

TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM

REPORT NUMBER: 24200

REPORT TYPE: SUBCATEGORY REPORT FOR  
ENGINEERING

REVISION NUMBER: 2

TITLE: ELECTRICAL SEPARATION

Page 1 of 17

REASON FOR REVISION:

1. Revised to incorporate initial SRP and TAS comments, and latest element evaluation status.
2. Revised to incorporate SRP and TAS comments and to add Attachment C.

PREPARATION

PREPARED BY:

*[Signature]*  
SIGNATURE

*[Initials]*

10/6/87  
DATE

REVIEWS

PEER: REVIEW COMMITTEE:

*[Signature]*  
SIGNATURE

10-6-87  
DATE

TAS:

*[Signature]*  
SIGNATURE

10-22-87  
DATE

CONCURRENCES

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE

CEG-H: *[Signature]* 10-18-87  
DATE

SRP: *[Signature]* 10-23-87  
SIGNATURE\* DATE

APPROVED BY:

*[Signature]* 10/26/87  
ECSP MANAGER DATE

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

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

---

EXECUTIVE SUMMARY

This subcategory report summarizes and evaluates the results of the element evaluations prepared under the Engineering Subcategory 24200, Electrical Separation. The element evaluations document the 16 issues applicable to TVA's four nuclear plants, Sequoyah, Watts Bar, Browns Ferry, and Bellefonte. The issues were derived from seven employee concerns that cited presumed electrical separation deficiencies or inadequacies in the design and installation of electrical equipment, cables/wires, and components.

Of the 16 issues reviewed, 10 were found to require no corrective action. Findings that required corrective actions were identified for the the six remaining issues.

Although some weaknesses were identified in the application of the separation criteria, which resulted in nonconformances, and in the completeness of the design basis for separation, the evaluation did not substantiate these as a generic problem for any of the four nuclear plants.

All corrective actions for the subcategory were judged to be significant from a plant safety standpoint. The nonconformances identified could result in a potentially unsafe condition caused by a common event, such as fire, that might affect redundant safety components. In turn, incomplete design basis documents resulted in few instances where full compliance with various licensing commitments, such as single failure criteria and independence requirements, could not be verified.

The corrective actions include requirements for hardware modifications as the result of the nonconformances, the evaluation and analysis of design for generic applicability of these nonconformances, and the revision of various documents, including licensing and design basis documents.

The number of nonconformances identified was limited and random in nature, and no systematic pattern could be established. No specific nonconformances with licensing commitments were identified as the result of the incomplete design basis documents, although a small number of potential nonconformances were observed. Implementation of the corrective actions in this report should resolve the problems identified.

Completion of the Design Baseline and Verification Program established by a Nuclear Performance Plan (NPP) will help to correct programmatic and management deficiencies and to prevent future design basis problems. The establishment of the Corporate Commitment Tracking System by the NPP will ensure timely and complete incorporation of commitments into the design basis.

CONTENTS

<u>Section</u>	<u>Page</u>
Executive Summary	ES-1
Preface	i
ECSP Glossary of Report Terms	iii
Acronyms	v
1 Introduction	3
2 Summary of Issues/Generic Applicability	4
3 Evaluation Process	4
4 Findings	6
5 Corrective Actions	7
6 Causes	8
7 Collective Significance	9
Glossary Supplement for the Engineering Category	15
 <u>Attachments</u>	
A Employee Concerns for Subcategory 24200	A-1
B Summary of Issues, Findings, and Corrective Actions for Subcategory 24200	B-1
C References	C-1

TABLES

<u>Table</u>	<u>Page</u>
1 Classification of Findings and Corrective Actions	11
2 Findings Summary	12
3 Matrix of Elements, Corrective Actions, and Causes	13

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

HISTORY OF REVISION

<b>REV NUMBER</b>	<b>PAGES REVISED</b>	<b>REASON FOR CURRENT REVISION</b>
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
CMTB	Certified Material Test Report
COC	Certificate of Conformance/Compliance
DCR	Design Change Request
DNC	Division of Nuclear Construction (see also NU CON)

**TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM**

**REPORT NUMBER: 24200**

**FRONT MATTER REV: 2**

**PAGE vi OF viii**

---

**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

**TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM**

**REPORT NUMBER: 24200**

**FRONT MATTER REV: 2**

**PAGE vii OF viii**

---

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

**TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM**

**REPORT NUMBER: 24200**

**FRONT MATTER REV: 2**

**PAGE viii OF viii**

---

**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**  
**IVA**      **Tennessee Valley Authority**  
**TVILC**    **Tennessee Valley Trades and Labor Council**  
**UT**        **Ultrasonic Testing**  
**VI**        **Visual Testing**  
**WBECS**    **Watts Bar Employee Concern Special Program**  
**WBN**      **Watts Bar Nuclear Plant**  
**WR**        **Work Request or Work Rules**  
**WP**        **Workplans**

## 1. INTRODUCTION

This report summarizes and evaluates the results of the ECSP element evaluations prepared under Engineering Subcategory 24200, Electrical Separation. The element evaluations document the review of 16 issues (four per plant) related to TVA's four nuclear plant sites: Sequoyah (SQN), Watts Bar (WBN), Browns Ferry (BFN), and Bellefonte (BLN). The issues were derived from seven employee concerns which cited presumed electrical separation deficiencies or inadequacies in the design and installation of electrical equipment, cables/wires, and components.

The 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 shown.

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

- o Section 2 -- summarizes, by element, the issues stated or implied in the employee concerns and addresses determination of generic applicability
- o Section 3 -- outlines the process followed for the element and subcategory evaluations and cites documents reviewed
- o Section 4 -- summarizes, by element, the findings and identifies the negative findings that must be resolved
- o 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
- o Section 6 -- identifies causes of the negative findings
- o Section 7 -- assesses the significance of the negative findings
- o 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
- o 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

- o Attachment C -- contains the references cited in the text

## 2. SUMMARY OF ISSUES/GENERIC APPLICABILITY

The employee concerns listed in Attachment A have been examined for all four plant sites. The seven concerns raised have been identified as 16 separate issues, four issues per plant. The issues are common to each of the four plants, and hence are common to each of the four element evaluations. The issues, which are reviewed in the four element evaluations, are summarized as follows:

242.0, Inadequate Electrical and Physical Separation - Electrical and physical separation for redundant wiring, cable, components, and equipment is inadequate.

The issues, which deal with presumed physical separation deficiencies or inadequacies in the design and installation of electrical cable/wiring, also claim that procedures were violated (such as inadequate separation of Q and non-Q cables in trays) and suggest that these separation deficiencies result in improper installation of cable tray covers and in overfilled cable trays.

As the following sections show, the issues were found to be valid to the extent that a limited number of nonconformances with design criteria requirements and licensing commitments, specifically for minimum spacial separation requirements (e.g., redundant cable trays), were identified for all four plants. Similarly, all four plants require revision of the design criteria addressing separation to satisfy or clarify commitments to licensing requirements. As a result of these findings, corrective actions are required at all four plants.

Each issue reviewed within the element evaluations 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 that address the specific employee concerns related to the issues broadly defined in Section 2. The evaluation process consisted of the following steps:

- a. Defined the issues from the employee concerns.

- b. Reviewed for each plant applicable sections of the Final Safety Analysis Report (FSAR), Safety Evaluation Report (SER), and SER Supplements (Refs. 53 through 58) to understand scope and basis of NRC review, to determine the extent of regulatory compliance, and to identify any open issues or TVA commitments related to the design.
- c. Reviewed regulatory requirements (Ref. 3), industry standards (Refs. 4, 5, and 6), and TVA criteria documents (Refs. 7 through 17 and 108 through 112) related to the issues to develop an understanding of the design basis.
- d. Reviewed applicable design documents (Refs. 18 through 37) and conducted facility walkdowns (Refs. 38 through 52) to develop design understanding and to verify implementation status and compliance with licensing commitments/design requirements.
- e. Reviewed other documents applicable to the issues and determined to be needed for the evaluation, such as correspondence (Refs. 59 through 96), transcripts of interviews (Ref. 97), procedures (Ref. 98), condition adverse to quality reports (NCRs, SCR, PIRs, and CAQRs) (Refs. 99 through 104), and evaluation reports (Refs. 105, 106, and 107).
- f. Using the results from steps a through e above, reviewed the issues for each element and documented the findings in element evaluations.
- g. Tabulated the 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/or unique issues, findings, and corrective actions among the four plants.
- i. Classified the findings and corrective actions from the element evaluations using the definitions in Table 1.
- j. On the basis of ECSP guidelines, analyzed the collective significance and causes 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. Reviewed the Nuclear Performance Plan (NPP, Ref. 2) to determine whether the resolution of possible programmatic and management deficiencies that resulted in problems identified during the evaluation will be covered under the plan.

