EMPLOYEE CONCERNS

SPECIAL PROGRAM

VOLUME 2
ENGINEERING CATEGORY

SUBCATEGORY REPORT 22400
RACEWAY SUPPORT DESIGN

UPDATED

TVA

NUCLEAR POWER

TVA EMPLOYEE CONCERNS SPECIAL PROGRAM

REPORT NUMBER: 22400

REPORT TYPE: SUBCATEGORY REPORT FOR ENGINEERING

REVISION NUMBER: 2

TITLE: RACEWAY SUPPORT DESIGN

REASON FOR REVISION:

1. Revised to incorporate initial SRP comments and latest element evaluation status.
2. Revised to incorporate additional SRP and TAS comments; added Attachment C (References).

PREPARATION

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SIGNATURE — DATE: 10/10/87

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SIGNATURE — DATE: 10-13-87

TAS:

SIGNATURE — DATE: 10/28/87

CONCURRENCES

SIGNATURE — DATE

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NA
MANAGER OF NUCLEAR POWER — DATE
CONCURRENCE (FINAL REPORT ONLY)

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

EXECUTIVE SUMMARY

This subcategory addresses employee concerns about electrical raceway support design and includes such items as seismic requirements, support connections, support design, seismic safety of nonsupported Flamastic-covered cable, provision for expansion of conduit, and seismic qualification of locally mounted electrical motor boxes. The concerned employees generally cited a presumed deficiency or inadequacy in the design of raceway supports.

For ten issues evaluated (derived from a total of 11 employee concerns), three corrective actions were identified. Two of the corrective actions were initiated by TVA before the Employee Concerns Task Group evaluations and have been completed. The remaining one is new action required to resolve a Watts Bar peripheral issue identified during the evaluations.

The causes for the negative findings were diverse, with weaknesses in the design process dominating. Only one of the three corrective actions for this subcategory was judged to be important from a safety standpoint. It requires revision of two Watts Bar documents to remove discrepancies and will include new calculations to verify adequacy of design; it may also require minor hardware modifications.

The employee concerns and issues examined during the evaluations did identify a few valid problems that require resolution. However, because of the relatively small number of negative findings and the random nature of the causes, it cannot be concluded that raceway support design for the areas evaluated in this subcategory constitute a serious problem for Watts Bar, Sequoyah, Browns Ferry, or Bellefonte nuclear power plants sites.

The causes identified and other evaluation results are being reexamined from a wider perspective in the Engineering category evaluation.

Preface, Glossary, and List of Acronyms
for ECTG Subcategory Reports

HISTORY OF REVISION

REV NUMBER	PAGES REVISED	REASON FOR CURRENT REVISION
3	i	To clarify that one or more attachments will help the reader find where a particular concern is evaluated

Preface

This subcategory report is one of a series of reports prepared for the Employee Concerns Special Program (ECSP) of the Tennessee Valley Authority (TVA). The ECSP and the organization which carried out the program, the Employee Concerns Task Group (ECTG), were established by TVA's Manager of Nuclear Power to evaluate and report on those Office of Nuclear Power (ONP) employee concerns filed before February 1, 1986. Concerns filed after that date are handled by the ongoing ONP Employee Concerns Program (ECP).

The ECSP addressed over 5800 employee concerns. Each of the concerns was a formal, written description of a circumstance or circumstances that an employee thought was unsafe, unjust, inefficient, or inappropriate. The mission of the Employee Concerns Special Program was to thoroughly investigate all issues presented in the concerns and to report the results of those investigations in a form accessible to ONP employees, the NRC, and the general public. The results of these investigations are communicated by four levels of ECSP reports: element, subcategory, category, and final.

Element reports, the lowest reporting level, will be published only for those concerns directly affecting the restart of Sequoyah Nuclear Plant's reactor unit 2. An element consists of one or more closely related issues. An issue is a potential problem identified by ECTG during the evaluation process as having been raised in one or more concerns. For efficient handling, what appeared to be similar concerns were grouped into elements early in the program, but issue definitions emerged from the evaluation process itself. Consequently, some elements did include only one issue, but often the ECTG evaluation found more than one issue per element.

Subcategory reports summarize the evaluation of a number of elements. However, the subcategory report does more than collect element level evaluations. The subcategory level overview of element findings leads to an integration of information that cannot take place at the element level. This integration of information reveals the extent to which problems overlap more than one element and will therefore require corrective action for underlying causes not fully apparent at the element level.

To make the subcategory reports easier to understand, three items have been placed at the front of each report: a preface, a glossary of the terminology unique to ECSP reports, and a list of acronyms.

Additionally, at the end of each subcategory report will be a Subcategory Summary Table that includes the concern numbers; identifies other subcategories that share a concern; designates nuclear safety-related, safety significant, or non-safety related concerns; designates generic applicability; and briefly states each concern. Either the Subcategory Summary Table or another attachment or a combination of the two will enable the reader to find the report section or sections in which the issue raised by the concern is evaluated.

The subcategories are themselves summarized in a series of eight category reports. Each category report reviews the major findings and collective significance of the subcategory reports in one of the following areas:

- management and personnel relations
- industrial safety
- construction
- material control
- operations
- quality assurance/quality control
- welding
- engineering

A separate report on employee concerns dealing with specific contentions of intimidation, harassment, and wrongdoing will be released by the TVA Office of the Inspector General.

Just as the subcategory reports integrate the information collected at the element level, the category reports integrate the information assembled in all the subcategory reports within the category, addressing particularly the underlying causes of those problems that run across more than one subcategory.

A final report will integrate and assess the information collected by all of the lower level reports prepared for the ECSP, including the Inspector General's report.

For more detail on the methods by which ECTG employee concerns were evaluated and reported, consult the Tennessee Valley Authority Employee Concerns Task Group Program Manual. The Manual spells out the program's objectives, scope, organization, and responsibilities. It also specifies the procedures that were followed in the investigation, reporting, and closeout of the issues raised by employee concerns.

ECSP GLOSSARY OF REPORT TERMS*

classification of evaluated issues the evaluation of an issue leads to one of the following determinations:

Class A: Issue cannot be verified as factual

Class B: Issue is factually accurate, but what is described is not a problem (i.e., not a condition requiring corrective action)

Class C: Issue is factual and identifies a problem, but corrective action for the problem was initiated before the evaluation of the issue was undertaken

Class D: Issue is factual and presents a problem for which corrective action has been, or is being, taken as a result of an evaluation

Class E: A problem, requiring corrective action, which was not identified by an employee concern, but was revealed during the ECTG evaluation of an issue raised by an employee concern.

collective significance an analysis which determines the importance and consequences of the findings in a particular ECSP report by putting those findings in the proper perspective.

concern (see "employee concern")

corrective action steps taken to fix specific deficiencies or discrepancies revealed by a negative finding and, when necessary, to correct causes in order to prevent recurrence.

criterion (plural: criteria) a basis for defining a performance, behavior, or quality which ONP imposes on itself (see also "requirement").

element or element report an optional level of ECSP report, below the subcategory level, that deals with one or more issues.

employee concern a formal, written description of a circumstance or circumstances that an employee thinks unsafe, unjust, inefficient or inappropriate; usually documented on a K-form or a form equivalent to the K-form.

evaluator(s) the individual(s) assigned the responsibility to assess a specific grouping of employee concerns.

findings includes both statements of fact and the judgments made about those facts during the evaluation process; negative findings require corrective action.

issue a potential problem, as interpreted by the ECTG during the evaluation process, raised in one or more concerns.

