

5. Implement reinstallation steps for the total population to ensure proper alignment and bolt tensile loads prior to system turnover for testing.

STATUS:

Complete engineering by November 30, 1992.

This scope includes the implementation of additional testing efforts. Modification for the total population are implemented on a system basis.

REFERENCES:

1. Methodology and Design Criteria for Pipe Supports utilizing U-bolts to maintain stability (T41920918885) - (copy enclosed)

2. Test plan and test procedure for verification of stability of pipe supports with cinched U-bolts (B18920921751) - (copy enclosed)

3. Letter to NRC dated September 21, 1992 (T04920921983)

4. System 70 - DCN M-20712-A