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

#### 4. FINDINGS

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

A summary of the findings is presented below:

242.0, Inadequate Electrical and Physical Separation - Regarding the general issue of electrical and physical separation inadequacy, specific cases of nonconformances with licensing commitments or design criteria requirements were identified for all plants. Such nonconformances include redundant raceways not meeting minimum separation requirements (spatial, missing tray covers, or improper installation of tray covers) at WBN, SQN, and BFN; internal separation of wiring or components not meeting minimum separation requirements (spatial and missing barriers) at WBN and BFN; class 1E cables incorrectly routed in nonclass 1E conduits or not meeting separation requirements at BFN; redundant instrument air tubing not meeting minimum separation requirements at BLN; and other nonconformances either internally identified by TVA at WBN and BFN, or identified as violations by the NRC at BFN.

In addition, instances were identified where inconsistencies existed between licensing commitments and the design criteria and where the design criteria requirements were unclear or incomplete to demonstrate compliance with licensing requirements. Such instances include certain aspects of the separation of cables in free air, internal separation (including adequacy of barriers), raceway separation, and electrical isolation.

These findings were judged to be significant from a plant safety point of view because the nonconformances identified could result in a potentially unsafe condition caused by a common event, such as a fire, that may affect redundant safety components.

No instances were identified where procedures were intentionally ignored. The limited cases of nonconformance previously described cannot be construed as a systematic violation of procedures. The specific issue about Q and non-Q cables routed in common trays could not be substantiated as a violation of procedures. Design criteria and licensing commitments allow this kind of configuration. The limitation for installation of non-Q cables is that, once they are routed in class 1E cable trays with Q cables of one division, they can not be routed in trays containing cables of the redundant division. However, a violation was identified at BFN where class 1E cables were routed in a nonclass 1E conduit. The issues of raised covers and overfilled trays causing separation deficiencies could not be substantiated, although cases of



improper installation of cable tray covers were identified at BFN. Raised covers are acceptable, if adequate separation is maintained, and overfills are not the result of improper separation.

In summary, although corrective actions require some modifications to documentation and physical installation, in the judgment of the evaluation team, the current overall design and installations generally comply with the separation criteria.

The classified findings are summarized in Table 1. Class A and B findings indicate that there is no problem and that corrective action is not required. Class C, D, and E findings require corrective action. 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. Where more than one corrective action is identified in Table 1 for a single finding (e.g., Element 242.0, Finding "a"), Table 2 counts only a single classification, with class D classification given preference over the C if both are used. Thus, Table 2 identifies one finding for each issue evaluated. Of the 16 findings identified by a classification in Table 1, ten require no corrective action. The remaining six require corrective actions to resolve the identified problems. From this table, it can be seen that at Watts Bar, where most of the issues originated, one out of four issues was found to be valid and to require corrective action. At Browns Ferry, three of four issues are valid. At Sequoyah and Bellefonte, one of four issues is valid. No peripheral findings were identified.

##### 5. CORRECTIVE ACTIONS

Table 2 identifies six issues that require corrective action. The corrective actions, along with their findings/corrective action classifications, are summarized in Table 3. The corrective action descriptions in the table are a condensation of the more-detailed corrective action information provided in Attachment B. Table 3 indicates the plant or plants to which a corrective action is applicable in the Corrective Action Tracking Document (CATD) column, where the applicable plant is identified by the CATD number.

Corrective actions to resolve the negative findings may be combined into two major groups. One of them deals with the resolution of identified nonconformances, the second one addresses adequacy of the design criteria and conformance to licensing commitments. The corrective actions involve - singly or in combination - evaluation, hardware modification, and document revision. A condensation of this information applicable to all plants is presented in the following paragraphs.

The first group of corrective actions, to resolve conditions where design output documents and/or physical installations do not conform with licensing requirements or design criteria, will consist of modification or justification/analysis to satisfy the requirements. In other cases, evaluations will be performed and corrective action will be taken as required to assure raceway installations and internal wiring meet the established separation criteria. A similar approach is applicable for corrective action required for conditions either identified before the evaluation team's involvement (class 1E cables routed in non-Q conduits, and NRC-identified conditions at BFN, and separation of redundant instrument air tubing not meeting the separation criteria at BLN) or where existing corrective action will cover specific items identified by the evaluation team (internal separation not meeting the separation-criteria at BFN).

The second group of corrective actions will ensure that the design basis documents include the commitments and that these commitments are properly reflected in the design output documents and actual installation. This will require an evaluation of commitments/requirements (C/Rs), design criteria, the FSAR, and design output documents associated with electrical equipment and raceway separations. The design criteria will be revised if they are found to be incomplete, do not reflect C/Rs, contain discrepancies with other documents, or simply need clarification. As a result of these activities, analyses, inspections, or modifications may be required, although no specific separation conditions were identified that do not conform with licensing commitments, such as divisional separation of cables in free air; internal separation in class 1E control boards, panels, and relay racks; and electrical isolation. (A few areas that may require corrective action were observed, such as some redundant cables in free air in close proximity to each other, or a vertical and a redundant horizontal tray located less than 3 feet from each other. These areas are considered potential, because the corrective action, if any, can be established only after the applicable separation requirements in the design basis are defined.) However, such additions to design criteria requirements must primarily keep future modification in mind.

The evaluation team finds the corrective action plans acceptable to resolve the findings.

## 6. CAUSES

Table 3 identifies the cause for each negative finding requiring corrective action. The causes are diverse, but are all related to the effectiveness of management and of the design process.

Seven causes for the identified nonconformances, which resulted in some installations not meeting design criteria or licensing commitment requirements, are in the management effectiveness area and are related to procedures (separation criteria) not being followed. The remaining four causes are in the design process effectiveness area. Two of these causes are related to inadequate design bases and are reflected in the incompleteness of the separation design criteria. The two other causes can be considered isolated occurrences, and were identified at BFN only. One of these causes, lack of engineering judgment documentation, concerns Engineering's failure to provide justification for a corrected nonconformance. The other cause, design commitment not met, concerned an instance where the design failed to satisfy commitments made to the NRC.

The fact that design basis documents did not completely follow or reflect the licensing commitments and requirements regarding separation; particularly for cables in free air, interfacing of horizontal and vertical trays, panel internal wiring; shows lack of management and design process effectiveness in this area.

Other than the identified deficiencies, the overall separation program appears to be adequate. The nonconformances could have been identified earlier, or even prevented by earlier management awareness of the need for ensuring compliance with design basis documents associated with separation.

TVA has developed a Nuclear Performance Plan (NPP), to correct programmatic and management deficiencies. The consolidated nuclear organization should assure centralized direction, clear lines of responsibility, and delegated authority. TVA has also developed three plant-specific NPPs to provide a complete account of the actions it is taking to improve its nuclear program. As indicated in the corporate NPP, TVA will have multidiscipline teams to investigate and resolve engineering issues. The completion of the Design Baseline and Verification Program established by the NPP will help to prevent such design basis problems as discussed above, and the independent oversight reviews being performed by Engineering Assurance will provide feedback to DNE management on performance and, thus, provide closer control of the design process. The strengthening of the licensing process and the establishment of the Corporate Commitment Tracking System by the NPP will ensure timely and complete incorporation of commitments into the design basis.

#### 7. COLLECTIVE SIGNIFICANCE

As can be seen from the significance columns of Table 3, all corrective actions for this subcategory are judged to be significant because installation nonconformances could result in a potentially unsafe condition from a common event, such as fire, that may affect redundant safety components. Although the identified nonconformances could have an effect on safety-related cable systems, their limited number cannot be considered uncommon for nuclear

projects. Furthermore, the identified nonconformances were random in nature, and no systematic pattern could be detected that would indicate a more generalized problem in the separation program. Incomplete design basis documents or inconsistencies between these documents and licensing commitments could result in error in the separation design; however, no specific nonconformances with licensing commitments were identified (a very small number of potential nonconformances were observed).

On the basis of these observations and in spite of some weaknesses and problems identified that validate the employee concerns, the overall physical and electrical separation design appears to be adequate and does not constitute a generic problem for any of the four nuclear plants. Furthermore, implementation of the corrective actions, which include actual and potential hardware modification, evaluation, review for generic applicability, and revision of design criteria and licensing documents, should resolve the problems identified during the evaluation and any other problems that may be uncovered during the implementation of corrective actions.

A significant portion of the identified deficiencies were attributable to inadequate procedures and inadequate design basis documents as addressed and analyzed in Subcategory Report 24500.

The results of this subcategory evaluation are being combined with the other subcategory evaluations and reassessed for the engineering category report.

