

EMPLOYEE CONCERNS SPECIAL PROGRAM

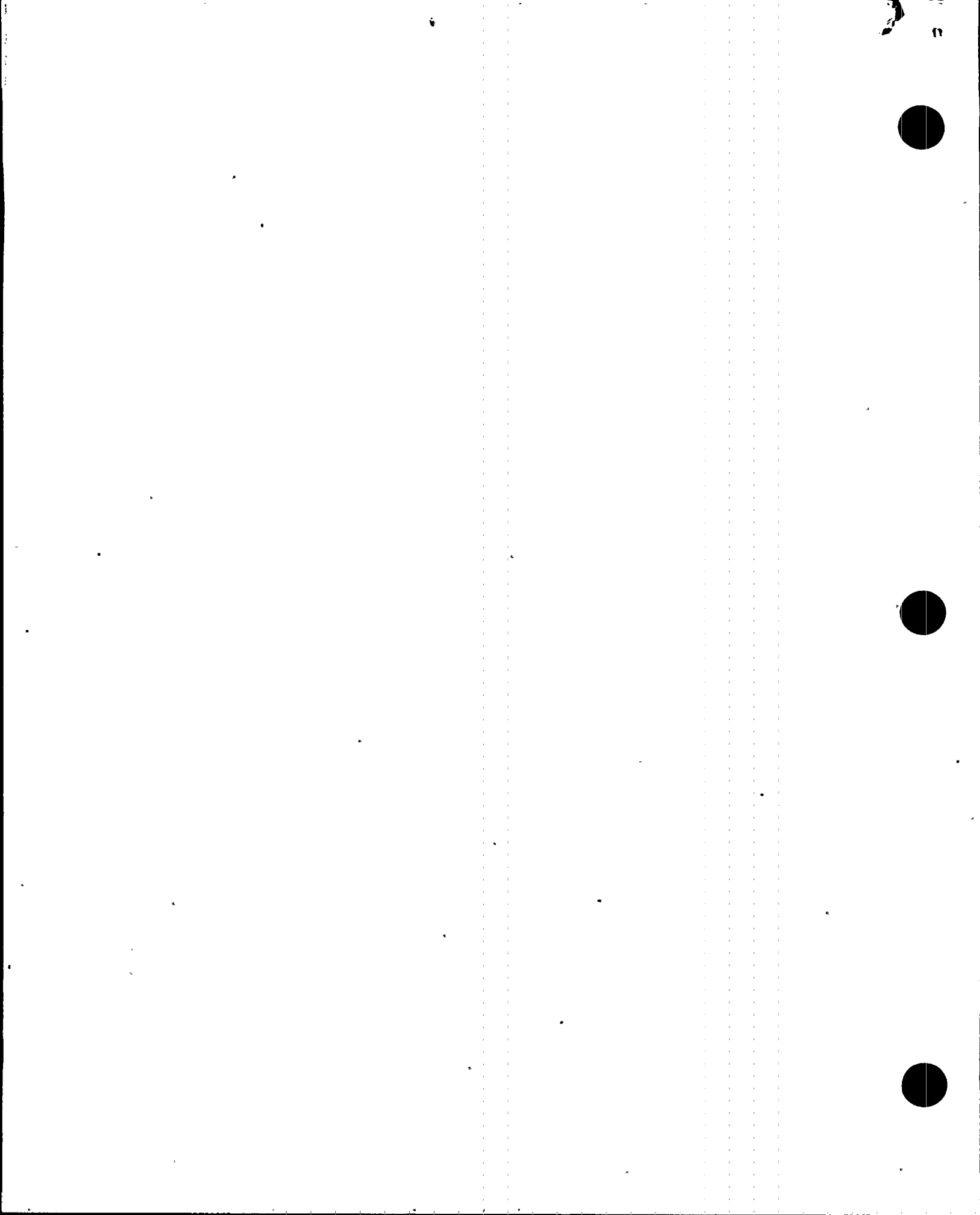
VOLUME 2
ENGINEERING CATEGORY

SUBCATEGORY REPORT 22000
SUPPORT DESIGN GENERAL

UPDATED

TVA
NUCLEAR POWER

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TVA EMPLOYEE CONCERNS
SPECIAL PROGRAM

REPORT NUMBER: 22000

REPORT TYPE: SUBCATEGORY REPORT FOR
ENGINEERING

REVISION NUMBER: 3

TITLE: SUPPORT DESIGN GENERAL

Page 1 of 30

REASON FOR REVISION:

1. Revised to incorporate SRP and TAS comments.
2. Revised to incorporate Bellefonte corrective action plans and SRP comments.
3. Revised text and Attachment B to incorporate SRP and TAS comments and added Attachment C (References).

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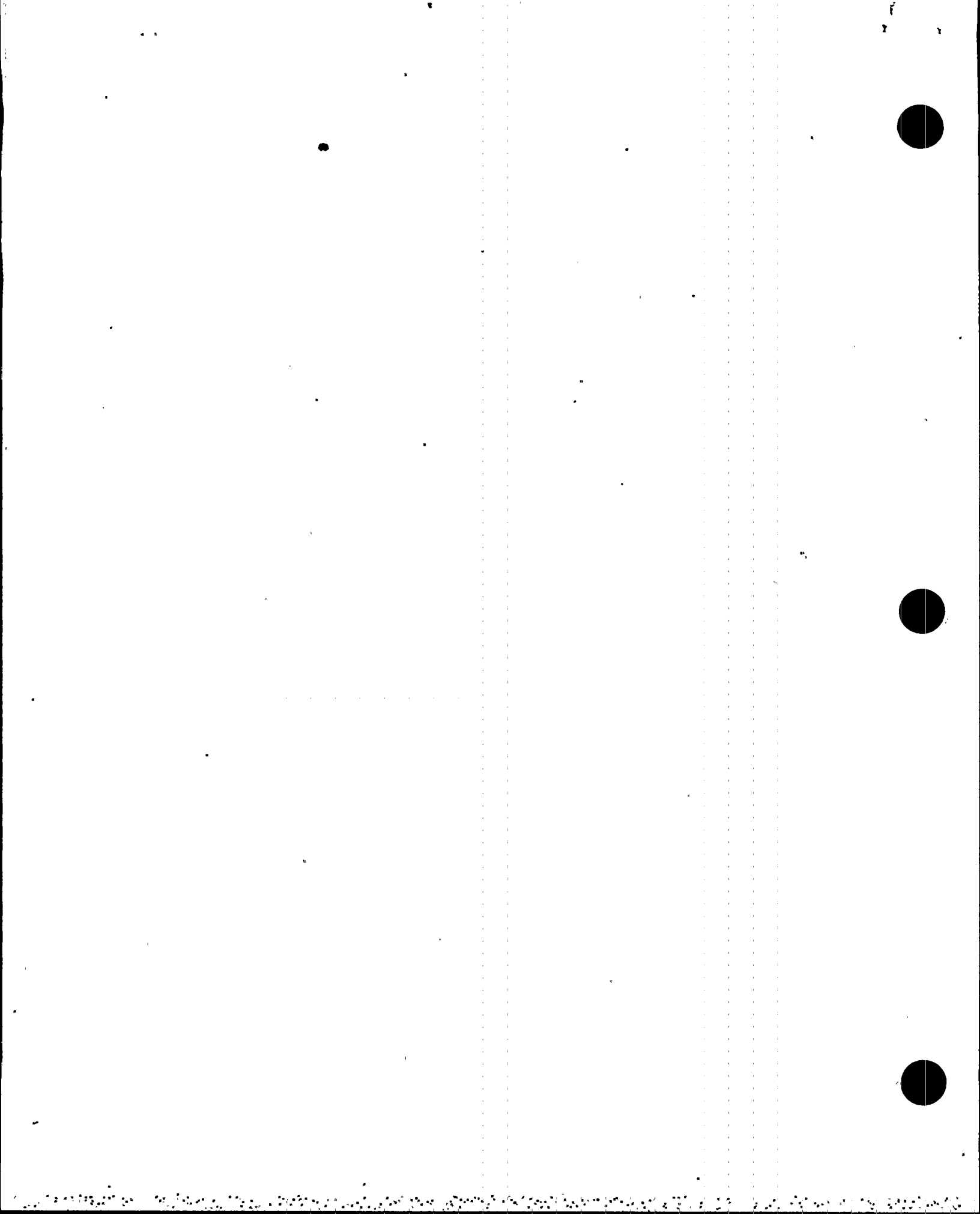
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CONCURRENCE (FINAL REPORT ONLY)

