TVA EMPLOYEE CONCERNS
SPECIAL PROGRAM

REPORT NUMBER: 220.3(B)

REPORT TYPE: SEQUOYAH ELEMENT

REVISION NUMBER: 1

TITLE: SUPPORT DESIGN GENERAL

Design of Supports

REASON FOR REVISION:

TVA comments incorporated.

PREPARATION

PREPARED BY:

SIGNATURE — DATE: 12-3-86

REVIEWS

[redacted] REVIEW COMMITTEE

SIGNATURE — DATE: 12-3-86

TAS:

SIGNATURE — DATE

CONCURRENCES

SIGNATURE — DATE

CEG-H: — DATE: 12-4-86

SRP: SIGNATURE — DATE

APPROVED BY:

ECSP MANAGER — DATE

MANAGER OF NUCLEAR POWER — DATE

CONCURRENCE (FINAL REPORT ONLY)

1. CHARACTERIZATION OF ISSUES:

Concerns:

00-85-005-008
"Sequoyah seismic supports are not designed properly. They are rigid and will break loose during a seismic event and will fall down and damage other equipment, as well as failing to support their respective components. CI has no further information. Construction Department Concern."

IN-85-886-001
"TVA designs were not developed well enough to be constructible 1) Design changes are still being instituted in areas where there should have been minimal changes especially in area of conflicts between TVA and Vendor Drawings. 2) Engineering design criteria is often non-existent, particularly for Seismic Hanger design. Many design criteria or acceptance criteria are still being changed. This is generic concern. Any further information would divulge confidentiality. Construction dept. concern. CI has no further information."

Issues:

a. Seismic supports are designed inadequately.

b. They are too rigid and will break loose during a seismic event and will fall on other equipment and damage it.

c. Pipe support designs are not constructible.

d. Seismic support design criteria are nonexistent.

The following issues from these concerns are addressed in other reports:

Design changes take place in areas of conflict between TVA and vendor drawings (addressed in Sequoyah Element Report 204.4).

Design and acceptance criteria are still being changed (addressed in Sequoyah Element Report 201.3).

2. HAVE ISSUES BEEN IDENTIFIED IN ANOTHER SYSTEMATIC ANALYSIS? YES X NO

   o Identified by TVA SQN NSRS

     NSRS Report No. 1-86-131-SQN, (for pipe supports), (3/6/86)

   o Identified by Generic Concern Task Force

     Generic Concern Task Force Employee Concern IN-85-886-001, R1, (6/6/86)

3. DOCUMENT NOS., TAG NOS., LOCATIONS, OR OTHER SPECIFIC DESCRIPTIVE IDENTIFICATIONS STATED IN ELEMENT:

   TVA and vendor drawings

4. INTERVIEW FILES REVIEWED:

   Interview files 00-85-005 and IN-85-886 were reviewed in response to RFI #SQN 640. No information, other than K-forms and NSRS Report No. 1-86-131-SQN, is contained in these files.

5. DOCUMENTS REVIEWED RELATED TO THE ELEMENT:

   See Appendix A.

6. WHAT REGULATIONS, LICENSING COMMITMENTS, DESIGN REQUIREMENTS OR OTHER APPLY OR CONTROL IN THIS AREA?

   See Appendix A.

7. LIST REQUESTS FOR INFORMATION, MEETINGS, TELEPHONE CALLS, AND OTHER DISCUSSIONS RELATED TO ELEMENT.

   See Appendix A.

8. EVALUATION PROCESS:

a. Reviewed NSRS report to determine the scope of the employee concern.

b. Reviewed pipe support design criteria and a sample of support calculations to verify seismic design adequacy.

c. Reviewed seismic support criteria to determine rigidity requirements.

d. Reviewed sample of pipe support drawings for constructibility.

