TVA EMPLOYEE CONCERNS
SPECIAL PROGRAM

REPORT NUMBER: 237.1 (B)

REPORT TYPE: SEQUOYAH ELEMENT

REVISION NUMBER: 2

TITLE: ELECTRICAL PROTECTION DESIGN
Thermal Overload Bypass and
Indication Problems

PAGE 1 OF 14

REASON FOR REVISION:

1. Revised to incorporate Senior Review Panel and Technical Assistance Staff comments; to add CATD #237.01-SQN-4; and to conform with the recommended format for SQN element report.

2. Revised to add chronology and Section 10, Corrective Action.

PREPARATION

PREPARED BY:

J. Scarbrough — SIGNATURE — 1/23/87 DATE

REVIEWS

~~PEER:~~ REVIEW COMMITTEE:

Jordan Parkinson Karl Spedden — SIGNATURE — 1/24/87 DATE

TAS: — SIGNATURE — 2-2-87 DATE

CONCURRENCES

		Earl B. Nesbitt	1/27/87
		CEG-H: George R McNutt	1-27-87
SIGNATURE	DATE	SRP: Jimmie W Doyle* SIGNATURE	2-2-87 DATE

APPROVED BY:

M W Rabich — ECSP MANAGER — 2/2/87 DATE

N/A — MANAGER OF NUCLEAR POWER — DATE
CONCURRENCE (FINAL REPORT ONLY)

* SRP Secretary's signature denotes SRP concurrences are in files.

1. CHARACTERIZATION OF ISSUE(S):

Concern:	Issue:
XX-85-122-024, 025, 026 WI-85-100-008 "Sequoyah - Thermal overload bypass and indication problems involving Regulatory Guide 1.97. CI has no further information. Anonymous concern via letter."	a. Inadequate design compliance with NRC Regulatory Guide 1.97. (This is being interpreted as inadequate compliance with Regulatory Guide 1.106, which deals with thermal overload bypass for motor operated valves.)

2. HAVE ISSUE(S) BEEN IDENTIFIED IN ANOTHER SYSTEMATIC ANALYSIS? YES X NO

- Identified by Black and Veatch (B&V)

  Date October 27, 1982 and October 28, 1982

  Watts Bar Nuclear Plant, B&V Findings No. F-108 (10/27/82) and No. F-122 (10/28/82)

- Identified by TVA Task Force for Review of B&V Findings

  Date April 20, 1983

  Task Force Category 38 for Sequoyah Nuclear Plant - Units 1 and 2, Evaluation Sheet Rev. 0 (04/20/83)

- Identified by TVA Nuclear Safety Review Staff (NSRS)

  Date February 3, 1986 - February 7, 1986

  NSRS Investigation Report No. I-85-129-SQN for Employee Concern XX-85-122-024 Thermal Overload Bypass and Indication Problems (dates of investigation 02/03/86 through 02/07/86)

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

Concerns apply to all safety-related motor operated valves (MOVs).

4. INTERVIEW FILES REVIEWED:

Files WI-85-100 and XX-85-122 were reviewed and no additional unreviewed information for Sequoyah was identified for the concerns addressed in this report.

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 available transcripts of NRC investigative interviews for additional information on the concerns.

b. Determined applicability to SQN of NRC Regulatory Guides 1.106 and 1.97 for thermal overload bypass and indication.

c. Reviewed the extent of SQN commitment regarding compliance to these guides and the method of compliance.

d. Reviewed existing reports (e.g., NSRS Report I-85-129-SQN), findings, and responses to the findings to assess their adequacy and the extent to which they satisfy the employee concerns.

e. Reviewed existing TVA Construction, QA/QC, Operations, and Material Control reports for the Employee Concerns Special Program for applicability to the concerns discussed in this report.

f. Reviewed other documents (e.g., Tech. Spec. for MOV thermal overload protection, sample schematics for safety related MOVs, and criteria for selecting and testing thermal overload elements for MOVs) to verify adequacy of compliance to the Regulatory Guides.

g. Assessed overall compliance to the Regulatory Guides and identified findings as applicable.