TABLE 1  
CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

Element	Issue/ Finding**	Finding/Corrective Action Class*			
		SQN	WBN	BFN	BLN
242.0 Inadequate Electrical and Physical Separation between Redundant and between Q and non-Q Wiring, Cabling, Equipment, and Components	a	D1	D6	C1	C1
		D6	-	C6	D3
	b	-	-	D6	-
		A	A	D3	A
	c	-	-	D6	-
		A	A	A	A
	d	A	A	D6	A

\*Classification of Findings and Corrective Actions

- |  |   |
|--|---|
| <p>A. Issue not valid.<br/>No corrective action required.</p> <p>B. Issue valid but consequences acceptable.<br/>No corrective action required.</p> <p>C. Issue valid. Corrective action<br/>initiated before ECTG evaluation.</p> <p>D. Issue valid. Corrective action<br/>taken as a result of ECTG evaluation.</p> <p>E. Peripheral issue uncovered during ECTG<br/>evaluation. Corrective action required.</p> | <p>1. Hardware</p> <p>2. Procedure</p> <p>3. Documentation</p> <p>4. Training</p> <p>5. Analysis</p> <p>6. Evaluation</p> <p>7. Other</p> |
|--|---|

\*\*Defined for each plant in Attachment B.

TABLE 2  
FINDINGS SUMMARY

<u>Classification of Findings</u>	<u>Plant</u>				<u>Total</u>
	<u>SQN</u>	<u>WBN</u>	<u>BFN</u>	<u>BLN</u>	
A. Issue not valid. No corrective action required.	3	3	1	3	10
B. Issue valid but consequences acceptable. No corrective action required.	0	0	0	0	0
C. Issue valid. Corrective action initiated before ECTG evaluation.	0	0	0	0	0
D. Issue valid. Corrective action taken as a result of ECTG evaluation.	1	1	3	1	6
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.	0	0	0	0	0
<b>Total</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>16</b>

TABLE J  
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES  
SUBCATEGORY 24200

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CATD	CAUSES OF NEGATIVE FINDINGS *																	Signifi- cance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS						DESIG. PROCESS EFFECTIVENESS						TECHNICAL ADEQUACY							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
				Frag- men- ted Orga- niza- tion	Inade- quate Trng	Inade- quate Q- dures	Proce- dures Not Fol- lowed	Inade- quate Com- muni- cation	Un- timely Res of Issues	Lack of Mgt Atten	Inade- quate Design Bases	Inade- quate As-bit Calcs	Inade- quate Recon- cil.	Lack of Detail	Engry Judgmt not Docu- mented	Design Crit/ Not Met	Insuf. Verif Docu- menta- tion	Stds Not Fol- lowed	Engrg Error	Vendor Error			
																		D	M	H			
242.0	D1	Correct specific physical and electrical separation nonconformances identified during the evaluation team's walkdown to satisfy design criteria requirements.	SQN 03				X													A	-	A	
	D6	Determine generic applicability of separation nonconformances identified during the evaluation team's walkdowns, and correct as needed.	SQN 03				X													P	-	P	
	D6	Correct separation nonconformances identified during the evaluation team's walkdowns by performing generic applicability reviews.	WBN 04				X													P	-	P	
	D6	Evaluate separation nonconformances identified during the evaluation team's walkdown through inspections and generic applicability reviews, and determine and initiate corrective actions as needed.	BFN 03				X													P	-	P	
	C6	Generic BF-CAR-86-0259 will also address and correct internal separation nonconformances identified during the evaluation team's walkdown to satisfy design criteria requirements.	BFN 02				X													P	-	P	
	C1	Implement ECNs P-0753 and P-0822 to satisfy an NRC violation notice.	BFN 04															X			A	-	A

\* Defined in the Glossary Supplement.

\*\* Defined in Table 1.

TABLE 3  
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES  
SUBCATEGORY 24200

FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CAID	CAUSES OF NEGATIVE FINDINGS*																	Signifi- cance of Corrective Actions*	
			MANAGEMENT EFFECTIVENESS					DESIGN PROCESS EFFECTIVENESS								TECHNICAL ADEQUACY					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
			Frag- mented Organ- iza- tion	inade- quate Q- trng	inade- quate Proce- dures	Proce- dures Not Fol- lowed	inade- quate Cor- muni- cation	Un- timely Res of Issues	Lack of Mgt Atten	Inade- quate Design Bases	Inade- quate Calc	Inade- quate Recon- cil.	Lack of Design Detail	Engrg Judgmt not Docu- mented	Design Crit/Commit Not Met	Insuf. Verif Docu- menta- tion	Stds Not Fol- lowed	Engrg Error	Vendo- Error		
D6	Review separation design basis to verify that no discrepancies exist with pertinent licensing commitments and that all commitments have been included in the FSAR, in the design basis and criteria, in the design documents, and in the actual installation. Corrective actions will be performed (modifications or justification analyses) as needed to correct identified deficiencies and to clarify design criteria requirements.	SQM 01								X								P	-	P	
		SQM 02																			
		SQM 04																			
		WBN 01																			
D3	Justify the change of conduit designation from non-class IE to class IE.	WBN 03																			
		BFN 01																			
D3	Justify the change of conduit designation from non-class IE to class IE.	BFN 04										X						A	-	-	
D6	Perform review to determine if other class IE cables have been routed in nonclass IE conduits (N conduits)	BFA 04				X												P	-	P	
C1	Correct instrument air tubing separation nonconformances identified by TWA to satisfy design criteria requirements.	BLN 01				X												A	-	A	
D3	Revise design criteria to either clarify design requirements or to document licensing commitments.	BLN 02								X								A	-	-	
TOTALS						7				2			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:

- o 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.
- o 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.
- o 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 24200

Attachment A -- lists, by element, each employee concern evaluated in the subcategory. The concern's confidential 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 characterized as safety related, not safety related, or safety significant.

## ATTACHMENT A

## EMPLOYEE CONCERNS FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
PAGE A-2 OF 2

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION*
			SQN	WBN	BFN	BLN	
242.0	WI-85-100-004	WBN	X	X	X	X	"Electrical separation and physical separation of redundant wiring and cabling and for equipment and components are inadequate at all plants. CI expressed that detailed reviews need to be made, and are so extensive that a consultant probably should be used, providing independence from TVA." (SR)
	XX-85-122-011	SQN	X	X	X	X	"Electrical separation and physical separation of redundant wiring and cabling and for equipment and components are inadequate at all plants. CI expressed that detailed reviews need to be made, and are so extensive that a consultant probably should be used, providing independence from TVA." (SR)
	XX-85-122-012	BLN	X	X	X	X	"Electrical separation and physical separation of redundant wiring and cabling and for equipment and components are inadequate at all plants. CI expressed that detailed reviews need to be made, and are so extensive that a consultant probably should be used, providing independence from TVA." (SR)
	XX-85-122-013	BFN	X	X	X	X	"Electrical separation and physical separation of redundant wiring and cabling and for equipment and components are inadequate at all plants. CI expressed that detailed reviews need to be made, and are so extensive that a consultant probably should be used, providing independence from TVA." (SR)
	IN-86-254-004	WBN	X	X	X	X	"CI believes procedures are being violated (in general) when Q and non-Q electrical cables are not being separated in cable trays. This includes low, medium, and high voltage cables. By not separating the cables, the trays are being overloaded." (SR)
	IN-86-259-006	WBN	X	X	X	X	"Many electrical cables have been placed in cable trays without adequate separation. Many cable tray covers extend 3 to 4 inches above the tray because of cable arrangement." (SR)
	IN-86-314-004	WBN	X	X	X	X	"Cable separation is inadequate and in many cases nonexistent." (SR)

\* 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 24200

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.

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-2 of 16

Issues	Findings	Corrective Actions
<p>***** Element 242.0 - Inadequate Electrical and Physical Separation ***** (between wiring, cabling, equipment and components)</p>	<p align="center">SQN</p> <p>a. SQN is committed to comply with IEEE Standards 279-1971 (Ref. 5) and 308-1971 (Ref. 4) for independence and redundancy, but not committed to Regulatory Guide 1.75-1974 or 1978 (Ref. 3), or to IEEE Standard 384-1974 (Ref. 6).</p> <p>Electrical separation and isolation commitments on C/R data sheets (Refs. 108 through 112) have not been reflected in the separation design criteria (Ref. 8).</p>	<p align="center">SQN</p> <p>a. None required.</p> <p>TVA committed to review all commitments/requirements (C/Rs) in the design bases in C/R Analysis Report 039, "Electrical Separation," to determine if the C/Rs must be addressed before or after restart. TVA indicated that no action will be taken before restart if the C/R is addressed in the design criteria, design output document, construction requirement/procedure, or through verification of physical installation or analysis.</p> <p>If the C/R has not been addressed, any required analysis, inspections, or modifications to ensure compliance will be done before restart.</p> <p>TVA also stated that any required changes to design criteria or design output documents will be made after restart unless the changes support modifications that are required for restart.</p> <p>Furthermore, TVA will implement the appropriate measures to ensure that the effect of any C/Rs which are not adequately covered in design criteria or design output document will be addressed in all ECNs in the interim before the design criteria and design output document are updated.</p> <p>A CAQ will be generated for any deficiencies identified. Completion is scheduled for 03/15/87. (CATO 242 00 SQN 01)</p>

Issues

Findings

Corrective Actions

Element 242.0 - SQM (Continued)

Separation of redundant cables in free air appears to satisfy the design intent as approved by the NRC in the Safety Evaluation Report (SER) (Ref. 5, para. 8.5.3). No criteria could be found for separation of cables in free air except for those in the cable spreading room.