K-form (see "employee concern")

requirement a standard of performance, behavior, or quality on which an evaluation judgment or decision may be based.

root cause the underlying reason for a problem.

*Terms essential to the program but which require detailed definition have been defined in the ECTG Procedure Manual (e.g., generic, specific, nuclear safety-related, unreviewed safety-significant question).

Acronyms

AI	Administrative Instruction
AISC	American Institute of Steel Construction
ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BFN	Browns Ferry Nuclear Plant
BLN	Bellefonte Nuclear Plant
CAQ	Condition Adverse to Quality
CAR	Corrective Action Report
CATD	Corrective Action Tracking Document
CCTS	Corporate Commitment Tracking System
CEG-H	Category Evaluation Group Head
CFR	Code of Federal Regulations
CI	Concerned Individual
CMTR	Certified Material Test Report
COC	Certificate of Conformance/Compliance
DCR	Design Change Request
DNC	Division of Nuclear Construction (see also NU CON)

DNE	Division of Nuclear Engineering
DNQA	Division of Nuclear Quality Assurance
DNT	Division of Nuclear Training
DOE	Department of Energy
DPO	Division Personnel Officer
DR	Discrepancy Report or Deviation Report
ECN	Engineering Change Notice
ECP	Employee Concerns Program
ECP-SR	Employee Concerns Program-Site Representative
ECSP	Employee Concerns Special Program
ECTG	Employee Concerns Task Group
EEOC	Equal Employment Opportunity Commission
EQ	Environmental Qualification
EMRT	Emergency Medical Response Team
EN DES	Engineering Design
ERT	Employee Response Team or Emergency Response Team
FCR	Field Change Request
FSAR	Final Safety Analysis Report
FY	Fiscal Year
GET	General Employee Training
HCI	Hazard Control Instruction
HVAC	Heating, Ventilating, Air Conditioning
II	Installation Instruction
INPO	Institute of Nuclear Power Operations
IRN	Inspection Rejection Notice

L/R	Labor Relations Staff
M&AI	Modifications and Additions Instruction
MI	Maintenance Instruction
MSPB	Merit Systems Protection Board
MT	Magnetic Particle Testing
NCR	Nonconforming Condition Report
NDE	Nondestructive Examination
NPP	Nuclear Performance Plan
NPS	Non-plant Specific or Nuclear Procedures System
NQAM	Nuclear Quality Assurance Manual
NRC	Nuclear Regulatory Commission
NSB	Nuclear Services Branch
NSRS	Nuclear Safety Review Staff
NU CON	Division of Nuclear Construction (obsolete abbreviation, see DNC)
NUMARC	Nuclear Utility Management and Resources Committee
OSHA	Occupational Safety and Health Administration (or Act)
ONP	Office of Nuclear Power
OWCP	Office of Workers Compensation Program
PHR	Personal History Record
PT	Liquid Penetrant Testing
QA	Quality Assurance
QAP	Quality Assurance Procedures
QC	Quality Control
QCI	Quality Control Instruction

QCP	Quality Control Procedure
QTC	Quality Technology Company
RIF	Reduction in Force
RT	Radiographic Testing
SQN	Sequoyah Nuclear Plant
SI	Surveillance Instruction
SOP	Standard Operating Procedure
SRP	Senior Review Panel
SWEC	Stone and Webster Engineering Corporation
TAS	Technical Assistance Staff
T&L	Trades and Labor
TVA	Tennessee Valley Authority
TVTLC	Tennessee Valley Trades and Labor Council
UT	Ultrasonic Testing
VT	Visual Testing
WBECSP	Watts Bar Employee Concern Special Program
WBN	Watts Bar Nuclear Plant
WR	Work Request or Work Rules
WP	Workplans

CONTENTS

TABLES

1. INTRODUCTION

This subcategory report summarizes and evaluates the results of the ECSP element evaluations prepared under Engineering Subcategory 22400, Raceway Support Design, and includes such items as seismic requirements, support connections, support design, seismic safety of nonsupported Flamastic-covered cable, provision for expansion of conduit, and seismic qualification of locally mounted electrical motor boxes.

Eleven employee concerns provide the basis for the element evaluations and are listed by element number in Attachment A. The plant location where the concern was originally identified and the applicability of the concern to other TVA nuclear plant sites are also identified.

The evaluations are summarized in the balance of this report as follows:

- Section 2 -- summarizes, by element, the issues stated or implied in the employee concerns and addresses the determination of generic applicability
- Section 3 -- outlines the process followed for the element and subcategory evaluation and cites documents reviewed
- Section 4 -- summarizes, by element, the findings and identifies the negative findings that must be resolved
- Section 5 -- highlights the corrective actions required for resolution of the negative findings cited in Section 4 and relates them to element and to plant site
- Section 6 -- identifies causes of the negative findings
- Section 7 -- assesses the significance of the negative findings
- Attachment A -- lists, by element, each employee concern evaluated in the subcategory. The concern's number is given along with notation of any other element or category with which the concern is shared, the plant sites to which it could be applicable are noted, the concern is quoted as received by TVA, and is characterized as safety related, not safety related, or safety significant

- Attachment B -- contains a summary of the element-level evaluations. Each issue is listed, by element number and plant, opposite its corresponding findings and corrective actions. The reader may trace a concern from Attachment A to an issue in Attachment B by using the element number and applicable plant. The reader may relate a corrective action description in Attachment B to causes and significance in Table 3 by using the CATD number which appears in Attachment B in parentheses at the end of the corrective action description.

  The term "Peripheral finding" in the issue column refers to a finding that occurred during the course of evaluating a concern but did not stem directly from a employee concern. These are classified as "E" in Tables 1 and 2 of this report

- Attachment C -- lists the references cited in the text

2. GENERIC APPLICABILITY/SUMMARY OF ISSUES

The employee concerns listed in Attachment A for each element and plant have been examined, and the potential problems raised by the 11 concerns have been identified as ten issues. These issues were reviewed in the element evaluations for the six elements of this report. Not all issues apply to every plant because not all of the employee concerns from which they originate apply to every plant. Applicability determinations of each concern, within each element, were made in accordance with Section 7.3 of Employee Concerns Task Group Procedure ECTG M.1, "Program Description," Rev. 5.

The criteria for making the generic applicability determinations are described in ECTG M.1, Attachment E. The criteria clearly limit the determinations of generic applicability to circumstances where there is "reasonable factual basis (not merely speculation)" for concluding that a concern is generic and applicable to other plants or plant features.

2.1 Generic Applicability Determination

The generic applicability determinations made are given below:

2.1.1 Elements 224.1, 224.2, and 224.3

Concerns IN-85-289-003, IN-85-289-N08, IN-85-107-001, IN-85-289-004, IN-85-325-004, EX-85-066-001, and EX-85-068-001 were evaluated for WBN. Upon evaluation these concerns were found not to be valid. In addition, the evaluation concluded that the concerned individuals had an incomplete understanding of the design process in the concern area. Therefore, these concerns were not reviewed for the other plants.