9. DISCUSSION, FINDINGS, AND CONCLUSIONS:

Chronology:

05/08/74:	TVA memo provides Sequoyah with guidelines for selecting and testing of MCC overload elements used in MOV circuits
03/77:	NRC Regulatory Guide 1.106 Revision 1 states positions on MOV thermal overload protection
04/20/83:	TVA Task Force evaluates Black and Veatch findings on Watts Bar and concludes that Sequoyah is in compliance with Regulatory Guide 1.106
01/06/84:	Sequoyah Technical Instruction, TI-76 R0, outlines post-maintenance testing on valves
03/29/84:	Sequoyah Technical Specification amended to require periodic calibration of listed MOV thermal overload protection devices
12/07/84:	Sequoyah Surveillance Instructions, SI-251.1 and 251.2, revised to cover periodic calibration of MOV thermal overload protection devices
12/07/85:	Concerns received by TVA
03/07/86:	NSRS Report I-85-129-SQN concludes that Sequoyah conforms with Regulatory Guide 1.106

Discussion:

Although Regulatory Guide 1.97 is referenced in the concerns, the applicable reference as interpreted by the evaluator is Regulatory Guide 1.106. Regulatory Guide 1.97 deals with instrumentation to

assess plant and environs conditions during and following an accident, whereas Regulatory Guide 1.106 addresses thermal overload protection for motor operated valves. The thermal overload bypass and indication concerns bring out a plant safety-related issue, because improper implementation of the NRC Regulatory Guide 1.106 requirements could result in an unsafe condition.

NRC Regulatory Guide 1.106 is primarily directed at ensuring a reliable operation of motor operated valves used in safety systems and in their auxiliary supporting systems. The intent of this guide is to ensure that safety-related MOVs whose motors are equipped with thermal overload protection devices integral with the motor starter will perform their safety functions. To achieve this, the following two alternate regulatory positions are presented in the guide:

Position 1: "(a) The thermal overload protection devices should be continuously bypassed and temporarily placed in force only when the valve motors are undergoing periodic or maintenance testing or (b) those thermal overload protection devices that are normally in force during plant operation should be bypassed under accident conditions," or

Position 2: "The trip setpoint of the thermal overload protection devices should be established with all uncertainties resolved in favor of completing the safety related action. With respect to those uncertainties, consideration should be given to (a) variations in the ambient temperature at the installed location of the overload protection devices and the valve motors, (b) inaccuracies in motor heating data and the overload protection device trip characteristics and the matching of these two items, and (c) setpoint drift. In order to ensure continued functional reliability and the accuracy of the trip point, the thermal overload protection device should be periodically tested."

The current design indicates that the Sequoyah Nuclear Plant adopted Position 2 to satisfy the regulatory requirements. The following information was used to supplement the review of the concerns:

a. TVA Task Force for review of Black and Veatch findings evaluated Watts Bar Nuclear Plant B&V findings F-108 and F-122 for the Sequoyah Nuclear Plant to determine whether the design met the requirements of NRC Regulatory Guide 1.106 and IEEE Standard 279-1971. The Task Force Report (04/23/83; App. A, 5.g) concluded that Position 2 of the regulatory requirement was implemented and, therefore, the Sequoyah Nuclear Plant was in full compliance with NRC Regulatory Guide 1.106 and no further action was required. The report indicated that the 16 to 30 seconds locked rotor current setting of the overload relays as well as their periodic testing per Technical Specifications fully satisfied the regulatory position for vital motor operated valves.

b. The Nuclear Safety Review Staff (NSRS) also conducted an investigation on this subject (from 02/03/86 through 02/07/86; App. A, 5.h), specifically to determine the validity of the employee concern of this report. The NSRS, for the same considerations described in "a" above, concluded in its report (I-85-129-SQN) that the Sequoyah Nuclear Plant conformed to Regulatory Position 2 and, therefore, the concern was not substantiated.