9. DISCUSSION, FINDINGS, AND CONCLUSIONS:

Discussion:

The CI stated in his concern that Sequoyah seismic supports are not designed properly. They are rigid and will break loose during a seismic event. In his concern, the CI did not specifically indicate the commodities (such as cable trays, conduits, piping, etc.) for which seismic supports were not designed properly. The Nuclear Safety Review Staff (NSRS) issued Investigation Report I-86-131-SQN to address this issue. Review of the NSRS report indicates that the employee concern is for pipe supports. The evaluation team considers it appropriate to also address seismic supports for piping systems in this report.

a. Issue "a" states that the seismic supports are not designed adequately. To assess this, the seismic design requirements of the pipe support design criteria were evaluated, and seismic support calculations were reviewed to verify that design requirements were implemented. The SQN pipe support design criteria (App. A, 5.a, 5.b, and 5.c) were evaluated, and it was determined that they do address the following seismic design requirements:

- Design loads and load combination (i.e., seismic loads with other design loads)
- Applicable codes and allowable stresses
- Rigidity requirements

Fifteen calculations for seismic supports (App. A, 5.f) were randomly selected from various piping systems for review to ascertain that seismic requirements were implemented in pipe support designs. The evaluation team made the following observations:

Support Mark No.	Observations
2-MSH-315/903 2-MSH-348/902 2-RCH-302/905 1-UHIH-130/908 2-SGBH-290/904 2-CSH-5/9	Support calculations are incomplete and appear to be supplements to the original calculations. They only document EN DES justification for the changes.
1-CCH-470/909 1-SIH-437/7 1-AFDH-329/906	Bolts and base plate calculations do not consider base plate flexibility and prying action. This may have been addressed in SQN response to NRC IE Bulletin 79-02, but this is not documented in the calculations. For 1-AFDH-329 computations for fillet weld between bar (item 7) and process pipe are not documented. It seems engineering judgment may have been used for sizing of this weld. The weld is judged acceptable by the evaluation team. All other seismic design requirements are properly addressed for these three calculations.
1-CVCH-100/901	Support configuration does not match the STRUDL model used in the calculation. It appears that calculations are not updated to agree with the current support configuration.
1-AFDH-328/906	Calculation for this support is common with support 1-AFDH-329. The calculation for added components such as channels for support 1-AFDH-328 is not performed. However, this support is judged acceptable by the evaluation team, since design loads are small.

Support Mark No.	Observations
2-RHR-449/904	Calculations for shear stress and buckling for the frame members are not performed. All other seismic design requirements are addressed.
2-FPCH-6/2 1-SGBH-262/903 1-RCH-106/909	All seismic design requirements are properly addressed. Base plate flexibility and prying action are considered.

Six pipe support calculations observed were considered acceptable and seismic design requirements were properly addressed in their calculations. Of the remaining nine calculations, six calculations were incomplete, and three calculations had discrepancies as indicated in the above tabulation. The six incomplete calculations are partial calculations performed after the original calculations to technically justify TVA changes in the support design. The original calculations were performed by TVA's contractor and are not in SQN records. TVA's assumption is that the original calculations are adequate. The evaluation team is unable to verify this assumption.

b. Issue "b," that seismic supports are too rigid and will fail under seismic loading, has been addressed in NSRS Report 1-86-131-SQN. This report concludes that:

> "In seismic analysis of piping systems, supports (including snubbers) are assumed to be absolutely rigid (zero deflection under load). The support loads are developed based on an amplified response of the flexible piping. As long as supports are 'more rigid' (have higher frequencies) than the piping or the dominant seismic frequencies, the zero deflection assumption in the analysis does not cause a significant error in support load calculations. . . . [The supports are designed taking into account the above described support load,] and the flexibility of the support is maintained by limiting support deflection to 1/16 inch under the design load."

Therefore, the supports being too rigid does not cause excessive seismic loading on them. They are not likely to break loose or fall during a seismic event, as they are designed to carry the seismic load.

c. Issue "c" states that the pipe support designs were not developed well enough to be constructible. Two likely conditions causing nonconstructible support designs are:

- o Incomplete drawings issued to Construction
- o Installation interference with other commodities and plant features

The issue of incomplete drawings has been addressed in Sequoyah Element Report 222.3, which reviewed 34 pipe support drawings to verify the following:

- o Welded connections have the required weld symbols
- o Items specified in the bill of materials are correct and complete
- o Sufficient dimensional information is included for use by Construction
- o Design details are presented with sufficient clarity
- o Degree of completeness for other miscellaneous items (location plan, load or movement information, clearances, etc.) is adequate
- o Detailing method for welds is properly considered

Observations made in Sequoyah Element Report 222.3 were: missing weld size and welds; improper weld details, i.e., wrong weld symbols; and various minor discrepancies such as an item missing in the bill of materials, wrong hanger mark, no orientation and location for item, and missing north arrow for plan views. These missing items do not demonstrate that the supports cannot be constructed. However, they indicate that construction of these supports may have been delayed until this missing information was provided or approved by Engineering. This was verified by a walkdown of a sample of supports as described in Sequoyah Element Report 222.3.