The NSRS conclusion (Ref. 107) that divisionalized cable trays are adequately separated in compliance with design criteria was confirmed by walkdowns by the evaluation team, with two minor exceptions where cable tray covers should have been installed but were not.

TVA committed that the same process outlined in the corrective action for CATD 242 00 SQM 01 above will be followed to ensure that any commitment for separation in free air, or a more general commitment to keep adequate independence to satisfy the single failure criterion requirement is met. (The following is a generic statement of the single failure criterion: The system shall be capable of performing the protective actions required to accomplish a protective function in the presence of any single detectable failure within the system concurrent with all identifiable, but nondetectable failures, all failures occurring as a result of the single failure, and all failures which would be caused by the design basis event requiring the protective function.) This review will be completed before restart. CAQS will be generated as needed if deficiencies are found. Completion is scheduled for 03/15/87. (CATD 242 00 SQM 02)

Problem Identification Report (PIR) SQNEEB86175 has been generated to identify and document the specific separation problem between cable trays of Channels I, II, III, and IV. An engineering change notice will be generated to install the tray covers and bottoms on these cable trays to satisfy the separation criteria. PIR SQN EEB86175, R1, addressing a generic discrepancy between the design criteria and the 45N880 series drawings resulted in a revision to these drawings that eliminated the discrepancy.

TVA also indicated that the complete 45N880 series drawings were thoroughly studied and walkdowns performed as needed to determine the extent of this potentially generic problem. This covered all areas of the plant that had cable trays installed except the area inside the steel containment of the reactor building (these trays are non-class 1E).



Issues

Findings

Corrective Actions

Element 242.0 - SQM (Continued)

In addition, TVA performed a field walkdown in all areas where there was a question of train or channel interaction (separation, crossing, etc.), a question of barriers, or where there was a lack of dimensioning on the drawings. The walkdowns revealed that no other cases exist where covers have not been installed per design criteria and/or 45N880 drawings requirements.

In the course of the TVA field walkdown, it was found that trays (channel separation group) running vertically pass within 3 feet of trays (train separation group) running horizontally. This situation is not specifically addressed in the design criteria intent or the FSAR. As a result, TVA committed that the same process outlined in the corrective action described for CATD 242 00 SQM 01 above will be followed for all separation C/Rs. Implementation of this process will ensure that all commitments for separation between trays running horizontally and trays running vertically, or a more general commitment to keep adequate independence to satisfy the single failure criterion requirement, are properly addressed. CAQs will be generated as needed if deficiencies are found. Completion is scheduled for 03/15/87.  
(CATU 242 00 SQM 03)

Separation of internal wiring in specific Westinghouse-furnished control boards was confirmed, during walkdowns (Ref. 41), to comply with design criteria. However, no design criteria were found for wiring separation in other class 1E control boards, panels, and relay racks as committed in the FSAR (Ref. 55).

TVA indicated that the same process outlined in the corrective action for CATD 242 00 SQM 01 above will be followed for all separation C/Rs to ensure that all commitments for separation of internal wiring in class 1E control boards, panels, and relay racks are properly addressed. CAQs will be generated as needed if deficiencies are found. Completion is scheduled for 03/16/87.  
(CATU 242 00 SQM 04)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-5 of 16

Issues	Findings	Corrective Actions
<b>Element 242.0 - SQN (Continued)</b>		
	Although design criteria documents are silent in this area, separation of divisionalized and nondivisionalized cable trays appears to satisfy separation commitments as approved in the SER (Ref. 56, para. 8.5.3).	Although no specific requirement for corrective action was identified or committed to, the process outlined in corrective action for CATD 242 00 SQN 01 should also cover this aspect of the separation requirements as applicable.
b. Inadequate separation in trays of Q and non-Q cables for all voltage levels as a result of procedures being violated.	b. Lack of verification of the currently as-installed status of cables in raceways makes compliance to the design criteria and procedures indeterminate.	b. TVA committed to verify the as-installed status of cables in raceways. The corrective action plan is addressed in Subcategory Report 26600, SQN element 239.0. (CATDs 239 00 SQN 01 and 04)
c. Cable trays are overloaded as a result of inadequate separation.	c. Cable tray overloading is not a result of inadequate divisional separation. Overloading is a problem independent of divisional separation.	c. Cable tray overloading is addressed in Subcategory Report 26600, SQN elements 238.3 and 240.0.
d. Inadequate cable arrangement results in covers extending 3 to 4 inches above trays.	d. Raised tray covers are acceptable as long as they are properly installed and separation requirements are complied with. Furthermore, no evidence was found during the walkdowns (Refs. 42 and 44) to indicate that inadequate cable arrangement caused covers to extend above safety-related cable trays.	d. None required.
<b>WBN</b>	<b>WBN</b>	<b>WBN</b>
a. Electrical separation is inadequate. Review is required to assess electrical and physical separation adequacy of redundant wiring, cables, components as well as equipment.	a. Watts Bar is committed to comply with IEEE Standards 279-1971 and 308-1971 for independence and redundancy, but no specific commitments to Regulatory Guide 1.75-1974 or 1978, or to IEEE Standard 384-1974 for separation are identified in the FSAR. However, Watts Bar SER (Ref. 54) covers the approach at WBN to satisfy the intent of Regulatory Guide 1.75 and IEEE Standard 384 for the separation criteria between class 1E and non-class 1E circuits, and for associated circuits. Although the SER indicates that TVA has adequately demonstrated to the NRC compliance with the intent of the regulatory requirements for WBN, this has not been fully reflected in the FSAR (Ref. 53) and the design criteria (Ref. 7).	a. TVA committed to review and identify separation commitments and requirements contained in the FSAR, SER, and licensing commitments, and to ensure that the partial commitments to Regulatory Guide 1.75 and IEEE Standard 384 are included in design criteria and/or design output documents. Completion is scheduled for 10/01/87. (CATD 242 00 WBN 01)

Issues

Findings

Corrective Actions

Element 242.0 - MBN (Continued)

No specific commitments were identified in the FSAR and design criteria for redundant cable separation in free air except for those in the cable spreading room.

TVA indicated that although separation of cables in free air is not covered in Watts Bar Design Criteria WB-DC-30-4, TVA drawing 45W896-1, R4 (Watts Bar), provides partial details of free air separation requirements. TVA committed to ensure that all commitments for separation of cables in free air and/or a more general commitment to keep adequate independence to satisfy the single failure criterion will be reflected in design documents, with adequate justification being provided for exceptions. Additionally, the as-installed condition of cable in free air will be verified as necessary. Completion is scheduled before unit 1 fuel load.  
(CAIU 242 OU MBN 03)

The design criteria and the FSAR are not specific regarding separation between channel and train raceways.

TVA indicated that the design criteria do address separation of redundant cables in trays and conduits. Specifically, horizontal separation and vertical separation of the generating station protection system (GSPS) cables, which include channel and train separation, are covered. No further action is required.

The design criteria and the FSAR do not address separation of vertical from redundant horizontal trays. The walkdown performed by the evaluation team (Ref. 40) revealed that in the cable spreading room (elevation 741 feet), the horizontal distance between horizontal trays 3A135 and 3A166 and vertical tray 3B270 is less than 3 feet.

TVA indicated that although the Watts Bar design criteria address horizontal separation and vertical separation of GSPS cables, they do not address separation between redundant cables in trays running vertically from those in trays running horizontally. Therefore, TVA committed to review all C/Rs and licensing commitments and to revise the design criteria to ensure that all commitments for separation between redundant horizontal and vertical trays

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-7 of 16

Issues

Findings

Corrective Actions

Element 242.0 - WBN (Continued)

The design criteria do not address internal wiring separation. These requirements are covered in the Westinghouse specification for Westinghouse panels only and in the "Wiring Diagram for Control Boards Critical Wiring Braid Installation." Furthermore, the separation criteria address only barriers for raceway separation. Barriers and acceptable materials are not specified in the criteria for internal separation of redundant devices in panels. In addition, the evaluation team performed a walkdown (Ref. 39) on three Westinghouse panels (1-M-3, 1-M-4, and 1-M-6). The following observations were made:

or a more general commitment to keep adequate independence to satisfy the single failure criterion requirement are properly addressed. Accordingly, it will be determined whether an evaluation of the current design is necessary.