2.1.2 Element 224.5

Concern MAS-86-005 was evaluated only for SQN because of its specific reference to SQN features. Also, TVA had already initiated corrective action for this concern before the ECTG evaluation, and no further corrective action was specified by the evaluation team. Thus, this concern was not evaluated for the other plants.

2.1.3 Element 224.7

Concern BNP-QCP-10.35-8-1 was evaluated for BLN. Upon evaluation, this concern was found not to be valid. In addition, the concern cited BLN unique features. Therefore, this concern was not evaluated for other plants.

2.1.4 Element 224.9

Concerns BNP-QCP-10.35-16 and OE-QMS-6 were evaluated for BLN regarding seismic qualification of ERCW pump motor boxes and installation. The evaluation team determined that while the concerns were valid when initiated, a technical issue no longer existed because of the adequate seismic qualification documentation prepared by BLN after the date of the concern. This corrective action was initiated before the ECTG evaluation, and no further corrective action was specified by the evaluation team. Therefore, these concerns were not evaluated for the other plants.

2.2 Summary of Issues

A summary of the ten issues evaluated under this subcategory, grouped by element, is listed below.

- o 224.1, Category I vs Noncategory I Raceway - The cable tray and conduit support seismic requirements in the Turbine and Control Buildings are less than those for the supports in the Auxiliary and Reactor Buildings (applied to WBN).

- o 224.2, Raceway Connections - Cable tray supports should be assumed as pinned so that moments are not developed at ceiling embedded plates which are not strong enough to resist imposed moments. Beveled full penetration welds should have been used in the conduit support design instead of butt welds or fillet welds (applied to WBN).

- o 224.3, Raceway Layout - Conduits do not have adequate support design because the number of support types for supporting multiple conduits on a common support is insufficient. Conduit routing was poorly planned and, as a result, conduits require too many supports and are poorly located (applied to WBN).

- o 224.5, Support of Cables - The nonsupported Flamastic-covered cable in the cable spreading room that penetrates walls and ceiling may not be seismically safe (applied to SQN).

- o 224.7, Conduit Expansion/Movement - Differential movements between structural elements of the unit 1 Reactor Building are not considered in the design of electrical conduits (applied to BLN).

- o 224.9, ERCW Pump Electrical Motor Boxes - The lack of seismic analysis and mounting details for the electrical motor boxes attached to the ERCW pump motors is an oversight by the manufacturer and Engineering (applied to BLN).

The issue summaries above deal with presumed deficiencies or inadequacies in the design of raceway supports. More specifically, four of the issue summaries are concerned with the design adequacy (224.1, 224.2, 224.3, and 224.5) and the other two suggest oversights or errors in the design (224.7 and 224.9).

As the following sections show, three of the above summarized issues were found to be valid and require corrective actions (224.3, 224.5, and 224:9). Two of these involve design adequacy, and the other involves design oversights or errors.

Each issue evaluated within the element is stated fully in Attachment B, which also lists corresponding findings and corrective actions that are discussed in Sections 4 and 5 of this report.

3. EVALUATION PROCESS

This subcategory report is based on the information contained in the applicable element evaluations addressing the specific employee concerns related to the issues summarized in Section 2. The evaluation process consisted of the general methodology used in the evaluation (Section 3.1) as well as the specific method employed in each element evaluation (Section 3.2).

3.1 General Evaluation Process

The general evaluation process is as follows:

a. Defined issues for each element from the employee concerns.

b. Reviewed current regulatory requirements, industry standards, and TVA criteria documents related to the issues to develop an understanding of the design basis.

c. Reviewed applicable design documents and conducted facility walkdowns, as appropriate, to develop design understanding and to verify implementation status.

d. Reviewed applicable FSAR to determine regulatory compliance and to identify TVA commitments related to the design.

e. Reviewed any other documents applicable to the issues and determined to be needed for the evaluation, such as correspondence, transcripts of interviews, procedures, test reports, NCRs, ECNs, evaluation reports, etc.

f. Using the results from steps a through e above, evaluated the issues for each element.

g. Tabulated issues, findings, and corrective actions from the element evaluations in a plant-by-plant arrangement (see Attachment B).

h. Prepared Tables 1, 2, and 3 to permit comparison and identification of common and unique issues, findings, and corrective actions among the four plants.

i. Classified the findings and corrective actions from the element evaluations using the ECSP definitions.

j. On the basis of ECSP guidelines, analyzed the causes and established the collective significance of the findings from the element evaluations.

k. Evaluated defined corrective actions to determine if additional actions are required as a result of causes found in step j.

l. Provided additional judgment or information that may not be apparent at the element level.

3.2 Specific Evaluation Process

The evaluation process for each element is given below.

o Category I vs. Noncategory I Raceway (Watts Bar) - Element 224.1

a. Reviewed FSAR licensing commitments.

b. Reviewed Design Criteria WB-DC-20-21.1 (Ref. 2) and WB-DC-40.31.10 (Ref. 3)

c. Performed plant walkdown in the Control and Auxiliary Buildings to compare raceway support configurations.

o Raceway Connections (Watts Bar) - Element 224.2

a. Reviewed Design Criteria WB-DC-20-21.1 (Ref. 2) and WB-DC-40.31.10 (Ref. 3) and also raceway support drawings.

b. Performed detail review of cable tray supports located at Auxiliary Building elevation 757.0 feet, and Control Building elevation 755.0 feet.

c. Reviewed cable tray support Calculation WCG-2-28 (Ref. 4).

d. Reviewed specified welding types and sizes of conduit support in drawing series 47A056 (Ref. 5).

o Raceway Layout (Watts Bar) - Element 224.3

a. Reviewed FSAR licensing commitments.

b. Reviewed Design Criteria WB-DC-40-31.10 (Ref. 3) for conduit supports.

c. Reviewed drawing series 47A056 (Ref. 5) conduit support.

d. Performed walkdown to observe conduit support details.

o Support of Cables (Sequoyah) - Element 224.5

a. Reviewed appropriate design documents that support the existing configuration.

b. Performed walkdowns of the cable spreading room and main control room to review existing conditions. Identified vertical and horizontal support at the cable spreading room ceiling and determined if there are other supports.

c. Performed required analysis.

o Conduit Expansion/Movement (Bellefonte) - Element 224.7

a. Reviewed General Construction Specification G-40 (Ref. 6) for installation of electrical conduits.

b. Walked down unit 1 Reactor Building at elevation 662 feet around azimuth 300 degree of both the primary containment and the secondary shielding wall (D-ring wall) to observe conduit installation interface between the two structural elements.

c. Reviewed drawing 5RW0816-RU-9 (Ref. 7) for electrical raceway layout at location in question.

o ERCW Pump Electrical Motor Boxes (Bellefonte) - Element 224.9

a. Reviewed appropriate design documents and OE Calculation CEB-CAS-179 (Ref. 8) that support the existing configuration.

b. Performed a walkdown of the ERCW pump electrical motor boxes located in the Intake Pumping Station. Identified mounting installation between electrical box and ERCW pump motor.

c. Performed required analysis.

4. FINDINGS

The findings from each of the six element evaluations for this subcategory are contained in Attachment B. The findings are listed by element number and by plant.