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



EXECUTIVE SUMMARY

The concerns of Subcategory Report 22000, Support Design General, deal mainly with the design adequacy of pipe supports. Other related issues in this subcategory report include design change control, technical decisions made by Construction, and technical review by Engineering. The findings confirm that the only issue of major significance is the adequacy of pipe support design.

The evaluation team examined both the design criteria and individual pipe support calculations. The pipe support design criteria for all four plants were found to adequately address the necessary seismic design requirements, with the exception of one Browns Ferry criterion, which did not include the deflection/rigidity requirement. This requirement will be implemented in the individual pipe support calculations under the Browns Ferry calculation verification review program, and the criterion will be revised to include the requirement.

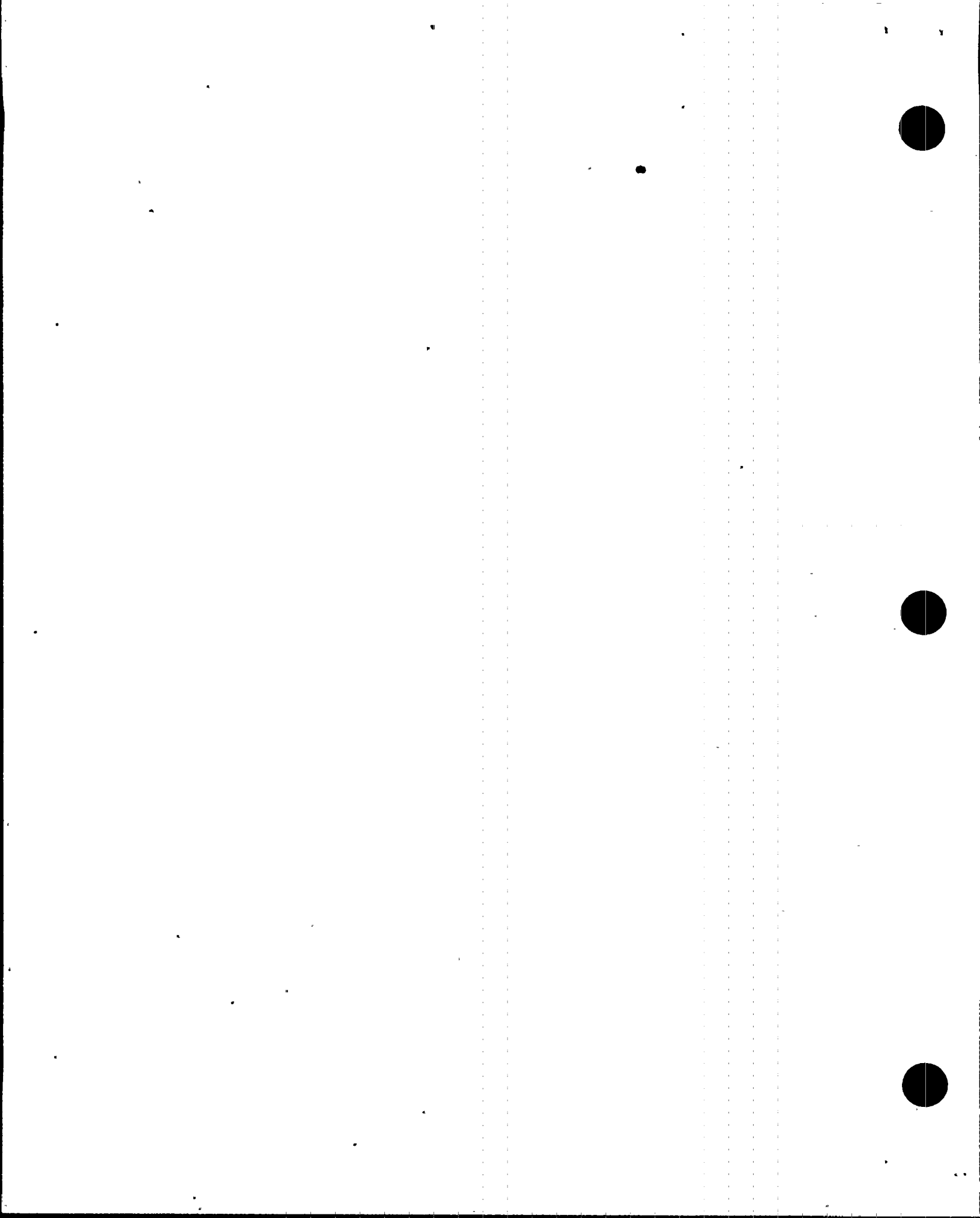
The pipe supports reviewed by the evaluation team for all four plants were found to be adequately designed based on applicable design criteria, with the exception of four (of 28 reviewed) Watts Bar pipe supports that did not meet code stress allowables. Some calculation documentation was found to be incomplete or irretrievable, or contained minor discrepancies and inadequate documentation of engineering judgment. The rest of the related issues were found to be either technically insignificant or invalid.