TVA also committed to generate CAQs for any deficiencies that are identified. Completion is scheduled before unit 1 fuel load.  
(CATU 242 00 WBN 03)

TVA committed to determine the separation requirements for redundant safety-related electrical equipment and components inside panels that involved the following:

- o Review watts Bar design criteria for similar commitments
- o Determine all internal separation requirements necessary to ensure independence between redundant equipment and wiring inside panels
- o Determine and document discrepancies between the FSAR, design criteria, and necessary requirements
- o Review design drawings for applicability of requirements
- o Determine and implement corrective action for identified deficiencies

Completion of corrective action is scheduled for 10/01/87.

(CATD 242 00 WBN 01)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page 8-8 of 16

Issues

Findings

Corrective Actions

Element 242.0 - WBN (Continued)

o In many instances in all three panels, nonmetallic sliding boards were used as separation barriers and were placed on the modules between the switches of different trains. No assessment by the evaluation team was made regarding the adequacy of this material for use as an acceptable barrier.

Review the FSAR for commitments to separate equipment and components inside panels or electrical enclosures. Also, TVA will provide a justification to why nonmetallic sliding boards (plastic type UTR barrier provided by Westinghouse) were used as separation barriers between redundant switches. Completion is schedule for 10/01/87.  
(CATD 242 00 WBN 01)

o Division and/or train wires are covered with metal braid in exposed panel areas. This covering is in agreement with the Westinghouse specification.

None required.

o Division and/or train wires are routed via metal enclosures to division and/or train risers located on opposite ends of the panel. This routing is in accordance with the design criteria and with WBN mechanical layout drawings.

None required.

Numerous noncompliances with the Watts Bar separation criteria were identified in an audit conducted prior to the evaluation team review. The summary of these findings was submitted to the NRC (Ref. 59). The findings were regarding equipment separation, internal wiring separation, raceway separation, and cable identification. As a result of these findings NCR W-31-P (Ref. 99) was issued. Although some of the noncompliances were resolved, the evaluation team could not identify all the documentation required to verify the resolution of all the items in the NCR. Closed NCR and samples taken by the evaluation team confirm that the sampled items have been satisfactorily resolved.

TVA established that all items of NCR W-31-P were completed based on the closure of the subject NCR. No further action is required.  
(CATU 242 00 WBN 02)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-9 of 16

Issues

Findings

Corrective Actions

Element 242.0 - WBN (Continued)

Electrical separation and isolation commitments in the FSAR have not been reflected in the separation design criteria. In addition, NCR W-31-P, which resulted from the audit discussed above, identified instances where the interlock circuit between trains A and B does not maintain the minimum air space, nor is there a metal barrier installed. Furthermore, the design of these circuits does not conform to the FSAR criteria for a train A circuit with an interlock from train B device.

Walkdowns by the evaluation team (Refs. 38 and 40) revealed that:

- o Tray 2B2227 crosses over trays 3A2221 and 3A2222 at column S. Tray 2B2227 has a top cover but no bottom cover. Also, trays 3A2199 and 3A2200 cross trays 3B2178 and 3B2226. Trays 3A2200 and 3A2199 both have solid bottom covers, but only one tray has a top cover. Trays 2B2178 and 3B2226 have top covers but no bottom covers.
- o In the cable spreading room (elevation 741 feet), the horizontal distance between trays 3B255 and 3A135, and between 3B297 and 3A166 is less than 3 feet. This is against the requirements of the design criteria.
- o At elevation 708 feet, coordinate C5-Q, in the auxiliary instrument room, the distance between conduit 1PV806E and the raised cover on redundant tray 2D1 is 1/2 inch (criteria require 1-inch minimum separation).

TVA committed to review and identify separation commitments and requirements contained in the FSAR, SER, and licensing commitments, and to ensure that the partial commitments to Regulatory Guide 1.75 and IEEE Standard 384 are included in design criteria and/or design output documents. Completion is scheduled for 10/01/87.  
(CATD 242 00 WBN 01)

None required.

TVA established that these items are in full compliance with Watts Bar separation criteria. The evaluation team verified that the design is in conformance with design criteria requirements.

TVA agreed that this item is not in compliance with the design criteria and committed to determine if a generic CAQ has been generated that would encompass those two items. TVA also committed that if no CAQ can be found, one will be initiated to identify and resolve these items. Completion is scheduled before unit 1 fuel load.  
(CATD 242 00 WBN 04)

TVA agreed that the 1/2 inch conduit/tray separation is not in compliance with the design criteria and committed to determine if a generic CAQ has been generated. Completion is scheduled before unit 1 fuel load.  
(CATD 242 00 WBN 04)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page 8-10 of 16

Issues

Findings

Corrective Actions

Element 242.0 - WBN (Continued)

- |   |  |   |
|---|--|---|
| <p>b. Inadequate separation of Q and non-Q cables in trays, for all voltage levels, is the result of a violation of procedures.</p> | <p>b. Lack of verification of the currently as-installed status of cables in raceways makes compliance to the design criteria and procedures indeterminate.</p>  | <p>b. TVA committed to verify the as-installed status of cables in raceways. The corrective action plan is addressed in Subcategory Report 26600, WBN element 239.0. (CATUs 239 00 WBN 02 and 04)</p> |
| <p>c. Cable trays are overloaded as a result of inadequate separation.</p>  | <p>c. Cable tray overloading is not a result of inadequate divisional separation. Overloading is a problem independent of divisional separation.</p>   | <p>c. Cable tray overloading is addressed in Subcategory Report 26600, WBN elements 238.1 and 240.0.</p>  |
| <p>d. Inadequate cable arrangement results in covers extending 3 to 4 inches above the tray.</p>                                    | <p>d. Raised tray covers are acceptable as long as they are properly installed and separation requirements are complied with. The Nuclear Safety Review Staff (NSRS) Report 1-85-570-WBN (Ref. 105) concluded that tray covers had been raised 3 to 4 inches, which violates specific separation criteria. In addition, the tray covers and the solid cable tray bottoms, which provided steel barriers between separate safety divisional crossovers, do not meet the gauging requirement of Design Criteria WB-DC-30-4. The NSRS report also concluded that the lack of implementing design separation requirements in the design output document resulted in tray separation deficiency. All issues identified in this report have been satisfactorily resolved and corrective actions completed.</p> | <p>d. None required.</p>  |

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-11 of 16

Issues	Findings	Corrective Actions
Element 242.0 - BFN	BFN	BFN
a. Electrical separation is inadequate. Review is required to assess electrical and physical separation adequacy of redundant wiring, cable, and components as well as equipment.	a. Browns Ferry is committed to complying with IEEE Standards 279-1971 and 308-1971 for independence and redundancy, but not committed to Regulatory Guide 1.75-1974 or 1978, or to IEEE Standard 384-1974.  Separation requirements for cable trays are adequately addressed in design criteria except for separation between redundant vertical and horizontal trays and for separation between redundant vertical or horizontal trays running on different planes.  No criteria could be found for separation of cables in free air except for those in the cable spreading room.  Design criteria (Ref. 10) are not specific for electrical isolation between redundant circuits and between class 1E and non-class 1E circuits	a. None required.  CAQRs BFP 870509, BFP 870515, and BFP 870516 have been initiated requiring clarification of design criteria BFN-50-794 relative to the separation of redundant vertical or horizontal trays running on different planes. Corrective action will be completed prior to restart of each unit. (CATD 242 00 BFN 01)  CAQRs BFP 870508, BFP 870515, and BFN 870516 have been initiated to track in TROI the clarification of design criteria BFN-50-794 for separation of redundant cables in free air. Corrective action will be completed prior to restart of each unit. (CATD 242 00 BFN 01)  Design criteria BFN-50-794 specifically addresses electrical isolation of redundant circuits and electrical isolation between class 1E and non-class 1E circuits in Section 5.2.2.3.1. The evaluation team verified that electrical isolation is addressed in the design criteria as indicated. (CATD 242 00 BFN 01)



Issues

Findings

Corrective Actions

Element 242.0 - BFN (Continued)

The following observations made during the evaluation team walkdown (Refs. 46, 47 and 48) indicate noncompliance with the BFN FSAR (Ref. 57) and GE design criteria (Ref. 15) in the following aspects:

- o Instances were identified in panel 9-3, where switches of redundant division were not adequately separated. Redundant division and/or channel cables or wires connected to these switches, which do not meet the minimum separation requirements, are not run in an enclosed raceway and in some instances are even run together.
- o Noncompliance with design criteria for terminating redundant divisions was observed in panel 9-3 and identified on terminal block "VV," and potential for noncompliance might exist on terminal blocks "LL" and "AAA."
- o In the unit 1 cable spreading room, at elevation 606 feet, the evaluation team observed that unmarked conduits carrying cables from a division I tray were in contact with Division II trays. Also, trays (top to bottom) S2-II, JDA, JE, XF and cables in trays JE and JDA are in contact with the trays directly overhead. This does not provide adequate separation between divisional and nondivisional, and between nondivisional trays. Similarly, cables in tray S2-II touch JAT cable tray above. This does not provide adequate separation between divisional and nondivisional trays.