c. A memo, Chandler to Pierce (05/08/74; App. A, 5.l) contains guidelines for selecting MCC overload elements. This document specifies that the thermal overload relays for motor operated valves that are vital for reactor safety must be set to trip between 16 and 30 seconds at locked rotor current with an optimum setting of 20 seconds. The design basis for the settings is, however, not documented, and it is unclear how this setting satisfies Position 2 of the regulatory requirement (i.e., correlation with stroke times for valves).

d. Amendments to Technical Specifications for Units 1 and 2 (both dated 03/29/84; App. A, 5.e) stipulate the surveillance requirements for periodically testing (calibrating) the overload protection devices and provide the listing of valves to be tested under this program.

e. Surveillance Instructions SI-251.1 and SI-251.2 (App. A, 5.i) implement the Technical Specification requirements for periodic calibration of the overload protection devices for the valves listed in the Technical Specifications.

f. Technical Instruction TI-76 (App. A, 5.k) outlines the post-maintenance testing required on equipment listed in the instruction. Table 1 lists valves that must be tested per SI-251.1 and SI-251.2. Although the lists in these documents should be the same, valves 1-FCV-63-6 and 1-FCV-63-7 are listed in SI-251.1 but not in TI-76.

g. Maintenance Instruction MI-10.52 (App. A, 5.j) contains work instructions for selecting overload heaters. Specifically for MOVs, this document provides instructions for sizing overload heaters to meet SI-251.1 and SI-251.2 requirements.

h. Sequoyah Nuclear Plant FSAR, Appendix 6.8c (App. A, 5.b) lists all the valves that are under the Sequoyah Nuclear Plant In-Service Valve Testing Program. A memo, Abercrombie to Seiberling (05/05/86; App. A, 5.p) implies that this list of valves is intended to be equivalent to the list of active valves in the Watts Bar FSAR Tables 3.9-17 and 3.9-25 with the exception of valves listed in Attachment 1 to the memo. The memo states that no requirements exist for SQN to maintain a record of active valves, and it also implies that the valves covered in Appendix 6.8c must remain active following an accident. However, not all the valves in this appendix are currently listed in the Sequoyah Technical Specifications. Furthermore, no justification is provided in the memo for not including Watts Bar active valves 0-FCV-67-151, 1-FCV-67-147, 2-FCV-67-223, and 1-FCV-67-478 in Appendix 6.8c. (Note that although this memo addressed only torque switch bypass requirements, it is assumed that Appendix 6.8c is equally applicable to the thermal overload bypass design.)

None of the documents described in "c" through "h" above were issued or revised as a result of corrective actions occurring subsequent to the concerns. In fact, since the concerns were not substantiated as indicated above, no corrective actions were deemed necessary.

Findings:

a. No formal records were identified for the Sequoyah Nuclear Plant documenting licensing commitments for the extent of compliance to NRC Regulatory Guide 1.106. It should be noted, however, that commitment to comply with Regulatory Position 2 is implied in the response to the B&V findings and the NSRS conclusions.

b. No design basis for compliance with NRC Regulatory Guide 1.106 has been established through design criteria or other design basis documents. This results in an unclear definition of the valves that must meet the regulatory position which, in turn, results in inconsistencies among the different lists of valves included in documents "d," "e," "f," and "h" of the discussion.

c. No design basis has been documented which supports the motor operated valve thermal overload settings of 16 to 30 seconds at locked rotor current and demonstrates that they satisfy Position 2 requirements of NRC Regulatory Guide 1.106.

Conclusion

It is concluded that the concerns as they apply to Sequoyah are valid. Although some documents imply SQN commitment to comply with Regulatory Position 2 of NRC Regulatory Guide 1.106, no licensing documents currently reflect this commitment. Furthermore, in view of the unavailability of design bases establishing the methods of compliance with this guide, it is not possible to determine to what extent the existing design satisfies the intent of this guide. This also leads to inconsistencies among the different valve lists included in site procedures and in the SNP FSAR, Appendix 6.8c.