Significant technical or safety problems are not apparent from this evaluation for Sequoyah, Browns Ferry, or Bellefonte. However, TVA has identified the need for better documentation (of analysis, engineering judgment, test data, etc.) in the area of pipe support design, and has initiated corrective action to improve the documentation. In addition, an extensive effort is underway at Watts Bar, Browns Ferry, and Sequoyah to locate or reperform the pipe support calculations that were irretrievable.

The four Watts Bar supports that do not meet code allowables are of technical significance. However, Watts Bar has committed to reevaluate and, if necessary, modify these supports. All Watts Bar calculations for engineered pipe supports will be reevaluated under the Hanger and Analysis Update Program.

The corrective action plans provided by TVA are found to be acceptable by the evaluation team to resolve the negative findings.

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



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

HISTORY OF REVISION

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

Preface

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

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

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

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

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

Additionally, at the end of each subcategory report will be a Subcategory Summary Table that includes the concern numbers; identifies other subcategories that share a concern; designates nuclear safety-related, safety significant, or non-safety related concerns; designates generic applicability; and briefly states each concern.

Either the Subcategory Summary Table or another attachment or a combination of the two will enable the reader to find the report section or sections in which the issue raised by the concern is evaluated.

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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 ECTIG 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.

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

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

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

K-form (see "employee concern")

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

root cause the underlying reason for a problem.

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

Acronyms

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

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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

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

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

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1. INTRODUCTION

This subcategory report summarizes and evaluates the results of the ECSP element evaluations prepared under Engineering Subcategory 22000, Support Design General. It deals mainly with the design adequacy of pipe supports. Other related issues include design change control, technical decisions made by construction, and technical review by engineering.

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 their 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's number is given along with notation of any other element or category with which the concern is shared, the plant sites to which it could be applicable are noted, the concern is quoted as received by TVA, and is characterized as safety related, not safety related, or safety significant.
- 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.

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

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

The employee concerns providing the basis for the element evaluations are listed by element number in Attachment A. The plant location where the concern was originally identified and the concern applicability are also identified.

2. SUMMARY OF ISSUES/GENERIC APPLICABILITY

The employee concerns listed in Attachment A have been examined for each element and the potential problems raised by the concerns have been identified as issues in Attachment B. Some of these issues were evaluated for more than one plant when deemed generically applicable in accordance to ECTG Program Manual M.1, Section 7.3. Investigation of these issues constitutes the element evaluations.

2.1 Summary of Issues

Summaries of the issues evaluated under this subcategory for each element are listed below.

- o 220.1, "'A' Series Hanger Drawings and 0-50 Notes" - The 47A050 series drawing notes are confusing, open to interpretation, and allow rejected hangers to be accepted. NRC wrote violations against the 47A050 notes because they did not satisfy inspection criteria.
- o 220.3, "Design of Pipe Supports" - Pipe supports are designed inadequately. Seismic pipe support criteria are nonexistent. Seismic pipe supports are too rigid.
- o 220.6, "Revisions to Hanger Designs" - Pipe support designs are inadequately controlled and have as many as 100 revisions.
- o 220.7, "Installation-related Technical Decisions" - Crafts assume too much responsibility for originating design. Engineering revises the drawings to reflect as-built condition without review and approval.
- o 220.9, "Oversizing of Pipe Support Steel and Slick Grinding of Welds" - Pipe supports are overdesigned. The former practice of slick grinding welds is unnecessary.
- o 220.10, "Replacement Hangers" - Installed pipe supports have often been modified or removed.

- o 220.11, "Temperature Variation Consideration" - Thermal expansion is not considered in the pipe support calculations.
- o 220.12, "Technical Review" - Technical review is not performed after the checker's review of a pipe support calculation.

The issues summarized above deal mainly with presumed deficiencies or inadequacies in the design of pipe supports. Other related issues deal with the quality and use of the support installation tolerance notes (220.1), technical decisions made by Construction (220.7), and technical review by Engineering (220.12).

A complete statement of each issue investigated in the element evaluation is provided in Attachment 8. This attachment also lists findings and corrective actions, which will be discussed in Sections 4 and 5 of this report.

Three of the above summarized issues were found to be valid and require corrective action (elements 220.1, 220.3, 220.11). On the basis of the findings, only the issues of inadequately designed pipe supports (element 220.3) are technically significant with respect to design adequacy.

2.2 Generic Applicability of Employee Concerns

The generic applicability of the employee concerns was determined as follows:

- o 220.1, "'A' Series Hanger Drawings and 0-50 Notes"
 - WBN - All eight concerns of this element are applicable.
 - SQN - Only Concern IN-85-024-001 was applied to SQN. Since all concerns for this element originated at WBN, many of them made direct or inferred references to WBN, making the concern plant-specific to WBN. Concerns IN-85-052-001, IN-85-932-001, and IN-85-445-013 contained specific references to WBN documents. Concern IN-85-010-002 inferred it was specific to WBN because of the reference to an NRC violation. In addition, Concerns IN-85-415-001 and IN-86-249-001 implied the notes were vaguely written; however, the notes at SQN (and BLN) were found to be clear and concise. Therefore, these concerns are also plant-specific to WBN. The last concern, PH-85-006-001, was found not to be valid at WBN. Since field change request procedures similar to WBN's exist at SQN (and BLN), no further evaluation is required.

-
- BFN - The element is not applicable because no such notes (or similar notes) exist at BFN.
 - BLN - The original TVA determination was that the concern of this element was not applicable. However, through the evaluation of element 220.3 for BLN, it was found that notes similar to SQN/WBN 47A050 notes (Refs. 1 and 2) existed at BLN as 36A0059 notes (Ref. 3). The issue stemming from Concern IN-85-024-001 that the notes may be misinterpreted was applied to BLN. The concern also deals with "A" series hanger drawings; however, they, or similar drawings, do not exist at BLN.
 - o 220.3, "Design of Pipe Supports" - The concerns of this element are applicable to all four plants.
 - o 220.6, "Revisions to Hanger Designs"
 - WBN - The concern of this element is applicable and found not to be valid.
 - SQN, BFN, BLN - The representative sample of supports from various safety-related systems (Refs. 18, 20, and 21) reviewed in element 220.3 for these three plants does not indicate that pipe support drawings were excessively revised. Hence, this concern does not require further evaluation.
 - o 220.7, "Installation - Related Technical Decisions"
 - WBN - The concern of this element is applicable and found not to be valid.
 - SQN, BFN, BLN - Changes required by construction are initiated through field change requests which are approved by Engineering before the physical change is made. Since document change procedures similar to WBN's also exist for these three plants, this concern does not require further evaluation.
 - o 220.9, "Oversizing of Pipe Supports Steel and Slick Grinding of Welds"
 - WBN - The concern of this element is applicable and found not to be valid.