It is possible that some supports could not be installed during construction because of interference with other commodities. Such interference problems are common during the course of the design and construction of nuclear power plants. Modification of a support design caused by interferences does not indicate a lack of constructibility in the initial design.

To evaluate constructibility of the original design, the following support drawings were reviewed:

2-SGBH-70 (2-H47-70)/R0
2-CCH-374 (2-H10-374)/R0
1-FPCH-527 (1-H50-527)/R0
2-SGBH-72 (2-H47-72)/R0
2-CVCH-813 (2-H34-813)/R0

Four of the five support drawings were found constructible per Revision 0, and no change in configuration was observed when compared with final revisions. Support drawing (ANCHOR) (2-CCH-374) was modified in Revisions 1 and 2 because of interference with plant features. This indicates that in general, the original designs issued to Construction were constructible.

d. To determine the validity of issue "d," that seismic support design criteria are nonexistent for SQN support designs, Sections 6.1 and 8.0 of Design Documents (App A, 5.b and 5.c), issued in 1975, were reviewed. These documents provide the seismic design requirements for pipe supports.

In June 1986, Generic Concern Task Force (GCTF) investigation report IN-85-886-001 concluded that no seismic design criteria exist. This conclusion was based on the design criteria SQN-DC-V-24.1 (App A, 5.a) in progress during the time of the GCTF investigation. However, the 1975 detailed design criteria (App A, 5.b, and 5.c) were followed by SQN to design seismic supports prior to the issuance of the new design criteria SQN-DC-V-24.1, This new document consolidates other design criteria that have been used for SQN support design.

Findings:

a. The SQN pipe support design criteria adequately address the seismic design requirements. Some calculations for seismic supports were observed to be incomplete (they were supplements to the original calculations), and some calculations lacked documentation of engineering judgment used. The supports with complete calculations were found to be adequately designed for seismic design requirements.

b. The issue that seismic supports are too rigid has been addressed in NSRS Report No. I-86-131-SQN. The supports being too rigid does not cause excessive loading on them.

c. Pipe support designs are found to be constructible by reviewing the initial designs.

d. SQN seismic support design criteria have existed since August 1975.

Conclusions:

a. The SQN design criteria for pipe support design are adequate for addressing seismic design requirements, but implementation of the criteria could not be verified for all pipe support designs within the sample, since some of these calculations were partial calculations performed by TVA as technical justification for design changes. Therefore the concern is valid only for the implementation of SQN design criteria.

b. The concern that seismic supports will fail because they are too rigid is not valid.

c. SQN pipe supports are constructible: therefore, the concern is not valid.

d. The issue of seismic support design criteria being nonexistent is not valid, as these criteria have been in existence since 1975.

APPENDIX A

5. DOCUMENTS REVIEWED RELATED TO THE ELEMENT:

a. Detailed Design Criteria SQN-DC-V-24.1, "Location and Design of Piping Supports and Supplemental Steel in Category 1 Structures," RO, (6/23/86)

b. CEB-SQN-100(CEB-80-75), "Guidelines for Design of Component Supports for TVA Class A through D," R3, (1/19/81), RO, (03/10/75)

c. Detailed Design Criteria WB-DC-40-31.9, "Location and Design of Piping Supports and Supplemental Steel in Category 1 Structures," R6, (2/10/86), RO, (08/29/75)

d. Detailed Design Criteria SQN-DC-V-2.14, "Piping System Anchors Installed in Category I Structures," RO, (06/30/86)

e. Pipe support drawings (Rev. 0):

2-SGBH-70 (2-H47-70)
2-CCH-374 (2-H10-374)
1-F PCH-527 (1-H50-527)
1-SGBH-72 (2-H47-72)
1-CVCH-813 (2H34-813)

f. Pipe Support Drawings and calculations:

SUPPORT			Calc.
Sheet No.	Mark No.	Rev.	Rev.
2-HI-315	2-MSH-315	903	0
2-HI-348	2-MSH-348	902	0
1-H10-511	1-CCH-470	909	0
1-H20-451	1-SIH-437	7	0
1-H3-367	1-AFDH-328	906	0
1-H3-369	1-AFDH-329	906	0
1-H34-100	1-CVCH-100	901	0
2-H36-302	2-RCH-302	905	0
1-H45-130	1-UHIH-130	908	0
2-H47-290	2-SGBH-290	904	0
2-H50-6	2-FPCH-6	2	0
2-H63-449	2-RHR-449	904	1
1-H47-262	1-SGBH-262	903	0
1-H36-106	1-RCH-106	909	4
2-H21-5	2-CSH-5	9	0

APPENDIX A (Cont'd)

g. NSRS Report No. 1-86-131-SQN, "Seismic Supports are not designed properly because they are rigid", (10/28/85)

h. Generic Concern Task Force investigation report for Employee Concern No. IN-85-886-001, "Design Drawings not constructible; Design criteria non existent," R1, (6/1/86)

6. **WHAT REGULATIONS, LICENSING COMMITMENTS, DESIGN REQUIREMENTS, OR OTHER APPLY OR CONTROL IN THIS AREA?**

a. Detailed Design Criteria SQN-DC-V-24.1, "Location and Design of Piping Supports and Supplemental Steel in Category 1 Structures," R0, (6/23/86)

b. CEB-SQN-100(CEB-80-75) "Guidelines for Design of Component Supports for TVA Class A through D," R3, (1/19/81)

c. Detailed Design Criteria WB-DC-40-31.9 "Location and Design of Piping Supports and Supplemental Steel in Category 1 Structures," R6, (2/10/86).

d. Detailed Design Criteria SQN-DC-V-2.14, "Piping System Anchors Installed in Category I Structures," R0, (06/30/86)

7. **LIST REQUESTS FOR INFORMATION, MEETINGS, TELEPHONE CALLS, AND OTHER DISCUSSIONS RELATED TO ELEMENT:**

a. RFI #SQN-515 (8/24/86)

b. RFI #SQN-546 (9/09/86)

c. RFI #SQN-549 (9/09/86)

d. RFI #SQN-640 (10/16/86)

e. RFI #SQN-692 (11/5/86)

f. RFI #SQN-694 (11/5/86)

g. RFI #SQN-719 (11/17/86)

h. Telecon between N. A. Liakonis (TVA) and S. Chitnis (Bechtel) (12/01/86)

CATD LIST

The following CATD forms are included in this report:

220.03 SQN 01

ECSP CORRECTIVE
Action Tracking Document
(CATD)

INITIATION

1. Immediate Corrective Action Required: ☐ Yes ☒ No
2. Stop Work Recommended: ☐ Yes ☒ No
3. CATD No. 22003 SQN01 4. INITIATION DATE 11-26-86
5. RESPONSIBLE ORGANIZATION: DNE
6. PROBLEM DESCRIPTION: ☒ QR ☐ NQR

THE PROPER APPLICATION OF THE SEISMIC SUPPORT DESIGN CRITERIA CAN NOT BE VARIFIED FOR THE FOLLOWING SEISMIC SUPPORT CALCULATIONS:

2-MSH-315/R0, 1-CVCH-100/R0
2-MSH-348/R0, 1-AFDH-328/R0
2-RCH-302/R0, 2-RHR-449/R1
1-UHIH-130/R0, 2-CSH-5/R0
2-SGBH-290/R0.

☐ ATTACHMENTS

7. PREPARED BY: NAME [signature] DATE: 11-26-86
8. CONCURRENCE: CEG-H George R McNutt DATE: 12-4-86
9. APPROVAL: ECTG PROGRAM MGR. ________ DATE: ________

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN: ________

☐ ATTACHMENTS

11. PROPOSED BY: DIRECTOR/MGR: ________ DATE: ________
12. CONCURRENCE: CEG-H: ________ DATE: ________
SRP: ________ DATE: ________
ECTG PROGRAM MGR: ________ DATE: ________

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE	TITLE	DATE