Implementation of ECNs P-0753 and P-0822 to satisfy NRC violation notice is part of a long-term commitment by TVA.

Generic review under BF-CAR-86-0259 (cables entering control panel 25-165 do not meet the divisional separation criteria) and resulting corrective actions will also address all concerns identified in panel 9-3. Implementation of corrective actions will include walkdown of panels including 9-3. Corrective action will be completed prior to restart of each unit.  
(CATD 242 00 BFN 02)

Same as above.

CAQRs BFP 870509 and BFP 870513 have been initiated to perform an inspection of identified raceways and to evaluate the raceway configuration for violation of the Design Criteria BFN-50-794. The CAQRs will determine the corrective action for each discrepancy as well as initiate actions to revise design output documents. The corrective action will involve modification of raceways and/or justification of the existing configuration. By performing an analysis, TVA will also evaluate all CAQRs for generic applicability by responsible design discipline. Corrective action will be completed prior to restart of each unit.  
(CATD 242 00 BFN 03)

Implementation of the ECNs is tracked in the PROJECT?? (P?) system, which tracks activities that extend beyond 12/22/85.  
(CATD 242 00 BFN 04)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-13 of 16

Issues

Findings

Corrective Actions

Element 242.0 - BFN (Continued)

b. Inadequate separation in trays of Q and non-Q cables for all voltage levels as a result of procedures being violated.

b. Lack of procedures for manual routing of cables and verification of the cable routing program, and the resulting uncertainty regarding the current as-installed status of cables in raceways, make compliance with the BFN FSAR indeterminate for running Q and non-Q cables together. Routing of Q and non-Q cables in the same raceway is allowed per FSAR; however, the FSAR does not permit a non-Q cable, once routed in a Q tray, to be subsequently routed in a Q tray containing cables of another division.

NCR BFN BWP 8304 (Ref. 102) identified a non-conformance where division II cables were routed in a non-class IE conduit (M conduit). The problem was corrected by changing this conduit designation to class IE; however, no analysis was identified to justify this change. Also, no evidence could be found that an evaluation was performed to determine whether other, similar cases existed.

b. TVA committed to verify the as-installed status of cables in raceways. The corrective action plan is addressed in Subcategory Report 26600, BFN element 239.0.  
(CATDs 239 00 BFN 01, and 03)

TVA will review all "M" conduits to determine if other "M" conduits have class IE cables installed in them. TVA will also provide documentation justifying the change of conduit designation from "M80" to a "JES Division II" conduit. If other similar cases are discovered, they will also be justified by analysis and redesignated. This condition is not considered to be a CAQ at this time, so a Problem Identification Report (PIR) will be initiated to document and track this condition until a determination is made. Corrective action will be completed prior to the restart of each unit.  
(CATD 242 00 BFN 04)

c. Cable trays are overloaded as a result of inadequate separation.

c. Cable tray overloading (overflow) is not a result of inadequate divisional separation. Overloading is a problem independent of divisional separation.

c. Cable tray overloading is addressed in Subcategory Report 26600, BFN elements 238.1 and 240.0.

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page 8-14 of 16

Issues

Findings

Corrective Actions

Element 242.0 - BFM (Continued)

d. Inadequate cable arrangement results in covers extending 3 to 4 inches above trays.

d. Raised tray covers are acceptable as long as they are properly installed and separation requirements are complied with. However, during the walkdowns, although no evidence was found of tray covers extending 3 to 4 inches above class 1E trays, instances of improper cover installation were identified. This was the result of tray overflow which precluded the installation of a tray cover as required by separation requirements.

d. CAQRs BFP 870509 and BFP 870513 have been initiated to perform an inspection of identified raceways and to evaluate the raceway configuration for violation of the Design Criteria BFM-50-794. The CAQRs will determine the corrective action for each discrepancy as well as initiate actions to revise design output documents. The corrective action will involve modification of raceways and/or justification of the existing configuration. By performing an analysis, TVA will also evaluate all CAQRs for generic applicability by responsible design discipline. Corrective action will be completed prior to the restart of each unit. (CATD 242 00 BFM 03)

BLN

a. Electrical separation is inadequate. Review is required to assess electrical and physical separation adequacy of redundant wiring, cable, and components as well as equipment.

BLN

a. BLN is committed to complying with IEEE Standards 279-1971 and 308-1971 for independence and redundancy, as well as with Regulatory Guide 1.75-1978 and IEEE Standard 384-1974.

No documents were identified to verify the resolution and/or corrective action for Problem Identification Report PIR BLN EEB0619 (redundant instrument air tubing was installed with 6 inch separation instead of the required 18 inches) (Ref. 103).

BLN

a. None required.

TVA committed that construction will reroute instrument air tubing IRJ-LOPR-167B-A and IRT-LOPR-184C-B per SGB0925-10-series to meet general specification G-60 to ensure the instrument air tubing is installed with 18-inch separation as required. TVA also performed a walkdown in Train A and Train B areas for all the instrument air tubing installed before G-60 revision. (before February 1985) and identified six instances of instrument air tubing with separation conflicts. Four have been corrected and the remaining two are corrected under corrective action of PIR BLN EEB0619. Completion is scheduled before unit 1 fuel load. (CATD 242 00 BLN 01)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-15 of 16

Issues

Findings

Corrective Actions

Element 242.0 - BLN (Continued)

Separation requirements for cable trays are adequately addressed in design criteria. However, clarification is needed regarding the angular orientation between redundant vertical and horizontal trays, and for separation of redundant horizontal or redundant vertical trays running on different planes.

TVA committed to revise the design criteria M4-S-0785 to clarify the applicability of horizontal and vertical separation requirements to all raceway configurations encountered in the plant layout including specifically the separation of redundant horizontal or redundant vertical trays running on different planes. Completion is scheduled before unit 1 fuel load.  
(CATD 242 00 BLN 02)

No specific distance was identified in the design criteria to separate the internal wiring in all class 1E control boards, panels, and relay racks.

Based on commitments to Regulatory Guide 1.75 and IEEE Standard 384, TVA committed to document in the design criteria the requirements for internal wiring separation in equipment. Completion is scheduled before unit 1 fuel load.  
(CATD 242 00 BLN 02)

The following observations made during the evaluation team walkdown indicate (Refs. 49 through 52) noncompliance with the BLN FSAR and design criteria, as follows:

a. Instances were identified in panel 11X-1M-004, where switches of redundant division were not adequately separated. Redundant division and/or channel cables or wires connected to these switches, which do not meet the minimum separation requirements, are not run in an enclosed raceway and in some instances are even run together. Bellefonte is currently under construction, and this condition is considered normal; therefore, no immediate requirements exist for providing the required separation. However, future safe operation of the plant will require the installation of barriers and enclosed raceways.

None required as this condition is the result of ongoing modifications to this panel and is considered normal for a plant under construction.

b. Inadequate separation in trays of Q and non-Q cables for all voltage levels as a result of procedures being violated.

b. The lack of verification of the computer routing program and the adequacy of the computer-routed cables to the design criteria and procedures are indeterminate.

b. TVA committed to verify the as-installed status of cables in raceways. The corrective action plan is addressed in Subcategory Report 26600, BLN element 239.0.  
(CATD 239 00 BLN 01)

ATTACHMENT B  
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS  
FOR SUBCATEGORY 24200

REVISION NUMBER: 2  
Page B-16 of 16

Issues

Findings

Corrective Actions

Element 242.0 - BLN (Continued)

- |  |  |   |
|--|--|---|
| c. Cable trays are overloaded as a result of inadequate separation.                    | c. Cable tray overloading (overfill) is not a result of inadequate divisional separation. Overloading is a problem independent of divisional separation.   | c. Cable tray overloading is addressed in Subcategory Report 2460J, 9LN elements 238.i and 240.0. |
| d. Inadequate cable arrangement results in covers extending 3 to 4 inches above trays. | d. Raised tray covers are acceptable as long as they are properly installed and separation requirements are complied with. During the walkdown (Ref. 52), no evidence was found of tray covers extending above the tray. In fact, the trays that were inspected did not have covers because the plant is still under construction and it appears unlikely that raised covers will be required in the future. | d. None required.   |