- SQN, BFN, BLN - The representative sample of pipe supports (Refs. 18, 20, and 21) reviewed in element 220.3 for these three plants does not indicate that the pipe supports were oversized. Slick grinding of welds is an unnecessary procedure and, when properly performed does not impact the technical adequacy of the supports. Hence, the concern does not require further evaluation.
- o 220.10, "Replacement Hangers"
 - WBN - The concern of this element is applicable and found not to be valid.
 - SQN, BFN, BLN - Changes in hanger type and location changes are common during the design/construction process. These changes are considered and documented in the piping and support analyses. Hence, the concern does not require further evaluation.
- o 220.11, "Temperature Variation Consideration" - The concern of this element is applicable to all four plants.
- o 220.12, "Technical Review"
 - WBN - The concern of this element is applicable and found not to be valid.
 - SQN, BFN, BLN - From the WBN evaluation, it was found that 10 CFR 50, Appendix B (Ref. 4) and ANSI N45.2.11-1974 (Ref. 5) specify that verification or checking shall be performed by any competent individual or groups other than those who performed the original design. No additional verification or checking is required after the competent individual (or group) has checked or reviewed the calculations. Since these documents also apply to these three plants, the concern does not require further evaluation.

3. EVALUATION PROCESS

This subcategory report is based on the information contained in the applicable element evaluations addressing the specific employee concerns related to the issues summarized in Section 2.

3.1 Element Evaluation Process

The evaluation process for each element is as given below.

3.1.1 "'A' Series Hanger Drawings and 0-50 Notes" - Element 220.1

Sequoyah.

- a. Reviewed the 47A050 notes (Ref. 1) to determine if these notes were contradictory to hanger drawings (Ref. 9) and other installation documents (Refs. 6 and 7).
- b. Reviewed the 47A050 notes to determine if they can be misinterpreted.
- c. Reviewed TVA's corrective action plan for CATD 220 01 SQN 01.

Watts Bar.

- a. Reviewed applicable NSRS investigation reports (Ref. 8).
- b. Reviewed the 47A050 notes to establish whether these notes were contradictory to "A" series hanger drawings (Ref. 10).
- c. Reviewed the 47A050 notes to determine whether they can be misinterpreted. Interviewed site personnel to determine if interpretational conflicts exist (Ref. 11).
- d. Reviewed the 47A050 notes to determine whether revisions to the notes allow rejected supports to be accepted.
- e. Reviewed a sample of calculations (Ref. 12) for justification of specific notes.
- f. Reviewed TVA's corrective action plan for CATD 220 01 WBN 01.

3.1.2 "Design of Pipe Supports" - Element 220.3 (All Plants)

- a. Reviewed NSRS report (Ref. 13) to determine the scope of the employee concern.
- b. Reviewed applicable pipe support design criteria (Refs. 14, 15, 16, and 17) and a random sample of support calculations (Refs. 18, 19, 20, and 21) from various safety-related systems to verify seismic design adequacy (excluding the requirements for base plate and anchor bolts, as they are examined in Construction Subcategory Report 10400, Ref. 53).

- c. Reviewed seismic support criteria (Refs, 14, 15, 16, and 17) to determine rigidity requirements.
 - d. Reviewed sample of pipe support drawings (Refs. 22 and 23) for constructibility (for SQN, WBN only - based on the evaluations for SQN and WBN element 220.3, and evaluations for element 222.3 [all four plants]); this step was determined to be unnecessary for 8FN and BLN).
 - e. Performed study calculations (Refs. 24 and 25) to support evaluations, made engineering judgments as necessary, and conducted site interviews (BLN only, Ref. 25).
 - f. It was determined that BLN had similar notes (3GA0059 series) to the SQN/WBN 47A050 notes.
 - g. Evaluation of the 3GA0059 series (Ref. 3) notes was performed under element 220.3 as an additional finding.
 - h. Reviewed 3GA0059 notes to determine if they can be misinterpreted.
 - i. Reviewed TVA's corrective action plans for CATDs 220 03 SQN 01, 220 03 WBN 01, 220 03 BFN 01, 220 03 BLN 01, and 220 03 NPS 01.
- 3.1.3 "Revisions to Hanger Design" - Element 220.6 (Watts Bar)
- a. Reviewed pipe support design manual (Ref. 26) to verify the method of numbering hanger drawing revisions.
 - b. Reviewed TVA procedures (Ref. 27) for revising vendor drawings.
 - c. Reviewed WBN hanger tracking program report (Ref. 28) to verify the maximum number of revisions for a hanger drawing.
- 3.1.4 "Installation-related Technical Decisions" - Element 220.7 (Watts Bar)
- a. Reviewed the applicable procedures (Ref. 29) to determine the extent to which TVA might permit the crafts to participate in the design process.
 - b. Reviewed these same procedures to ascertain the degree of control of the FCR process in preventing hangers from being redesigned and installed without documented engineering approval.

- 3.1.5 "Oversizing of Pipe Support Steel and Slick Grinding of Welds" - Element 220.9 (Watts Bar)
- a. Reviewed TVA IOM (Ref. 30) regarding Employee Concern IN-85-316-002.
 - b. Reviewed TVA's General Construction Specification G-29C, Rev. 9
 - c. Reviewed TVA's General Construction Specification G-43, Rev. 8.
 - d. Reviewed TVA's typical small pipe standard drawings and general notes for Category I supports (drawings 47A053-62, 47A053-62A through 62E, 47A053-63, 47A053-63A, and 47A050-1P) for braced and unbraced cantilevers.

- 3.1.6 "Replacement Hangers" - Element 220.10 (Watts Bar)
- a. Reviewed documents (Ref. 31) and procedures (Ref. 32) relating to practices adopted for modifying the pipe supports that have already been installed (including deletions).
 - b. Reviewed ten sets of piping analysis calculations (Ref. 33), including stress isometric drawings, and the respective engineering change notices (ECNs)/field change requests (FCRs) causing the pipe support modifications (including deletions).

- 3.1.7 "Temperature Variation Consideration" - Element 220.11

Sequoyah.

- a. Reviewed design criteria (Ref. 34) and applicable codes (Ref. 35) to verify if consideration of temperature variations is required in the design of structural members of pipe supports.
- b. Reviewed design criteria to verify if thermal expansion of piping is considered in the piping analysis and if loads imposed by this expansion are considered in the pipe support design.
- c. Determined if SQN adequately addressed the WBN problem identification report (Ref. 36) on this subject.
- d. Reviewed TVA's corrective action plan for CATD 220 11 SQN 01.

Watts Bar.

- a. Reviewed design criteria (Ref. 37) and applicable codes (Ref. 38) to verify if consideration of temperature variations is required in the design of structural members of pipe supports.

- b. Reviewed design criteria to verify if thermal expansion of piping is considered in the piping analysis and if loads imposed by this expansion are considered in the pipe support design.
- c. Reviewed TVA's corrective action plan for CATD 220 11 SQN 01.

Browns Ferry.