The findings for each element are summarized below:

4.1 Category I vs Noncategory I Raceway - Element 224.1

Class 1E electrical service is provided in Category I structures which include the Reactor, Auxiliary, and Control Buildings. For comparable elevations in the Auxiliary and Control Buildings at WBN, the design basis and design output for cable tray and conduit supports are the same. The electrical services provided in non-Category I facilities, such as the Turbine Building, are not essential to the safe shutdown of the power plant or to maintaining radiation limits within NRC prescribed limits at the site boundary. Thus, the Turbine Building cable tray supports are non-Category I and are designed to a lesser design basis, and this is adequate.

4.2 Raceway Connections - Element 224.2

Since cable tray support members are welded to the embed plates at WBN, the design assumption for the connection should not be changed from a rigid to a pin connection. Design calculations of ten cable tray supports (Ref. 4) which imposed loads to the embed plates were reviewed. These supports were selected to include those with longer cantilever distance from the ceiling support and those with a larger number of attached cable trays to provide an envelope assessment of larger imposed moments. This review indicates that the embed plates and anchors are adequate to resist the forces and moments imposed during seismic events. Also, the weld type and size specified on the conduit support design drawing 47A056 series (Ref. 5) are found to be sufficient to meet design requirements.

4.3 Raceway Layout - Element 224.3

Watts Bar conduit drawing 47A056 series (Ref. 5) has shown both multiple and single conduit support types. The use of single conduit supports is frequently necessitated by plant layout. During a plant walkdown in March 1986, the evaluation team observed that both multiple and single conduit supports were used. The conduit routing and number of supports are adequate. A review of the Watts Bar Final Safety Analysis Report (FSAR) Section 3.10.3 (Ref. 9) and conduit support Design Criteria WB-DC-40.31.10 (Ref. 3) has identified a disagreement in conduit damping values in the design of conduit supports. Also, the design criteria do not require the conduit support evaluation for an operating basis earthquake (OBE).

4.4 Support of Cables - Element 224.5

On the basis of several walkdowns and subsequent evaluations (Refs. 1 and 10) performed by the evaluation team on the laterally unsupported Flamastic-covered vertical cables in the SQN cable spreading room, adequate vertical and horizontal cable restraint is provided to support the vertical cable runs under any design load. SQN had performed a full-scale shake table test of as-built configuration of Flamastic-covered cables (Ref. 11). The test was initiated before ECTG investigation. This test together with the above walkdowns and evaluations adequately demonstrates the seismic qualification of the laterally unsupported and Flamastic-covered vertical cables in the SQN cable spreading room.

4.5 Conduit Expansion/Movement - Element 224.7

General Construction Specification G-40 (Ref. 6) states that flexible conduit shall be used to interface the rigid conduit system with electrical equipment when they are subject to relative movements due to either thermal or seismic loading. In addition, drawing 5RW0816-RU-9 (Ref. 7) explicitly requires the use of flexible conduit to prevent rigid attachments between the primary containment and either the secondary containment or the containment internal structures.

A walkdown was performed by the evaluation team to observe a portion of the interface between the primary containment shell and adjacent structures. In all cases, including a specific review at elevation 622 feet, azimuth 300°, no violations to the above criteria were observed. Contrary to the concern, flexible conduit was installed where electrical cables were attached to both structural elements.

In an effort to locate the specific installation identified in the concern (unit 1 Reactor Building, elevation 622 feet and azimuth 300°), the evaluation team viewed the secondary shield wall (D-ring wall) at the corresponding location. At approximately a 10° offset on either side of azimuth 300° on the outside of the steam generator compartment, two series of conduits came out of the floor and connected to an electrical box attached to the wall. One series of conduits used a portion of flexible conduit and the other adjacent series used only rigid conduit. This installation is detailed in drawing 5RW0816-RU-13 as section A13-A13 (Ref. 12). It is evident to the evaluation team that this was the source of the concern filed.

The structural configuration was reviewed at the locations in question as detailed in the BLN FSAR, Figure 3.8.3-4 (Ref. 13), Section A6-A6. This figure revealed that the floor slab at elevation 622 feet and the secondary shield wall were integrally attached utilizing reinforcing dowels. On the

basis of this fact, it is evident that there will be no appreciable differential movement between the floor penetration and the wall-mounted electrical box. Therefore, flexible conduit is not necessary for the installations. The fact that flexible conduit was used for one series of conduits has no negative impact on the design and does not violate any TVA requirements or commitments.

4.6 ERCW Pump Electrical Motor Boxes - Element 224.9

The ERCW pump electrical motor boxes of concern are thermal element junction boxes. There are four ERCW pump motors for each unit and one thermal element junction box for each motor. The ERCW pump electrical motor boxes and installation at BLN were evaluated by TVA before the ECTG investigation. TVA qualified the motor boxes and installation to seismic Category I(L) and determined that no additional supports are required for the boxes (Ref. 8). A walkdown of the motor boxes and subsequent evaluation performed by the evaluation team confirmed the seismic qualification. On the basis of a General Electric Company (GE) letter to TVA (Ref. 14), the ERCW pump electrical motor boxes are not considered critical to the operation of the motors. While the boxes do monitor temperature conditions, the motors will continue to operate without them.

4.7 Summary of Subcategory Findings

The classified findings are summarized in Table 1. Class A and B findings indicate there is no problem and that corrective action is not required. Class C, D, and E findings require corrective actions. The corrective action class, defined in the Glossary Supplement, is identified in the table by the numeral combined with the finding class.

Findings are summarized by classification in Table 2. Of the ten findings identified by a classification in Table 1, seven require no corrective action. Of the remaining three, two had corrective actions initiated before the ECTG evaluation, which have been completed. One required a new corrective action to resolve a peripheral issue noted during the ECTG evaluation.

5. CORRECTIVE ACTIONS

Table 2 identifies three findings that require corrective action. Each finding is addressed by a single corrective action description for an individual plant. There are a total of three different corrective action descriptions required to remedy the three negative findings. The corrective actions, along with their finding/corrective action classifications, are summarized in Table 3. Two of the corrective actions were initiated before the ECTG evaluations and have been completed. The remaining one is new action

required to resolve a Watts Bar peripheral issue identified during the evaluations. This corrective action is described in detail in Attachment B. A summary of the corrective actions by element, with the applicable plant identified in parentheses, follows:

- 224.3, Raceway Layout - The FSAR and conduit support design criteria will be revised as required to show the correct conduit damping values used for both OBE and SSE load conditions. Also, the OBE load condition with its associated damping values will be evaluated or its exclusion from conduit support design criteria will be justified (WBN).

- 224.5, Support of Cable - A shake table test by TVA, together with several walkdowns and subsequent evaluations performed by the evaluation team on cable anchorage at the cable spreading room ceiling, confirmed the seismic qualification of the laterally unsupported and Flamastic-covered vertical cables in the cable spreading room (SQN).

- 224.9, ERCW Pump Electrical Motor Boxes - DNE qualified the ERCW pump electrical motor boxes and installation as seismic Category I(L) and determined that no additional supports are required for the boxes. A walkdown of the pump motor boxes and subsequent evaluation performed by the evaluation team confirmed the seismic qualification of the ERCW pump electrical motor box installation (BLN).