ATTACHMENT C

REFERENCES

1. Sequoyah Element Report 242.0, Rev. 3 (04/07/87), "Electrical Separation" (Inadequate Electrical and Physical Separation between Redundant and between Q and Non-Q Wiring, Cabling, Equipment, and Components)
2. TVA Nuclear Performance Plan:  
Revised Corporate Nuclear Performance Plan, Volume 1 (03/86)  
Revised Sequoyah Nuclear Performance Plan, Volume 2 (03/87)  
Browns Ferry Nuclear Performance Plan, Volume 3 (08/86)  
Watts Bar Nuclear Performance Plan, Volume 4 (03/87)
3. Regulatory Guide 1.75, "Physical Independence of Electric System," Rev. 0 and Rev. 2, (02/74 and 09/78)
4. IEEE Standard 308-1971, "Class 1E Power System for Nuclear Power Generating Stations"
5. IEEE Standard 279-1971, "Criteria for Protection System for Nuclear Power and Generating Stations"
6. IEEE Standard 384-1974, "Trial-Use Standard for Separation of Class 1E Equipment and Circuits"
7. WBN Design Criteria WB-DC-30-4 for Separation of Electric Equipment and Wiring, Rev. 4, [B42 851030 508], (10/03/85)
8. SQN Design Criteria for Separation of Electric Equipment and Wiring (SQN-DC-V-12.2), Rev. 6, (09/30/85)
9. SQN Design Criteria SQN DC-V-11-4.1 "Normal and Emergency Ac Auxiliary Power System," Rev. 2, (07/22/86)
10. BFN Design Criteria for Physical Independence of Electrical Systems, BFN-50-794, Rev. 0, (11/26/85)
11. BLN Design Criteria for Physical Independence of Electrical Systems, N4-50-D786, Rev. 3, (09/30/85)
12. BLN Design Criteria for Physical Separation Outside of the Primary Containment, N4-50-D741, Rev. 1, (10/04/84)

13. Westinghouse Specification 952367, "General Equipment Specification for Control Board Construction," Rev. 2, (11/12/73)
14. Westinghouse Specification Criteria for Internal Wiring (678855), Rev. 0, (07/30/71)
15. General Electric Design Specification 22A2809, "Electrical Equipment, Separation for Safeguard Systems," Rev. 2, (04/25/72)
16. Bobcock and Wilcox Equipment Specification 8-1153000001-10 for "Instrument and Control Panels," (05/22/79)
17. Babcock and Wilcox, "Electrical Equipment, Separation for Safeguard Systems"
18. TVA Drawings 47W605-6, 10, 14, 15, and 23, "Electrical Layout of Control Boards"
19. TVA Drawings 45N1643-1 through 8, "Wiring Diagrams Unit Control Board Panel 1-M-4"
20. Wiring Diagram, Control Boards Critical Wiring Braid Installation (E-45W1640 Rev. 3), (05/03/84)
21. OE Calculation, "Nonsafety-Related Electrical Equipment Important to Safety per 10 CFR 50.49(b)," [B25 851107 300], (11/07/85)
22. Mechanical Layout of Control Boards Drawings M4 47W6905-10, Rev. 19; M4 47W605-13, Rev. 13; M4 47W605-14, Rev. 21; M4 47W605-19, Rev. 10; and M4 47W600-55, Rev. 10
23. Drawing 47W200-2, "Equipment Plan - E1. 749.0 and Above," Rev. 13, Drawing 47W200-3, "Equipment Plan - E1. 734.0 and E1. 732.0," Rev. 15
24. OE Calculations, "Analysis of Ac/Dc Instrument and Control (I&C) Power System to Identify Associated Circuits," 10 CFR 50, Appendix R, [B43 860630 901], (06/30/86)
25. TVA Drawings 45W880-27, "Conduit and Grounding Cable Trays Detail Sheet 14," Rev. 3, (04/16/86)
26. OE Calculation, "Analysis of Ac/Dc Instrument and Control Power System to Identify Associated Circuits - 10 CFR 50, Appendix R," [B43 860129 903], (01/28/86)

TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM

REPORT NUMBER: 24200  
REVISION NUMBER: 0  
Page C-3 of 8

27. EN DES Calculation, "Listing of Electrical Equipment in a Harsh Environment Required to Satisfy 10 CFR 50, 49," [B45 850611 002], (06/11/85)
28. TVA Unit 2 "Wiring Diagrams Unit Control Boards Panel 9-3," 45N2641-1 Series, sheets 1 through 7
29. GE Unit 2 "Connection Diagram Panel 9-3," 791E489 Series, sheets 1 through 9
30. TVA Design Drawings "Equipment Location," 47W200 series drawings
31. "Equipment Plans & Sections" drawings, drawings 3DW0234-00-1, Rev. 3, (11/12/8) and 3DW0234-00-2, Rev. 3, (11/12/85)
32. Layout of control boards bench 1IX-IM-004 and 2IX-IM-004 drawing 5CW0935-1X-5, Rev. 6
33. Layout of control boards bench 1IX-IM-005 and 2IX-IM-005 drawing 5CW0935-1X-6, Rev. 13
34. Layout of control boards bench 1IX-IM-006 and 2IX-IM-006 drawing 5CW0935-1X-7, Rev. 6
35. Layout of control boards bench 1IX-IM-006 and 2IX-IM-006, and 1IX-IM-007 and 2IX-IM-007 drawing 5C0935-1X-8, Rev. 2
36. Control board instrument tabulation 5CB1906-IX-A, Rev. 2
37. Control board instrument tabulation 5CB1907-IX-A, Rev. 3
38. Walkdown performed by J. Wheeler, Bechtel, on 01/28/87, BLT 177
39. Walkdown performed by S. Mabie, Bechtel, on 02/24/87, IOM 1703
40. Walkdown performed by S. Mabie, Bechtel, on 02/28/87, ICM 1704
41. Walkdown performed by J. Wheeler, Bechtel, and N. Black, TVA, (BLT-080), (08/23/86)
42. Walkdown performed by J. Benkert, Bechtel, and H. Liao, TVA, (BLT-557), (09/17/86)
43. Walkdown performed by J. Benkert, Bechtel, and C. Dodson, TVA, (IOM 556), (09/18/86)



- 
44. Walkdown performed by J. Wheeler, Bechtel, and G. Bell, TVA, (BLT-061), (10/09/86)
  45. Walkdown performed by J. Wheeler, Bechtel, and R. Sentman, and J. Sanders, TVA, BLT-168, (03/11/87)
  46. Walkdown performed by S. Mabie, Bechtel IOM 848, (04/06/87)
  47. Walkdown performed by S. Mabie, Bechtel IOM 851, (04/07/87)
  48. Walkdown performed by S. Mabie, Bechtel IOM 867, (04/08/87)
  49. Walkdown performed by S. Mabie, Bechtel, for control room panel 1IX-IM-007, IOM 1096, (06/01/87)
  50. Walkdown performed by S. Mabie, Bechtel, IOM 1104, (06/05/87)
  51. Walkdown performed by S. Mabie, Bechtel, IOM 1138, (06/05/87)
  52. Walkdown performed by S. Mabie, Bechtel, IOM 1155, (06/08/87)
  53. WBN FSAR, Chapters 7 and 8
  54. WBN Safety Evaluation Report (SER), Docket No. 50-390 and 50-391 Section 8.3.3.3 also Supplement No. 3 Section 8.3.3.3
  55. SQN FSAR, Chapters 7 and 8
  56. SQN Safety Evaluation Report (SER), Docket No. 50-327 and 50-328, Section 8.5
  57. BFN FSAR Chapter 8
  58. BLN FSAR Chapters 7 and 8
  59. TVA letter to NCR, "Field Audit at Watts Bar Nuclear Plant," [A27 810024 014], (02/04/81)
  60. TVA memo from R. W. Cantrell to J. A. Raulston, "WBN - Nonconforming Condition Report (NCR) W-31-P Field Audit for Separation of Electrical Equipment and Systems Interim Report," [SWP 810415 007], (04/15/81)
  61. TVA memo from J. E. Wilkins to J. C. Standifer, "WBN 1 and 2 - Electrical Separation Field Audit - NCR W-31-P," [WBN 820517 011], (05/17/82)
  62. TVA memo from C. H. Jetton and J. E. Wilkins, "WBN - NCR W-31-P," [WBN 820115 200], (01/13/82)