- a. Reviewed design criteria (Ref. 16) and applicable codes (Ref. 35) to verify if consideration of temperature variations is required in the design of structural members of pipe supports.
- b. Reviewed design criteria to verify if thermal expansion of piping is considered in the piping analysis and if loads imposed by this expansion are considered in the pipe support design.
- c. Determined whether BFN adequately addressed the WBN problem identification report (Ref. 36) on this subject.
- d. Held discussions with BFN Engineering Design (EN DES) personnel, as required (Ref. 39).
- e. Reviewed (for adequacy) the criteria (Ref. 40) for evaluating structural steel components and piping subjected to the effects of the March 22, 1975 fire.

Bellefonte.

- a. Requested TVA (BLN) to provide the following documents related to the consideration of thermal stresses in the design of pipe supports and piping analysis:
 - o Design criteria (piping and pipe supports) (Refs. 17 and 41)
 - o List of affected drawings (Ref. 42)
 - o Results of TVA evaluation (Ref. 43)
 - o Sample drawings (Ref. 44)
- b. Reviewed design criteria, list of affected drawings, sample drawings, and written explanations received from TVA (BLN) in order to establish whether the concerned individual's claim that thermal stresses are not considered in the design of pipe supports has any impact on the safety of BLN.

- c. Reviewed corrective action plan provided by PIR BLN CEB 8512 (Ref. 55).
- 3.1.8 "Technical Review" - Element 220.12 (Watts Bar)
- a. Reviewed licensing commitments (Refs. 4, 5, 45) and TVA procedures (Ref. 46) for design calculation verification.
 - b. Reviewed pipe support calculations (Ref. 47) to verify the compliance with licensing commitments and TVA procedures.
 - c. Reviewed documentation pertaining to pipe support technical audit reports (Ref. 48).

3.2 Subcategory Evaluation Process

The evaluation process for this subcategory report was as follows:

- a. Tabulated issues, findings, and corrective actions from the element evaluations in a plant-by-plant arrangement (see Attachment B).
- b. Prepared Tables 1, 2, and 3 to permit comparison and identification of common and unique issues, findings, and corrective actions among the four plants.
- c. Classified the findings and corrective actions from the element evaluations using the ECSP definitions.
- d. On the basis of ECSP guidelines, analyzed the collective significance and causes of the findings from the element evaluations.
- e. Evaluated defined corrective actions to determine if additional actions are required as a result of causes found in step d.
- f. Provided additional judgment or information that may not be apparent at the element level.

4. FINDINGS

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

The findings for each element are summarized in the following paragraphs.

4.1 "A" Series Hanger Drawings and 0-50 Notes" - Element 220.1

The purpose of the notes is to provide Construction with as much flexibility as possible for hanger installation, and to provide guidelines for unforeseen situations and generic installation difficulties. The notes allow a larger number of pipe supports to meet acceptance inspections that otherwise would have required field change requests (FCRs) or would have been rejected by inspection rejection notices (IRNs).

For Sequoyah, the 47A050 series drawing notes were found to be neither confusing nor open to interpretation. However, minor discrepancies were found between a construction specification and an operations maintenance instruction.

For Watts Bar, the 47A050 notes were, in some cases, found to be confusing and contained conflicting or unnecessary instructions; however, they were revised in September 1985 to resolve conflicts and for clarification. Evaluation team interviews with site personnel (Construction and Quality Control) revealed that there were interpretational differences. There are Watts Bar programs in place to resolve the differences, such as inspection rejection notice (IRN) trend analysis, Quality Assurance (QA) training, and DNE/DNC biweekly meeting (see Attachment B). No NRC violations against the 47A050 notes were identified. However, it was found in a Nuclear Safety Review Staff (NSRS) report I-85-157-WBN (Ref. 8) and by the evaluation team that changes made to the 47A050 notes did not always have complete documented justification.

In addition, although the concerns were specifically directed at the 47A050 notes, similar notes were found at Bellefonte during investigation for element 220.3. These notes, 3GA0059 series drawings, were found to be reasonable and clear. However, some 3GA0059 notes did not have complete documented justification. Browns Ferry does not have any notes similar to the 47A050 notes.

4.2 "Design of Pipe Supports"- Element 220.3

The pipe supports reviewed by the evaluation team were found to be adequately designed for Sequoyah, Browns Ferry, and Bellefonte, but the calculation documentation was incomplete, or contained minor discrepancies. For Watts Bar, the above remarks apply in general. In addition, four Watts Bar pipe supports (1-74-11, 47A060-3-23, 47A060-70-27, and 1-63-404) did not meet code stress allowables because incorrect loads or load combinations had been applied.

The Sequoyah calculations for nine supports (2-MSH-315, 2-MSH-348, 1-AFDH-328, 1-CVCH-100, 1-RCH-302, 1-UHIH-130, 2-SGBH-290, 2-RHR-449, 2-CSH-5) provided justification of changes to the supports, but no analysis was included for the

original designs. From a general review (based on support configuration and size, and design loads) of these nine supports, the evaluation team determined that eight were adequately designed for the specified loads (Ref. 24). The adequacy of the remaining support, 2-CSH-5, could not be easily verified because of the complexity of the structure, its relationship with common supports, and the magnitude of the load. Complete reanalysis would be required, which is covered in the corrective action plan (CAP) for CATD 220 03 SQN 01. Under this CAP the adequacy of support 2-CSH-5 would be established, and modifications would be provided if necessary.

With the exception of Browns Ferry's General Design Criteria for the Long-Term Torus Integrity Program (LTTIP) BFN-50-D706 (Ref. 16), the pipe support design criteria for Sequoyah, Watts Bar, Browns Ferry, and Bellefonte were found to adequately address the necessary seismic design requirements. The criteria for the Browns Ferry plant-specific LTTIP lack deflection/rigidity requirements. Browns Ferry supports designed under these criteria are to be reevaluated under the Browns Ferry instruction for the calculation verification program (Ref. 49). Browns Ferry has not completed its commitment to issue criteria for box anchors and a pipe support handbook. In addition, the punching shear requirement for tube-to-tube connections was not included in the pipe support design criteria for the four plants, contrary to TVA policy memorandum PM 86-04 (Ref. 50).

Bellefonte design loads and allowable stresses were found to deviate from the ASME Section III-1974 NF code (Ref. 51); however, these deviations were reviewed and approved by the Nuclear Regulatory Commission. In addition, it was found that a section of the Bellefonte Final Safety Analysis Report (FSAR) (Ref. 52) was missing some provisions for one load condition due to an oversight by TVA. This load condition is included in the design criteria and considered in design. An additional finding was made concerning the lack of complete documented justification for some of the 3GA0059 series drawing notes. (See summarized findings for element 220.1.)