10. CORRECTIVE ACTION:

Four corrective action tracking documents (CATDs) have been prepared as result of the findings described in above section. These CATDs are numbered as 237.01-SQN-1 through 237.01-SQN-4. In response to the problems described in the CATDs, TVA has developed a corrective action plan (CAP). Revision 0 of the CAP was transmitted to Bechtel by TVA letter TCAB-024 (12/08/86; App. A, 5.r), and Revision 1 of the CAP is documented in TCAB-061 (01/15/87; App. A, 5.v).

The CAP provides for the following actions to resolve the problems described in the CATDs:

a. The FSAR will be revised to document compliance to Regulatory Guide 1.106. This action is considered an acceptable resolution to the problem (CATD 237.01-SQN-1) that the licensing documents do not reflect the extent of Sequoyah's compliance to the regulatory guide.

b. A design criteria document will be issued to provide the basis for TVA design. This action is considered an acceptable resolution to the problem (CATD 237.01-SQN-2) that design basis for compliance with Regulatory Guide 1.106 has not been established through design criteria or other documents.

c. An active valve list will be prepared with justification for listing only active valves instead of all safety-related valves. In addition, the valve listings in the Technical Specification, SI-251.1, SI-251.2, and TI-76 will be reviewed and revised so that the valve lists will agree with each other. These actions are considered acceptable to resolve the inconsistencies among the different valve lists in the site procedures (CATD 237.01-SQN-4).

d. Calculation SQN-APS-003, Revision 0 issued in 11/24/86, will be reviewed for possible revision. This calculation (App. A, 5.s) documents the evaluation of thermal overload heaters used to protect class 1E MOV motors. The calculation identifies the 11/04/86 TVA policy memo PM86-16 (EEB) (App. A, 5.t) for requirements in overload heater selection. The evaluation team's review of the two documents raised a few questions on the calculation, and these were discussed with TVA which provided clarifying remarks and an appropriate resolution by committing to review the calculation for possible revision (App. A, 7.c, d, and e). The possible revision of the calculation will not change the thermal overload heater selection methodology and results as it is intended to provide clarification.

Essentially, the existing heaters are evaluated to satisfy TVA criteria that the selected heaters will trip for a locked rotor condition between 10 to 15 seconds and will not trip at motor full load current for at least 200 percent of the valve stroke time. The design basis for the locked rotor time criterion is based on the IEEE Paper No. F79 669-3 (App. A, 5.w) as indicated in the TVA policy memo; the evaluation team finds this acceptable. In addition, the evaluation team finds the methodology for selecting the heaters to be conservative in that the trip times of the heaters are based on using manufacturer's data for maximum trip time characteristic of the heaters. This is viewed as establishing the trip set point of the thermal overload protection device in favor of completing the MOV safety-related function, thus satisfying Position 2 of

Regulatory Guide 1.106. The evaluation team considers the corrective action acceptable to resolve the problem that no design basis was identified to support the thermal overload device setting of 16 to 30 seconds at locked rotor current (CATD 237.01-SQN-3).

TVA has estimated the completion date of the correction actions as February 16, 1987.

In summary, the evaluation team believes that the completion of the TVA CAP will provide adequate design basis and documentation for compliance with Regulatory Guide 1.106.