Table 3 indicates the plant or plants to which a corrective action is applicable by the Corrective Action Tracking Document (CATD) column where the applicable plant is identified by the CATD number. From the Finding/Corrective Action Classification column of Table 3, it can be seen that of the three corrective actions identified, the first requires some type of documentation remedy and evaluation to verify adequacy of design, the second involved testing and evaluations to validate the design, and the third required analysis to justify the installation. In addition, the CATD column of the table shows that a particular corrective action is applicable to only a single plant. The corrective actions for elements 224.5 and 224.9 were initiated before the ECTG evaluation and have been completed. Therefore, no CATDs were generated for these two elements.

With respect to corrective actions, Table 3 shows that, of the six elements in this subcategory, three require no corrective action (namely, elements 224.1, 224.2, and 224.7) and three require corrective action (namely, elements 224.3, 224.5, and 224.9); two corrective actions were initiated before the ECTG evaluation and have been completed.

The evaluation team found the corrective action plan for element 224.3 and the completed corrective actions for elements 224.5 and 224.9 to be acceptable to resolve the findings.

6. CAUSES

Table 3 identifies one or more causes for each problem requiring corrective action. For each corrective action, the most important cause is identified; however, in some instances, it was felt that the problem resulted from a combination of causes, each of which should be identified. Therefore, more than one cause is identified for some of the corrective actions.

For the three corrective action descriptions listed in Table 3, six causes have been checked. These are shown in the table and totaled at the end. The most frequent cause is "Inadequate Design Bases," column 8. This cause, which reflects on the design process, and more particularly on design documentation, represents two of the six causes checked.

The following identifies the causes of Table 3 and the associated element evaluations with the negative findings identified in Section 4:

- Reconciliation of the FSAR and conduit support design criteria to eliminate inconsistencies in conduit damping values is required for Watts Bar because of inconsistent and contradictory design bases in establishing design requirements. Also, evaluation of the OBE load condition to verify adequacy of conduit support or justification for its exclusion from the conduit support design criteria is required because of failure to meet design commitment.

- Seismic safety of the laterally unsupported vertical cables in the Sequoyah cable spreading rooms was confirmed to be adequate by a shake table test and several walkdowns and subsequent evaluations. The cause of this problem appeared to be incomplete design bases in establishing design requirements.

- DNE qualified the ERCW pump electrical motor boxes and installation at Bellefonte as seismic Category I(L) and determined that no additional supports are required for the boxes. The lack of previous seismic qualification of the ERCW pump electrical motor boxes is an oversight or error by both the vendor and TVA Engineering. This oversight or error also led to the omission of design of support detail regarding the installation.

7. COLLECTIVE SIGNIFICANCE

The evaluation team's judgment as to the significance of the corrective actions listed in Table 3 is indicated in the last three columns of the table. Significance is rated in accordance with the type or types of changes that may be expected to result from the corrective action.

The 11 concerns expressed by TVA employees and covered in this subcategory directly resulted in three corrective actions. SQN corrective action (element 224.5) and BLN corrective action (element 224.9) had been initiated before the ECTG evaluation and have been completed. Watts Bar corrective action for element 224.3 was considered individually important from a safety standpoint because it requires reconciliation of FSAR and conduit support design criteria to show that the same conduit damping values are used for design of conduit support. Evaluation of the OBE load condition to verify adequacy of conduit support design or justify its exclusion from conduit support design criteria may result in minor hardware modification.

Because of the relatively low number of negative findings in this subcategory and the random nature of the causes, it cannot be concluded that the raceway support design for the four plant sites investigated and for the areas evaluated in this subcategory represents a serious technical problem. No broader issues can be identified in this area.

On the basis of these conclusions, the subject matter of this subcategory report does not require specific treatment in the TVA Nuclear Performance Plans.

The findings of this subcategory are being combined with the other subcategory reports and reassessed in the Engineering category evaluation.

TABLE 1

CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

	Element	Issue/ Finding**	Finding/Corrective Action Class* SQN	WBN	BFN	BLN
224.1	Category I vs Noncategory I Raceway	a	-	B	-	-
224.2	Raceway Connections	a	-	A	-	-
		b	-	A	-	-
		c	-	A	-	-
224.3	Raceway Layout	a	-	A	-	-
		b	-	A	-	-
		c	-	E6	-	-
224.5	Support of Cables	a	C6	-	-	-
224.7	Conduit Expansion/ Movement	a	-	-	-	A
224.9	ERCW Pump Electrical Motor Boxes	a	-	-	-	C5

*Classification of Findings and Corrective Actions

A. Issue not valid. No corrective action required.
B. Issue valid but consequences acceptable. No corrective action required.
C. Issue valid. Corrective action initiated before ECTG evaluation.
D. Issue valid. Corrective action taken as a result of ECTG evaluation.
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.

1. Hardware
2. Procedure
3. Documentation
4. Training
5. Analysis
6. Evaluation
7. Other

**Defined for each plant in Attachment B.

TABLE 2

FINDINGS SUMMARY

Classification of Findings	Plant SQN	WBN	BFN	BLN	Total
A. Issue not valid. No corrective action required.	0	5	0	1	6
B. Issue valid but consequences acceptable. No corrective action required.	0	1	0	0	1
C. Issue valid. Corrective action initiated before ECTG evaluation.	1	0	0	1	2
D. Issue valid. Corrective action taken as a result of ECTG evaluation.	0	0	0	0	0
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.	0	1	0	0	1
Total	1	7	0	2	10

TABLE 3
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES
SUBCATEGORY 22400

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CAID	CAUSES OF NEGATIVE FINDINGS *																	Significance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS							DESIGN PROCESS EFFECTIVENESS							TECHNICAL ADEQUACY					
				1 Fragmented Organization	2 Inadequate Q-trng	3 Inadequate Procedures	4 Procedures Not Followed	5 Inadequate Communication	6 Untimely Res of Issues	7 Lack of Mgt Atten	8 Inadequate Design Bases	9 Inadequate Calcs	10 Inadequate As-blt Recon.	11 Lack of Design Detail	12 Engrg Judgmt not Documented	13 Design Crit/ Commit Not Met	14 Insuf. Verif Documentation	15 Stds Not Followed	16 Engrg Error	17 Vendor Error	D	M	H
224.3	E6	Correct disagreement between the conduit damping values shown in the FSAR and design criteria. Evaluate OBE load condition or justify the basis for its exclusion in the conduit support design criteria.	WBN 01								X					X					A	P	P
224.5	C6	Corrective action for SQN was initiated before the ECTG evaluation. A shake table test and several walkdowns and evaluations were performed. They confirmed the seismic qualification of the laterally unsupported Flamastic-covered vertical cables in the cable spreading room.	(SQN)								X										-	-	-
224.9	C5	Corrective action for BLN was initiated before the ECTG evaluation. DNE qualified the ERCW pump electrical motor boxes and installation as seismic Category I(L) and requires no additional support. A walkdown and evaluation by the evaluation team confirmed the seismic qualification.	(BLN)											X					X	X	-	-	-
			TOTALS								2			1		1			1	1			

* Defined in the Glossary Supplement.

** Defined in Table 1.

GLOSSARY SUPPLEMENT
FOR THE ENGINEERING CATEGORY

Causes of Negative Findings - the causes for findings that require corrective action are categorized as follows:

1. Fragmented organization - Lines of authority, responsibility, and accountability were not clearly defined.

2. Inadequate quality (Q) training - Personnel were not fully trained in the procedures established for design process control and in the maintenance of design documents, including audits.