The findings for element 220.3 for all four plants do not include review of specific requirements for base plates and anchorage bolts (e.g., base plate flexibility, anchorage bolt safety factor, construction tolerance); as these requirements are addressed in Construction Subcategory Report 10400 (Ref. 53).

Rigidity is a major factor in determining the design loads. Since the rigidity of supports is considered in the analysis of seismic piping, and, therefore, reflected in the resulting support design loads, the supports are sufficiently designed to prevent them from breaking loose during a seismic event.

4.3 "Revision to Hanger Designs" - Element 220.6

Pipe support revisions are adequately controlled in accordance with applicable procedures. In the review of Watts Bar unit 1 pipe supports, the evaluation team observed only three support drawings (out of the listing of 11,300 supports from TVA's Hanger Tracking Program Report, Ref. 28) that were revised a maximum of 11 times. The average number of revisions of all supports was noted as four, which is reasonable.

4.4 "Installation-related Technical Decisions" - Element 220.7

There is no indication that the crafts or any other TVA Construction personnel assumed responsibilities beyond those called for in the applicable FCR procedure, or that Engineering revised design drawings without required analysis or evaluation.

4.5 "Oversizing of Pipe Support Steel and Slick Grinding of Welds" - Element 220.9

It is possible that a pipe support member may have appeared to be oversized for the load; however, there are other design requirements, such as deflection/rigidity, that need to be met. Although a properly performed slick-ground weld is not an undesirable condition, the practice of slick grinding is unnecessary and has been discontinued by TVA.

4.6 "Replacement Hangers" - Element 220.10

TVA has a quality control procedure (QCP) (Ref. 32) which requires verification that the pipe supports are installed within specified tolerances. Any changes (out of tolerance, replacement, or deletion) are evaluated and documented by field change requests (FCRs) and engineering change notices (ECNs).

4.7 "Temperature Variation Consideration" - Element 220.11

Additional loading due to the thermal expansion of structural members restrained between two rigid points was not considered at Sequoyah, Watts Bar, Browns Ferry, and Bellefonte because it was not a code requirement. However, if the temperature variation is considerable, a support configuration that is thermally restrained could experience considerable thermal loading. Watts Bar has since addressed this condition in its corrective action for Problem Identification Report (PIR) WBN CEB8536. There is no indication that this restraint condition exists at Browns Ferry. Bellefonte has addressed this thermal restraint condition in its corrective action for PIR BLN CEB8512.

Pipe expansion imposed loads on the supports are considered at Sequoyah, Watts Bar, Browns Ferry, and Bellefonte and are addressed in the applicable pipe stress analysis and support criteria.

4.8 "Technical Review" - Element 220.12

Technical review after the checker's review is not required by applicable TVA procedures. These procedures meet the licensing commitments for design calculation verification required by 10 CFR 50 (Ref. 4) and ANSI N45.2.11-1974 (Ref. 5). In addition, TVA (civil engineering branch chief) had conducted an independent review of WBN pipe support calculations to verify technical adequacy and compliance with pertinent controlling documents and procedures (Ref. 48).

4.9 Summary of Subcategory Findings

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 actions. The corrective action class, defined in the Glossary Supplement, is identified in the table by the numeral combined with the finding class. For element 220.3, some of the issues were found to be invalid, although corrective action was still required for the documentation and/or procedures. These findings requiring corrective action were classified as "E"; however, they cannot be genuinely classified as peripheral because of the integral relationship with the stated issue. In addition, for element 220.11, issue "c" was classified as "B" because Browns Ferry took immediate corrective action after 1975 and no further action was required.

The summary of findings by classification is given in Table 2. Where more than one finding/corrective action classification is listed in Table 1 for a single issue/finding, Table 2 counts only the classification that has the greater impact on the Employee Concerns Program. Thus for element 220.3, the "D" classification would be chosen over the "C" and the "E" classification over the "A." Therefore, Table 2 identifies only one finding/corrective action classification for each issue evaluated.

For Table 2 it can be seen that the majority of issues were not valid. Approximately half of the issues requiring corrective action have corrective action plans that were initiated by TVA before the ECTG evaluation. This is an indication that TVA is responsive in acting to correct known deficiencies. The most important finding, that Watts Bar did not meet code stress allowables, resulted from the ECTG evaluation.

(-SOUTH-)ngs requiring corrective action resulting from peripheral issues occurring at Sequoyah, Browns Ferry, and Bellefonte dealt basically with design documentation. Although the supports were found to be adequately designed, the design calculation documentation was not always complete and/or contained minor discrepancies.

In addition, the subject of irretrievable calculations is addressed in Subcategory Reports 21200 and 22100. (This subcategory report [22000] deals mainly with technical, not documentation issues.)

5. CORRECTIVE ACTIONS

The corrective actions for Sequoyah, Watts Bar, Browns Ferry, and Bellefonte along with their finding/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. The table indicates the plant or plants to which a corrective action is applicable by the Corrective Action Tracking Document (CATD) column, where the applicable plant is identified by the CATD number. The corrective action plans are summarized in the following paragraphs.

5.1 "'A' Series Hanger Drawings and 0-50 Notes" - Element 220.1

For Sequoyah, the differences between the construction specification and operations maintenance instruction will be reconciled. For Watts Bar, calculations for justification of the WBN 47A050 notes will be provided; and WBN Engineering (DNE) will reinform Construction (DNC) and Quality Control (DNQC) by memo of the programs in place to help resolve 47A050 note interpretational differences.

5.2 "Design of Pipe Supports" - Element 220.3

For Sequoyah, calculations will be performed for the nine pipe supports. For Watts Bar, code stress allowables will be met, and engineering judgment will be properly documented for all engineered pipe supports under its unit 1 Hanger and Analysis Update Program (Ref. 54) and a similar program for unit 2. The four Watts Bar pipe supports not meeting code stress allowables will be reevaluated. For Browns Ferry, the Box Anchor Criteria and Pipe Support Handbook are to be issued. The Long-Term Torus Integrity Program criteria are to be revised to include deflection/rigidity and punching shear requirements. The Browns Ferry pipe support calculation lacking analysis for the critical base plate is to be revised. For Bellefonte, FSAR Table 3.9.3-37 (Ref. 52) will be revised to include load and allowable stress for the upset (primary plus secondary) condition. The computer output for the eight identified Bellefonte calculations will be retrieved by ITT Grinnell.

Complete documented justification will be provided for the 3GA0059 series notes. Two-sided welds on tubing at Bellefonte will be evaluated and modified if required. The punching shear requirement will be incorporated into Civil Design Standard DS-C1.6.1 (Ref. 55), which covers all plants and applicable design criteria. Generic evaluations were performed on previously generated calculations for punching shear.

5.3 "Temperature Variation Consideration" - Element 220.11

For Sequoyah, steel supports with the identified condition that restrains thermal growth will be evaluated and modified as necessary. For Watts Bar, corrective action for this restraint condition is provided by PIR WBN CEB8536 (Ref. 36), which includes the activities as described for Sequoyah. For Browns Ferry, no corrective action is required. For Bellefonte, corrective action for this restraint condition is provided by PIR BLN CEB8512 (Ref. 56).