APPENDIX A

5. DOCUMENTS REVIEWED RELATED TO THE ELEMENT:

a. Sequoyah Nuclear Plant FSAR, Chapters 7 and 8

b. Sequoyah Nuclear Plant FSAR, Appendix 6.8c revised by Amendment 3, "Sequoyah Nuclear Plant Valve Program"

c. NRC Regulatory Guide 1.47 (05/73), "Bypass and Inoperable Status Indication for Nuclear Power Plant Safety Systems;" NRC Regulatory Guide 1.97, R3 (05/83), "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident;" and NRC Regulatory Guide 1.106, R1 (03/77), "Thermal Overload Protection for Electric Motors on Motor-Operated Valves"

d. IEEE Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"

e. Sequoyah Nuclear Plant Technical Specifications for Units 1 and 2, Sections 3.8.3.2 and 4.8.3.2, and Table 3.8-2 (Amendment No. 33, 03/29/84 for Unit 1 and Amendment No. 25, 03/29/84 for Unit 2)

f. Watts Bar Nuclear Plant Black and Veatch Findings F-108 (10/27/82) and F-122 (10/28/82)

g. TVA memo from Chandler to Jones, (EEB 840110 906), "Sequoyah Nuclear Plant Units 1 and 2 - Black and Veatch Findings - Task Force Category 38," (01/11/84) and attached "Evaluation Sheet Rev. 0 (04/23/83) of the TVA Task Force for Review of Black and Veatch Findings - Task Force Category 38 for Sequoyah Nuclear Plant - Units 1 and 2"

h. TVA memo from Whitt to Abercrombie, (no RIMS #), "Nuclear Safety Review Staff Investigation Report Transmittal," (03/07/86) and attached NSRS Investigation Report No. I-85-129-SQN "Thermal Overload Bypass and Indication Problems," dates of investigation 02/03/86 through 02/07/86

i. Sequoyah Nuclear Plant Surveillance Instructions SI-251.1, R3 (05/31/85) for Unit 1 and SI-251.2, R3 (10/09/85) for Unit 2, "Channel Calibration of Class 1E Motor Operated Valve Overload Relay Heaters"

APPENDIX A (cont'd)

j. Sequoyah Nuclear Plant Maintenance Instruction MI-10.52, R0, "Control of Overload Heaters in Appendix R Circuits," (07/30/86)

k. Sequoyah Nuclear Plant Technical Instruction TI-76, R4, "Electrical Maintenance Post-Maintenance Testing," (11/01/85)

l. TVA memo from Chandler to Pierce, (no RIMS #), "Sequoyah Nuclear Plant - Selecting and Testing of MCC Overload Elements," (05/08/74)

m. Sequoyah Nuclear Plant Schematics E-45N779-31, R18 and E-45N779-15, R21

n. Watts Bar Nuclear Plant FSAR Tables 3.9-17 and 3.9-25

o. Letter from Shell, TVA, to Grace, NRC, "Office of Inspection and Enforcement Bulletin 85-03 - Motor Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings - Sequoyah Nuclear Plant," (05/12/86), (L44 860512 803), and attached enclosure 1, Sequoyah Nuclear Plant (SQN), Response to IE Bulletin 85-03

p. TVA memo from Abercrombie to Seiberling, (no RIMS #), "Nuclear Safety Review Staff (NSRS) Report No. I-85-612-SQN, RCS Pressurizer Relief Flow Control Valves - Failure to Make Torque Switch Bypass Modifications," (05/05/86) and attached response to this report

q. Letter from B. J. Youngblood, NRC, to S. A. White, TVA, (B46 860714 832), (6/23/86), with the attached transcript of the investigat ve interview conducted by the NRC on 02/21/86 at the First Tennessee Bank Building in Knoxville, TN

r. Letter from G. R. McNutt, TVA, to G. L. Parkinson, Bechtel, TCAB-024, "Corrective Action Plan," (12/08/86)

s. DNE Calculation SQN-APS-003, "480V Ac APS Class 1E Load Coordination Study," R0, (B43 861124 906), (11/24/86)

t. TVA memo from Raughley to Those Listed, (B43 861107 908), "Policy Memorandum PM86-18 (EEB) - MCC Motor Starter Overload Heater Selection," (11/04/86)