3. Inadequate procedures - Design and modification control methods and procedures were deficient in establishing requirements and did not ensure an effective design control program in some areas.

4. Procedures not followed - Existing procedures controlling the design process were not fully adhered to.

5. Inadequate communications - Communication, coordination, and cooperation were not fully effective in supplying needed information within plants, between plants and organizations (e.g., Engineering, Construction, Licensing, and Operations), and between interorganizational disciplines and departments.

6. Untimely resolution of issues - Problems were not resolved in a timely manner, and their resolution was not aggressively pursued.

7. Lack of management attention - There was a lack of management attention in ensuring that programs required for an effective design process were established and implemented.

8. Inadequate design bases - Design bases were lacking, vague, or incomplete for design execution and verification and for design change evaluation.

9. Inadequate calculations - Design calculations were incomplete, used incorrect input or assumptions, or otherwise failed to fully demonstrate compliance with design requirements or support design output documents.

10. Inadequate as-built reconciliation - Reconciliation of design and licensing documents with plant as-built condition was lacking or incomplete.

11. Lack of design detail - Detail in design output documents was insufficient to ensure compliance with design requirements.

12. Failure to document engineering judgments - Documentation justifying engineering judgments used in the design process was lacking or incomplete.

13. Design criteria/commitments not met - Design criteria or licensing commitments were not met.

14. Insufficient verification documentation - Documentation (Q) was insufficient to audit the adequacy of design and installation.

15. Standards not followed - Code or industry standards and practices were not complied with.

16. Engineering error - There were errors or oversights in the assumptions, methodology, or judgments used in the design process.

17. Vendor error - Vendor design or supplied items were deficient for the intended purpose.

Classification of Corrective Actions - corrective actions are classified as belonging to one or more of the following groups:

1. Hardware - physical plant changes

2. Procedure - changed or generated a procedure

3. Documentation - affected QA records

4. Training - required personnel education

5. Analysis - required design calculations, etc., to resolve

6. Evaluation - initial corrective action plan indicated a need to evaluate the issue before a definitive plan could be established. Therefore, all hardware, procedure, etc., changes are not yet known

7. Other - items not listed above

Peripheral Finding (Issue) - A negative finding that does not result directly from an employee concern but that was uncovered during the process of evaluating an employee concern. By definition, peripheral findings (issues) require corrective action.

Significance of Corrective Actions - The evaluation team's judgment as to the significance of the corrective actions listed in Table 3 is indicated in the last three columns of the table. Significance is rated in accordance with the type or types of changes that may be expected to result from the corrective action. Changes are categorized as:

- Documentation change (D) - This is a change to any design input or output document (e.g., drawing, specification, calculation, or procedure) that does not result in a significant reduction in design margin.

- Change in design margin (M) - This is a change in design interpretation (minimum requirement vs actual capability) that results in a significant (outside normal limits of expected accuracy) change in the design margin. All designs include margins to allow for error and unforeseeable events. Changes in design margins are a normal and acceptable part of the design and construction process as long as the final design margins satisfy regulatory requirements and applicable codes and standards.

- Change of hardware (H) - This is a physical change to an existing plant structure or component that results from a change in the design basis, or that is required to correct an initially inadequate design or design error.

If the change resulting from the corrective action is judged to be significant, either an "A" for actual or "P" for potential is entered into the appropriate column of Table 3. Actual is distinguished from potential because corrective actions are not complete and, consequently, the scope of required changes may not be known. Corrective actions are judged to be significant if the resultant changes affect the overall quality, performance, or margin of a safety-related structure, system, or component.

ATTACHMENT A

EMPLOYEE CONCERNS
FOR SUBCATEGORY 22400

Attachment A -- lists, by element, each employee concern evaluated in the subcategory. The concern number is given along with notation of any other element or category with which the concern is shared, the plant sites to which it could be applicable are noted, the concern is quoted as received by TVA, and is characterized as safety related, not safety related, or safety significant.

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY SQN	WBN	BFN	BLN	CONCERN DESCRIPTION*
224.1	IN-85-289-003	WBN		X			"The requirement for cable tray supports is far less stringent in the turbine and control building than aux and reactor buildings. To prove the point, CI states that cable tray supports in turbine and control buildings are not as strong as the supports in aux and reactor building. CI thinks that same earthquake is going to hit all the buildings. CI has no more information." (SR)
	IN-85-289-N08	WBN		X			"NRC identified the following concern from review of QTC file. 'The requirement for conduit supports is far less stringent in the turbine and control buildings than the aux. and reactor buildings.'" (SR)
224.2	IN-85-107-001	WBN		X			"Some ceiling embedded plates, on which cable tray supports are attached, are not strong enough to resist high moments due to seismic loads. But there are no calculations to prove that they do not work. Engineer is of the opinion that it would be better if the cable tray supports are assumed pinned instead of rigid at the point of attachment, so moments are not developed. CI questions design philosophy and has no hardware specifics." (SR)
	IN-85-289-004	WBN		X			"Design consistently calls for butt welds on conduit supports built during '78 and '79, instead of bevel welds, although bevel welds are stronger during an earthquake. CI has no specifics. Construction Dept. concern." (SR)
	IN-85-325-004	WBN		X			"Butt welding on* fillet welding of conduit support hangers was insufficient to provide adequate strength and flexibility. It was expressed that beveled full penetration welds were necessary. No further details were provided." (SR)

*(Note: Presumed error which should read "or")

* SR/NU/SS indicates safety related, not safety related, or safety significant per determination criteria in the EQIG Program manual and applied by IVA before evaluations.

ATTACHMENT A

EMPLOYEE CONCERNS FOR SUBCATEGORY 22400

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY SQN	WBN	BFN	BLN	CONCERN DESCRIPTION*
224.3	EX-85-066-001	WBN		X			"Conduit runs do not have adequate support design. There are not enough supports designed for multiple conduits, resulting in too many single supports in the auxiliary and reactor buildings. Construction Department concern. CI has no additional information." (SR)
	EX-85-068-001	WBN		X			"Engineering on conduit runs is poorly planned. Hanger brackets are poorly placed. There are too many of them. Raceways in accumulator room #2. Construction Dept concern. CI has no additional information." (SR)
224.4			-	-	DELETED		
224.5	MAS-86-005	SQN	X				"Are the non-supported Flamastic covered cables in the spreading room that penetrate the walls and ceiling seismically safe." (SS)
224.6			-	-	DELETED		
224.7	BNP-QCP-10.35-8-1	BLN				X	"RB #1, elevation 670, no provision for expansion of pipes/conduits." (SS)
224.9	BNP-QCP-10.35-16	BLN				X	"No seismic analysis was done on electrical boxes on ERCW pump motors. Movement of boxes during seismic event could damage safety-related components." (SS)
	OE-QMS-6	BLN				X	"Mounting of electrical motor boxes on ERCW pump motors Contract 7/K35-820122-N4M-122 does not show how electrical motor boxes are mounted. CI feels they are not adequately supported and this is an oversight by manufacturer and engineering." (SS)

* SR/NO/SS indicates safety related, not safety related, or safety significant per determination criteria in the ECTG Program manual and applied by TVA before evaluations.