5.4 Summary of Subcategory Corrective Actions

From the Finding/Corrective Action Classification column of Table 3, it can be seen that all seven corrective actions identified require some type of documentation remedy. In addition, the CATD column of the table shows that, in most cases, a particular corrective action is applicable to only a single plant. The element requiring the most corrective actions is 220.3, Design of Pipe Supports. There is a potential for the corrective actions for the Element 220.3 to result in physical (hardware) modification of supports. Finally, with respect to corrective actions, Table 3 shows that, of the eight elements in this subcategory, five require no corrective action (namely, 220.6, 220.7, 220.9, 220.10, 220.12).

The corrective action plans provided by TVA are found to be acceptable by the evaluation team to resolve the negative findings.

6. CAUSES

Table 3 identifies one or more causes for each negative finding requiring corrective action. For each corrective action, the most important cause is identified; however, in many instances it was felt that the problem was the result of a combination of causes, each of which should be identified. In those cases, more than one cause is identified for some of the corrective actions.

The bases for identifying specific causes for each corrective action description in Table 3 and the linkage with the findings are described in the following paragraphs.

6.1 "'A' Series Hangers and O-50 Notes" - Element 220.1

- o The differences between Sequoyah M&AI-11 and General Construction Specification G-43 (applicable to all plants) are caused by lack of comparability between the two documents.
- o The subject Watts Bar calculation for the justification of the 47A050 notes is specified as an "Inadequate Calculation" in Table 3 because the necessary analysis was not performed, and engineering judgment, as well as test data and reference material, were not properly documented.
- o 47A050 note interpretational differences at Watts Bar are a result of "Inadequate Q-training" and "Inadequate Communication." Personnel are not fully aware of the programs in place to resolve these differences in interpretation.

6.2 "Design of Pipe Supports" - Element 220.3

- o The subject Sequoyah pipe supports calculations are "Inadequate Calculations" because procedures were not followed, engineering judgments were not properly documented, and there was an overall lack of completeness.
- o Calculations at Watts Bar are "Inadequate Calculations" because engineering judgments were not being properly documented and design procedures were not being followed.
- o The four Watts Bar pipe supports do not meet code stress allowables because design procedures were not being followed and engineering judgments were not properly documented.
- o The punching shear requirement for tube steel is not included in the design criteria of all four plants. The cause is specified (in Table 3) as "Inadequate Procedure" although the requirement is not a code commitment.
- o Browns Ferry is to complete its commitment to issue the Box Anchor Design Criteria and Pipe Support Handbook. In this case, it is normal handling of documentation. Browns Ferry will revise criteria BFN-50-D706 to include the deflection/rigidity requirement. These criteria were inconsistent with other Browns Ferry pipe support criteria (which included this requirement). However, on the basis of industry standards during plant construction, a deflection/rigidity evaluation was not a code requirement.

- o The calculation for Browns Ferry support RHR-159, unit 3, is an "Inadequate Calculation" because it lacked the analysis for critical base plates and assumptions on which engineering judgments are based.
- o The design load and allowable stress for the upset (primary plus secondary) condition were inadvertently left off Bellefonte FSAR Table 3.9.3-37 but were included in the design criteria.
- o The eight Bellefonte pipe support calculations, whose computer output is with ITT Grinnell, cannot be considered complete. Justification for some of the 3GA0059 notes may have been qualified by engineering judgments but not documented.
- o At Bellefonte, the shorter flat (installed) length of weld to tube steel is not considered in the design calculations. It is possible that designers were not aware of this site practice.

6.3 "Temperature Variation Consideration"- Element 220.11

- o The identified restrained thermal condition for pipe supports at all four plants was not considered because it was not a requirement specified in the design criteria. The cause is noted as "Inadequate Procedure" although this requirement is not a code commitment.

6.4 Summary of Subcategory Causes

In summary, considering the significance of the findings and corrective actions, it would appear that the most important cause would be "Inadequate Calculations." The "Inadequate Calculations" are also a result of procedures not being followed and failure to document engineering judgment. These causes point to an overall lack of attention paid to the adequate documentation of calculations required to demonstrate adherence to design commitments.

7. COLLECTIVE SIGNIFICANCE

The concerns expressed by TVA employees and covered in this subcategory resulted in approximately a third of the 42 findings (from Table 2) requiring corrective actions. Corrective action for approximately half of these findings had been initiated by TVA before the ECTG evaluation.

The findings for Sequoyah and Watts Bar 47A050 notes, and Bellefonte 3GA0059 notes and FSAR require only documentation corrective action. They do not directly impact the design of pipe supports, and, therefore, are of relatively minor significance.

Also of minor significance are the findings for punching shear and thermal considerations. Consideration of punching shear on support design has little effect on the overall member stresses because of the nature (configuration and size) of pipe supports. Thermal loads (due to environmental temperature) also have little impact on the overall member stresses provided that the configuration of the support structure is such that thermal stresses are self-relieving (i.e., structural members are allowed, to a degree, to thermally expand without restraint or undergo local yielding/distortion to relieve these stresses).

In the cases where the support structure is restrained from thermal expansion (e.g., member between two concrete walls), there is the possibility of member overstress. However, TVA has committed to evaluate and modify, if necessary, such cases. In addition, for Browns Ferry, although deflection/rigidity must be considered in the design of seismic pipe supports, this requirement in general is not the governing design factor.

The pipe supports reviewed by the evaluation team were adequately designed to applicable design criteria, with the exception of four Watts Bar pipe supports. The calculations were not always properly documented. Failure to document engineering judgment, analysis, or other related data (test data, memorandums, reports, etc.) was the most prevalent cause of the calculational deficiencies. It was observed that the items most frequently not documented were relatively minor and had little impact on the overall analysis of the supports. Therefore, pipe support design does not represent a significant technical or safety problem for Sequoyah, Browns Ferry, and Bellefonte. However, TVA is aware of the need for proper documentation in the area of pipe support design, and has initiated corrective action to improve the quality of the documentation.

Of technical significance are the four Watts Bar supports that do not meet code stress allowables. It was evident that design procedures were not properly followed, and thus design commitments were not met. However, Watts Bar had committed to reevaluating these support and providing hardware modifications if necessary. In addition, Watts Bar's commitment under its Hanger and Analysis Update Program (and similar program for unit 2) extends to all engineered pipe supports. Under this program, TVA will identify and correct document deficiencies, and if required, provide hardware modifications.

On the basis of these conclusions, the subject matter of this subcategory report does not require specific treatment in the TVA Nuclear Performance Plan. The results of this subcategory report are being combined with the other subcategory reports and reassessed in the Engineering category evaluation.