APPENDIX A (cont'd)

u. TVA memo from Wilson to Denney, (B25 870102 019), "Report 237.1 - Corrective Action Plan Revision," (01/02/87)

v. Letter from G. R. McNutt, TVA, to G. L. Parkinson, Bechtel, TCAB-061, "Corrective Action Plan," (01/15/87)

w. IEEE Transactions Paper No. F79 669-3, Vol. PAS-100, No. 1, 01/81, Page 43, "Motor Overload Protection for Motor Actuated Valves"

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

a. NRC Regulatory Guide 1.106, "Thermal Overload Protection for Electric Motors on Motor Operated Valves"

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

a. Meeting between Nesbitt, Purcell, and Romine, TVA, and Don-Doncow and Hegyi, Bechtel, at Sequoyah jobsite, IOM 530, (08/20/86)

b. Meeting between Nesbitt and Brush, TVA, and Don-Doncow, Bechtel, in Knoxville, IOM 530, (08/21/86)

c. Telecon between Fontenot and Pannel, TVA, and Lew, Bechtel, IOM 473, (12/23/86)

d. Telecon between Pannel, TVA, and Lew and Sarver, Bechtel, IOM 551, (01/09/87)

e. Telecon between Nicely and Nesbitt, TVA, and Don-Doncow, Lew, and Sarver, Bechtel, IOM 554, (01/20/87)

CATD LIST

The following CATDs identify and provide corrective actions for the findings included in this report:

237.01-SQN-1 (12/05/86; CAP revised 01/13/87)
237.01-SQN-2 (12/05/86; CAP revised 01/13/87)
237.01-SQN-3 (12/05/86; CAP revised 01/13/87)
237.01-SQN-4 (12/05/86; CAP revised 01/13/87)

CATEGORY: EN DES PROCESS & OUTPUT SUBCATEGORY: 23701 PROBLEMS WITH THERMAL OVERLOAD BYPASS & INDICATION

CONCERN NUMBER	CAT	SUB CAT	SHRD	PLT LOC	GENERIC APPL BF BL SQ WB	QTC/NSRS INVESTIGATION REPORT	PSR	CONCERN DESCRIPTION	KEYWORD A / KEYWORD B / KEYWORD C / KEYWORD D
WI -85-100-008 T50211	EN	23701	N	WBN	Y Y Y Y REPORT		SR	THERMAL OVERLOAD BYPASS AND INDICATI ON PROBLEMS INVOLVING REG. GUIDE 1.9 7. CI HAS NO FURTHER INFORMATION. ANONYMOUS CONCERN VIA LETTER.	STANDARDS NONCONFORMANCE ELECTRICAL GENERAL
XX -85-122-024 T50214	EN	23701	N	SQN	Y Y Y Y REPORT	I-85-~~[illegible]~~ 129-SQN PART 11/03/87	SS	SEQUOYAH: THERMAL OVERLOAD BYPASS AN D INDICATION PROBLEMS INVOLVING REG. GUIDE 1.97. CI HAS NO FURTHER INFO RMATION. ANONYMOUS CONCERN VIA LETT ER.	STANDARDS NONCONFORMANCE ELECTRICAL GENERAL
XX -85-122-025 T50214	EN	23701	N	BLN	Y Y Y Y REPORT		SR	BELLEFONTE: THERMAL OVERLOAD BYPASS AND INDICATION PROBLEMS INVOLVING RE G. GUIDE 1.97. CI HAS NO FURTHER IN FORMATION. ANONYMOUS CONCERN VIA LE TTER.	STANDARDS NONCONFORMANCE ELECTRICAL GENERAL
XX -85-122-026 T50215	EN	23701	N	BFN	Y Y Y Y REPORT	I-85-773-BFN	SS	BROWN'S FERRY: THERMAL OVERLOAD BYPA SS AND INDICATION PROBLEMS INVOLVING REG. GUIDE 1.97. CI HAS NO FURTHER INFORMATION. ANONYMOUS CONCERN VIA LETTER.	STANDARDS NONCONFORMANCE ELECTRICAL GENERAL

4 CONCERNS FOR CATEGORY EN SUBCATEGORY 23701