ATTACHMENT B

SUMMARY OF ISSUES, FINDINGS, AND
CORRECTIVE ACTIONS FOR
SUBCATEGORY 22400

Attachment B -- contains a summary of the element-level evaluations. Each issue is listed, by element number and plant, opposite its corresponding findings and corrective actions. The reader may trace a concern from Attachment A to an issue in Attachment B by using the element number and applicable plant. The reader may relate a corrective action description in Attachment B to causes and significance in Table 3 by using the CATD number which appears in Attachment B in parentheses at the end of the corrective action description.

The term "Peripheral finding" in the issue column refers to a finding that occurred during the course of evaluating a concern but did not stem directly from a employee concern. These are classified as "E" in Tables 1 and 2 of this report.

Issues	Findings	Corrective Actions
********** Element 224.1 - Category I vs Noncategory I Raceway **********		
SQN (N/A)	SQN (N/A)	SQN
WBN a. The seismic requirement for cable tray and conduit supports is less in the turbine and control buildings than in the auxiliary and reactor buildings. These supports in the turbine and control buildings are not as strong as those in the auxiliary and reactor buildings. Any earthquake will affect all buildings.	WBN a. The services provided in non-Category I facilities, such as the turbine building, are not essential to the safe shutdown of the power plant or to maintaining radiation limits within NRC prescribed limits at the site boundary. Thus, for these non-Category I facilities, it is not a requirement from either a safety or an economic viewpoint to apply the more severe seismic design criteria which are used for Category I facilities. The evaluation team performed a general walkdown of the plant on 03/26/86, as recorded in BLT-006 dated 04/08/86. The turbine building cable tray supports are much lighter in construction than those in Category I facilities. The concerns, however, group the control building raceway supports (Category I) with those of the turbine building. To help understand this aspect of the concerns, the evaluation team made a more specific plant walkdown on 04/16/86 to compare the general strength, rigidity, and detailing of Category I electrical raceway (both cable tray and conduit) supports in the auxiliary and control buildings. The walkdown observations indicate that, for comparable elevations in the auxiliary and control buildings, the design basis and construction for Category I electrical raceway supports are the same. The requirements for Category I raceway supports are detailed in design criteria WB-DC-20-21.1 (cable tray) and WB-DC-40-31.10 (conduit). The design criteria apply equally to all Category I raceway supports.	WBN a. None required.
BFN (N/A) BLN (N/A)	BFN (N/A) BLN (N/A)	BFN (N/A) BLN (N/A)

Issues	Findings	Corrective Actions
********** Element 224.2 - Raceway Connections **********		
SQN (N/A) WBN a. Some ceiling embedded plates for cable tray supports are not strong enough to resist imposed moments.	SQN (N/A) WBN a. Elevation 755.0 feet in the control building and elevation 757.0 feet in the auxiliary building were selected for detail review because they contain a sample of the heavier loaded cable tray supports subjected to higher seismic forces, thus providing a conservative loading envelope. The supports located at elevation 755.0 feet in control building are attached to the bottom of structural steel beams which support the ceiling slab and not to the embed plates in the ceiling slab. This framing is shown on drawing series 48N1331 and 48N1336. The supports at elevation 757.0 feet in auxiliary building are attached to embedded plates in the ceiling as shown on drawing 48N1225-9. The cable tray supports in this area are shown on drawings 48W1297-1 through 14 and are supported from embed types MK-1CT through MK-8CT shown on drawing 48N1225-9. The embeds used to support the cable trays in other areas of the auxiliary and control buildings are similar. The evaluation team reviewed the design calculations for 10 cable tray supports which imposed loading to the previously discussed embed plates. These supports were selected to include those with longer cantilever distance from the ceiling support and those with a larger number of attached cable trays to provides an envelope assessment of larger imposed moments. This review indicates that the embed plates and anchors are adequate to resist the forces and moments imposed during design seismic events.	SQN (N/A) WBN a. None required.

Issues	Findings	Corrective Actions
Element 224.2 - WBN (Continued)		
b. Cable tray supports should be assumed as pinned so moments are not developed at ceiling embedded plates.	b. The design of cable tray supports is adequate. Since the support members are welded to the embeds, the design assumption should not be changed from rigid to pin condition. Changing the assumption would require changing the actual welded connection to a bolted connection to eliminate the transfer of moments from the support to the embed. This is neither practical nor desirable because changing the connection from rigid to pin condition would require the addition of bracing members in both the longitudinal and transverse direction. That change would result in increased congestion and interference and in unnecessary cost.	b. None required.
c. Bevel full penetration welds should have been used in the support design instead of butt welds or fillet welds.	c. Per AWS D1.1, square butt welds and bevel penetration welds are interchangeable for material thickness up to 1/2-inch maximum. Both of these are classified as penetration welds and will provide the same strength for a given partial or full penetration depth. It is true that a fillet weld may provide less strength than a full or partial penetration weld. However, for material of smaller thicknesses, such as used for raceway supports, a fillet weld is adequate if properly designed to develop the design forces. Drawing series 47A056 indicates that the majority of the material used for design of conduit supports consists of steel tubing 3 inches x 3 inches or 4 inches x 4 inches with a wall thickness of 1/4 inch or 3/8 inch and of Unistrut material with a wall thickness of approximately 1/8 inch. The most commonly specified weld on the drawings is 3/16-inch or 1/4-inch fillet weld on all four sides of the tube or, where necessary, a fillet weld on two sides with a partial or full penetration butt weld on the other sides. Considering the size of the member and the maximum load anticipated at the connection consistent with overall support configuration, the evaluation team finds that the weld specified by design is sufficient to meet the design requirements.	c. None required.
BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)

Issues	Findings	Corrective Actions
********** Element 224.3 - Raceway Layout **********		
SQN (N/A) WBN	SQN (N/A) WBN	SQN (N/A) WBN
a. Conduits do not have adequate support design because the number of support types for supporting multiple conduits on a common support is insufficient. Further, too many single conduit supports are therefore used in the auxiliary and reactor buildings.	a. The issue that conduits do not have adequate support designs because not enough multiple supports are provided is not valid. Multiple conduit support designs are shown on numerous drawings (drawing series 47A056). Some conduit runs occupy common area with other conduits; however, they do not necessarily serve the same equipment, and these conduit runs do not necessarily lend themselves to common routing and common supports. Thus, the use of single conduit supports is frequently necessitated by plant layout. This usage is necessary even though a sufficient number of multiple conduit support types may be available. The evaluation team made a general walkdown of the plant on 03/26/86 as recorded in BLI-006 (04/08/86). It was observed that the multiple conduit supports were used, whenever feasible, in the auxiliary and control buildings.	a. None required.
b. Conduit routing was poorly planned by engineering. As a result, conduits require too many supports and are poorly located. An example of this occurs in accumulator room 2.	b. Based on a review of the planning and installation process of conduit run and support system, the conduit routing and number of supports are adequate. The Division of Nuclear Engineering (DNE) is responsible for designing typical conduit supports, defining schematic conduit routing (e.g., routing from point A to point B), and providing guidelines and criteria for detailed conduit routing and conduit support selection to the Division of Nuclear Construction (DNC). The DNC is responsible for determining detailed conduit routing and selecting the appropriate conduit supports. DNC responsibility also includes providing the most economical conduit and conduit support configuration.	b. None required.