63. TVA memo from R. W. Cantrell to J. A. Raulston, "WBN 1 and 2 - Electrical Separation Field Audit - 10 CFR 50.55(e) Report No. 3 (Interim) - NCR W-31-P," [SWP 810702 034], (07/01/81)
64. TVA memo from F. W. Chandler to Electrical Engineering Fields, "WBN - Design Input Memorandum on Separation of Electrical Equipment and Wiring, Design Criteria WB-DC-30-4," [B43 851125 911]
65. TVA memo from E. Chitwood to Electrical Engineering Fields, "WBN - Design Input Memo on Separation of Electric Equipment and Wiring Design Criteria WB-DC-30-4," [B43 860224 902], (02/18/86)
66. TVA memo from E. Chitwood to J. A. Raulston and J. C. Standifer, "WBN 1 and 2 - Significant Condition Report No. SCRWBNEEB8582," [B43 860224 940], (02/24/86)
67. TVA memo from E. Chitwood to J. A. Raulston, "WBN Unit 1 and 2 - 10 CFR 50.55(e) Final Report - SCRWBNEEB8582," [B43 860124 930], (01/24/86)
68. TVA memo from J. E. Wilkins to W. T. Cottle, "WBN Nonconforming Condition Report W-31-P," [WBN 820226 009], (02/26/82)
69. TVA memo from R. W. Cantrell to C. C. Mason, "WBN Unit 1 and 2 Nonconforming Condition Report W-31-P," [SWP 811013 006], (10/08/81)
70. TVA memo from W. T. Cottle to J. C. Standifer "WBN - Nonconforming Condition Report, W-31-P," [WBP 840607 008], (06/05/84)
71. TVA memo from Raughley to Electrical Engineering Files, "Design Input Memo on Separation of Electrical Equipment and Wiring Design Criteria SQN-DC-V-12.2," [B43 860710 921], (07/08/86)
72. TVA memo from Hall to Chandler, "Response to Memo from Chandler to Those Listed," [B25 851226 013], (12/23/85)
73. TVA memo from Chandler to Those Listed, "Potential Generic Condition Evaluation," [B43 851219 905], (12/19/85)
74. TVA memo from Wilson to Abercrombie, SQN - "Employee Concern XX-85-122-011 - Electrical and Physical Separation of Redundant Circuits and Equipment," [B25 860505 011], (05/05/86)
75. NRC-OIE Reportability Information Distribution, SCR WBNEEB8582, "Minimum Separation Distance between Different Divisional Cable Tray Crossings," [B45 860206 828], (12/31/85)

TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM

REPORT NUMBER: 24200  
REVISION NUMBER: 0  
Page C-6 of 8

76. TVA memo from Wilson to Raulston, SQN - SCR SQNEEB8634, Rev. 0, [B25 860509 004], (05/09/86)
77. SCR SQNEEB8634 "Minimum Separation Distance between Different Divisional Cable Trays," Rev. 0, (04/30/86)
78. TVA memo from Standifer to Ennis, "Watts Bar Nuclear Plant - Addendum to Employee Concern Investigation Report I-86-570-WBN," (01/02/86)
79. TVA memo from Standifer to Ennis, "Watts Bar Nuclear Plant - Employee Concern Investigation Report Number I-85-570-WBN," (12/13/85)
80. TVA memo from Ennis to Standifer, "Watts Bar Nuclear Plant - Employee Concern Investigation Report Transmittal," (11/15/85)
81. TVA memo from R. H. Davidson to N. B. Hughes, "Meeting with AEC staff - BFN Licensing Review - June 7, 1972," (07/18/72)
82. TVA letter from L. M. Mills to J. P. O'Reilly, "Response to the NRC dated 09/13/84 to H. A. Parris," [L44 841015 811], (10/15/84)
83. General Electric letter to W. C. Hibb, "Electrical Separation Specification Applications - Browns Ferry," (01/31/86)
84. TVA memo from N. R. Beasley to Hall, "BFN - Evaluation of General Electric Design Specification," [B22 851121 002], (11/21/85)
85. TVA memo from R. L. Lewis to E. P. Schlinger, "BFN - Engineering Report EEB 8606 Erroneous Specifications Listed on Design Drawings," [R39 860214 935], (02/20/86)
86. TVA memo from N. R. Beasley to E. P. Schlinger, "BFN - Units 1, 2, and 3 - Engineering Report for CAQ Report SCR BFNEEB8606 Revision," [B22 860228 015], (02/28/86)
87. TVA memo from D. T. Langley to BFEP Files, "BFN - SCR BFNEEB8606 - Walkdown" [B22 860421 001], (04/21/86)
88. Failure Evaluation/Engineering Report "ADS and Manual Relieve Valve Cables not Separated as Required by Fire Protection Plan," [NEB 840510 255], (05/10/84)
89. TVA memorandum from F. W. Chandler to Those Listed, "BFN Nonconformance (NCR) Report BFN BWP 8304," Rev. 1, (08/27/85)
90. Nonconformance Report (NCR) Report BFN BWP 8304, Rev. 1, [BWP 830307 002], (03/07/83)

TVA EMPLOYEE CONCERNS  
SPECIAL PROGRAM

REPORT NUMBER: 24200  
REVISION NUMBER: 0  
Page C-7 of 8

91. Quality Information Request/Release QIRNEB84014 from T. E. Haynes to C. H. Sudduth, "Criteria for Special Cable Separation," [NEB 841207 7251], (12/07/84)
92. QIR NEB84004 from H. L. Jones to G. R. Owens, "Criteria for Special Cable Separation," [NEB 840807 251], (08/09/84)
93. QIR NEB 84012 from T. E. Hayes to C. H. Sudduth, "Criteria for Special Cable Separation," [NEB 841113 257], (11/13/84)
94. TVA memo from J. P. Stapleton to E. D. Hill, "BFN - SCR BFN EEB8606 Field Verification of Panels 9-15, 9-17, 9-12, 9-14," [B22 860522 018], (05/22/86)
95. TVA memo from E. Chitwood to Electrical Engineering Files, "BLN - Design Input Memorandum on Physical Independence of Electrical System - Design Criteria N4-50-D786," [B43 860130 902], (01/29/86)
96. TVA memo from W. S. Raughley to R. R. Hoesley, "BLN Problem Identification Report (PIR) BLN EEB8615," [B43 860528 936], (05/28/86)
97. Letter from B. J. Youngblood, NRC, to S. A. White, TVA with the attached transcript of the investigative interview conducted by the NRC on 02/21/86 at the First Tennessee Bank Building in Knoxville, TN, [B45 860714 832], (06/23/86)
98. SQN Engineering Procedure SQEP-29, "Procedure for Preparing the Design Basis Document for Sequoyah Nuclear Plant," (07/18/86)
99. Nonconforming Condition Report (NCR) W-31P, (02/04/81)
100. Significant Condition Report WBNEEB8582, "Minimum Separation Distance between Different Divisional Cable Tray," [B43 851219 906], (12/13/85)
101. SCR BFN EEB8606, "Inadequate Design Control - Wrong Design Criteria Referenced on Drawings," Rev. 0, (02/07/86)
102. Nonconformance Report BFNBP8304, Rev. 1, [BWP 830307 002], (03/07/83)
103. PIR BLN EEB 8619, Rev. 0, [21 871117 002], (11/17/86)
104. Problem Identification Report (PIR) PIR BLN EEB 8615 [B43 860678 937], (05/22/86)
105. NSRS Report I-85-570-WBN, "Cable Arrangement in Cable Trays," (10/15/85)
106. NSRS Report I-85-706-WBN, "Cable Separation," (11/22/85)

- 
107. NSRS Report I-85-133-SQN, "Electrical and Physical Separation of Redundant Circuits and Equipment," (02/27/86)
  108. C/R No. SQN EEBPN1002 (Source of C/R FSAR Amendment 2, Section 7.1.4.2.1, page 7.1-19, paragraphs 5 and 7) "TSC/SMS Isolators - Define Functional, Qualification, Detailed Technical Requirements (e.g., maximum Cred. Voltage) and Testing Requirements"
  109. C/R No. SQN EEBPN1085 (Source of C/R SER 3/79) "Undervoltage and Underfrequency Trips Upgraded to Class 1E and Moved to Auxiliary Building to Satisfy NRC Requirements, Meets IEEE 279"
  110. C/R No. SQN EEBPN1134 (Source of C/R 3/79) "Assurance That Intertrain Interlocks Are Designed Such That a Failure in One Train Will Not Adversely Affect Devices in Other Train"
  111. C/R No. SQN EEBPN1082 (Source of C/R FSAR Amendment 2, Section 7.6.7.1) "A Failure in the Non 1E Part of the Low Temperature Over Press Circuit Will Not Harm the Protection Set Because of Isolation Device"
  112. C/R No. SQN EEBPN1013 (Source of C/R FSAR Amendment 2, Sections 7.2.1.1.8 and 7.2.2.2.3[5]) "Design Bases and Qualification Testing Requirements for Reactor Trip System Isolation Amplifiers"