Issues	Findings	Corrective Actions
Element 224.3 - WBN (Continued)		
c. Peripheral finding.	c. In addition, the evaluation team noted that design criteria for conduit supports are specified in FSAR Section 3.10.3 and TVA Design Criteria WB-DC-40-31.10, Rev. 3, "Seismically Qualifying Conduit Supports." The review results indicated that the damping values specified for the conduit support design are different in these documents. The FSAR states: ".1 percent damping for OBE and 2.0 percent damping." (Incomplete sentence.) On the other hand, the design criteria state: "2 percent damping is assumed for both the OBE and SSE." Design criteria also do not require the conduit support evaluation for OBE.	c. TVA transmittal TCAB-255 (03/11/87) submits corrective action plan (CAP) which will correct the disagreement between the damping values as shown in FSAR Section 3.10.3 and Design Criteria WB-DC-40-31.10, Rev. 3. TVA DNE will revise the criteria and FSAR as required and ensure that they agree with each other. Any FSAR change will be preceded by a letter to the NRC requesting the change. The change will be initiated after NRC concurrence is obtained. In addition, TVA DNE will evaluate the OBE load condition or justify the basis for its exclusion in the above design criteria. The evaluation team concludes that the stated CAP is an acceptable resolution of the finding. (CATD 224 03 WBN 01)
BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)

Issues	Findings	Corrective Actions
********** Element 224.5 - Support of Cables **********		
SQN	SQN	SQN
a. The non-supported Flamastic-covered cable in the spreading room that penetrates walls and ceiling may not be seismically safe.	a. Based on several walkdowns and subsequent evaluations performed by the evaluation team on the laterally unsupported Flamestic-covered vertical cables in the cable spreading room, adequate vertical and horizontal cable restraint is provided to support the vertical cable runs under any design load. The shake table test report TR CEB N-1010 has been reviewed by the evaluation team with the conclusion that it adequately demonstrates the seismic qualification of the vertical unsupported and Flamastic covered cables in the spreading room. This conclusion is based on the fact that, during testing, the cables stayed within allowable conductor tensile load ratings with no loss of power or significant current fluctuation on the instrumented cables. The evaluation team also performed a structural calculation, Rev. 0 (09/09/86), on a representative cable configuration to corroborate the above conclusion. This calculation confirms the above conclusion of seismic qualification.	a. None required.
WBN (N/A) BFN (N/A) BLN (N/A)	WBN (N/A) BFN (N/A) BLN (N/A)	WBN (N/A) BFN (N/A) BLN (N/A)

Issues	Findings	Corrective Actions
********** Element 224.7 - Conduit Expansion/Movement **********		
SQN (N/A) WBN (N/A) BFN (N/A) BLN	SQN (N/A) WBN (N/A) BFN (N/A) BLN	SQN (N/A) WBN (N/A) BFN (N/A) BLN
a. Differential movements between structural elements of unit 1 Reactor Building are not provided for in the design of electrical conduits.	a. General Construction Specification G-40 states that flexible conduit shall be used to interface the rigid conduit system with electrical equipment when they are subject to relative movements due to either thermal or seismic loading. In addition, drawing 5RWU816-RU-9, Rev. 17 explicity requires the use of flexible conduit to prevent rigid attachments between the primary containment and either the secondary containment or the containment internal structures. On the basis of an evaluation of requirements for considering differential movement affecting electrical conduits, adequate provisions for differential movement are employed by BLN to prevent any adverse impact. Walkdowns conducted by the evaluation team confirmed the proper use of flexible conduits at expansion/contraction joints between adjacent structures to prevent damage to conduit resulting from differential movements.	a. None required.

Issues	Findings	Corrective Actions
********** Element 224.9 - ERCW Pump Electrical Motor Boxes **********		
SQN	SQN	SQN
(N/A)	(N/A)	(N/A)
WBN	WBN	WBN
(N/A)	(N/A)	(N/A)
BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
a. The lack of seismic analysis and mounting details for the electrical motor boxes attached to the essential raw cooling water (ERCW) pump motors is an oversight by manufacturer and Engineering.	a. The concerned ERCW pump electrical motor boxes are thermal junction boxes. There are four ERCW pump motors for each unit and one thermal junction box for each motor. On the basis of a GE letter to TVA (07/17/85), the ERCW pump electrical motor boxes (thermal junction boxes) are not considered critical to the operation of the motors. While the boxes do monitor temperature conditions, the motors will continue to operate without them. Therefore, the boxes are not normally addressed in the seismic qualification report. TVA OE calculation CEB-CAS-179, Rev. 0, "Qualification of Electrical Box on ERCW Pump Motors," has been reviewed by the evaluation team with the conclusion that the ERCW pump electrical motor boxes and mounting installation are seismically adequate and require no additional support to remain qualified seismic Category I(L). The structural calculation, Rev. 0 (06/18/87), performed by the evaluation team confirmed the conclusion of seismic qualification.	a. None required.

ATTACHMENT C

REFERENCES

1. Sequoyah Element Report 224.5, "Support of Cables," Rev. 0, (09/29/86)

2. WBN Design Criteria WB-DC-20-21.1, "Design Criteria for Category I Cable Tray Supports," Rev. 2

3. WBN Design Criteria WB-DC-40-31.10, "Seismically Qualifying Conduit Supports," Rev. 3

4. WBN DNE Calculation WCG-2-28, "Auxiliary Building Cable Tray Supports Below Elevation 757 Feet," Rev. 4, [B41 870116 953], (01/15/87)

5. WBN Drawing 47A056 Series, Seismic Category I Structures, Mechanical Category I Conduit Supports, (revision current as of 05/12/86)

6. TVA General Construction Specification G-40, "Installing Electrical Conduit Systems and Conduit Boxes," Rev. 9, [B42 851219 509], (01/15/86)

7. BLN Drawing 5RW0816-RU-9, "Conduit and Grounding, Floor Elevation 622.0, Details," Rev. 17

8. BLN OE Calculation CEB-CAS-179, "Qualification of Electrical Box on ERCW Pump Motors," Rev. 0 [B41 860206 003], (02/06/86)

9. WBN FSAR through Amendment 56, Section 3.10.3, "Methods and Procedures of Analysis or Testing of Supports of Electrical Equipment and Instrumentation"

10. Letter from G. L. Parkinson, Bechtel, to G. R. McNutt, TVA, transmitting 04/15-16/87 SQN site visit trip report for walkdowns performed in control room and cable spreading room, and also a copy of evaluation team calculation 224.5(B)-1, Rev. 0, BLT-197, (04/27/87)

11. TVA informal memo from T. C. Cruise to C. N. Johnson of Sequoyah on the subject of employee concerns of Sequoyah element 224.5, with attached Preliminary Summary Test Report TR-CEB-N-1010, (07/18/86)

12. BLN Drawing 5RW0816-RU-13, "Conduit and Grounding Floor Elevation 622.0, Details," Rev. 10

13. BLN FSAR through Amendment 27, Figure 3.8.3-4, "Reactor Building Walls and Base Slab-Reinforcing, TVA Drawing No. 4RW0751-X1-6R3"

14. Letter from K. Kool, General Electric, to C. A. Chandley, TVA. Subject: "Stator Winding Thermal Junction Box," [B44 850723 502], (07/17/85)