TABLE 1
CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

Element	Issue/ Finding**	Finding/Corrective Action Class*			
		SON	WBN	BFN	BLN
220.1 "A" Series Drawing and 0-50 Notes	a	A	C3	-	-
	b	A	C2	-	-
	c	C2	A	-	-
	d	-	A	-	-
	e	-	A	-	-
	f	-	A	-	-
220.3 Design of Pipe Supports	a	A	C2	A	A
		E5	C3	E2	E2
		-	D5	-	E3
		-	-	-	E5
	b	A	A	A	A
		-	-	E2	-
	c	A	A	A	A
		-	-	E2	-
	d	A	A	A	A
		-	-	E5	-
e	-	-	-	E3	
220.6 Revisions to Hanger Designs	a	-	A	-	-
220.7 Installation-related Technical Decisions	a	-	A	-	-
	b	-	A	-	-
220.9 Oversizing of Pipe Support Steel and Slick Grinding of Welds	a	-	A	-	-
	b	-	B	-	-
220.10 Replacement Hangers	a	A	-	-	-

* Explanation of classes is on the next page.
** Defined for each plant in Attachment B.

TABLE 1 (Continued)

Element	Issue/ Finding**	Finding/Corrective Action Class*			
		SON	WBN	BFN	BLN
220.11 Temperature Variation Consideration	a	C5	C5	A	C5
	b	A	A	A	A
	c	-	-	B	-
220.12 Technical Review	a	-	A	-	-

*Classification of Findings and Corrective Actions

- | | |
|--|---|
| <p>A. Issue not valid.
No corrective action required.</p> <p>B. Issue valid but consequences acceptable.
No corrective action required.</p> <p>C. Issue valid. Corrective action
initiated before ECTG evaluation.</p> <p>D. Issue valid. Corrective action
taken as a result of ECTG evaluation.</p> <p>E. Peripheral issue uncovered during ECTG
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>SNQ</u>	<u>WBN</u>	<u>BFN</u>	<u>BLN</u>	
A. Issue not valid. No corrective action required.	7	13	3	4	27
B. Issue valid but consequences acceptable. No corrective action required.	0	1	1	0	2
C. Issue valid. Corrective action initiated before ECTG evaluation.	2	3	0	1	6
D. Issue valid. Corrective action taken as a result of ECTG evaluation.	0	1	0	0	1
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.	1	0	3	2	6
Total	10	18	7	7	42

* Note: This table summarizes information extracted from 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 22000

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

ATTACHMENT A

EMPLOYEE CONCERNS FOR SUBCATEGORY 22000

REVISION NUMBER: 3

PAGE A-2 OF 4

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION*
			SQN	WUN	BFN	BLN	
220.1	IN-85-010-002	WUN		X			"Hanger Quality Control O-50 notes (Evaluations) did not satisfy inspection criteria. There was an NRC violation written against Q.C. pertaining to this item. C/I has previously expressed this concern to INPO, NRC and NSRS. C/I would not provide any additional info. to ERT because C/I feels it would be a waste of time to investigate this since he has previously reported it to INPO,NRC,NSRS." (SR)
	IN-85-024-001	WUN	X	X			"*A* series hanger drawings and O-50 notes are contradictory and allow hangers or box anchors or structural features to be acceptable, even when they do not conform to the requirements of drawings details. The O-50 notes are misinterpreted by all those who utilize them." (SR)
	IN-85-052-001	WUN		X			"Drawing series A-O-50 notes are written to cover up problems during the hanger installation and inspection activities. An example: unit 1 & 2 system 6B, AZD2 [sic] degrees, R 40'-6". Hanger #47A455-3-52 [sic]." (SR)
	IN-85-413-001	WUN		X			"Hanger *O50* notes are routinely written and utilized to override inspection rejections of hangers, and are so vaguely written that they provide what amounts to an "open door" to hanger construction discrepancies. The interpretability of *O50* notes results in frequent disagreements between Construction and Inspection, which causes friction and delays in construction. This is a generic concern. Individual was unable to provide specifics, or any further details." (SR)
	IN-85-932-001	WUN		X			"*O50* notes are too numerous and too lax - have too much latitude on acceptance criteria. Some notes appear to conflict (EG #30 and #100). Notes are too open to interpretation. Ease of engineering overriding or rejection based on apparent conflict between notes 30 and 100." Details known to ERT, withheld due to confidentiality. C/I has no further information." (SR)
	IN-86-249-001	WUN		X			"The O50 notes should be discontinued and those "exceptions" listed on applicable controlled inspection check lists. Construction dept. concern. CI has no further information." (NU)
	IN-85-445-013	WUN		X			"Drawing notes in the *47-A05* series are hard to use: They are hard to interpret, too numerous, and are still being revised (...EG FCR-1-2394 just changed notes to allow clear support length of 6'9" instead of previously allowed 5'6" on conduit supports). CI has no more information. Construction department concern." (SR)

* SR/NU/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 A

EMPLOYEE CONCERNS FOR SUBCATEGORY 22000

REVISION NUMBER: 3
PAGE A-3 OF 4

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION*
			SQN	WBN	BFN	BLN	
220.1 (Cont'd)	PH-85-006-001	WBN		X			"Hanger Inspector utilize a locally generated hand book by management called O-50 notes. These notes authorize variations to hangers from the original design/drawing prior to the submission of the FCR. The FCR is submitted and approved then a change is submitted to the O-50 notes." (SR)
220.2			-	-			DELETED
220.3	OW-85-007-006	WBN		X			"Seismic supports were designed improperly. They are rigid and will fail during a seismic event and will damage other components." (SR)
	00-85-005-008	SQN	X	X	X	X	"Sequoyah seismic supports are not designed properly. They are rigid and will break loose during a seismic event and will fall down and damage other equipment, as well as failing to support their respective components. CI has no further information. Construction Department Concern." (SS)
	PH-85-003-005	WBN		X			"Supports are not properly designed throughout Watts Bar." (SR)
	1N-85-886-001 (shared with 20100 and 20400)	WUN	X	X	X	X	"TVA designs were not developed well enough to be constructible 1) Design changes are still being instituted in areas where there should have been minimal changes especially in area of conflicts between TVA and Vendor Drawings. 2) Engineering design criteria is often nonexistent, particularly for Seismic Hanger design. Many design criteria or acceptance criteria are still being changed. This is generic concern. Any further information would divulge confidentiality. Construction dept. concern. CI has no further information." (SR)
220.5			-	-			DELETED
220.6	1N-85-089-002	WUN		X			"Some hanger designs have as many as 100 revisions. Concerned they are not adequately controlled in addition concerned with excess cost. CI wants to be contacted on site during lunch time by ERT investigator. At that time, CI will provide additional information and will show ERT specific examples in the plant." (SR)
220.7	WI-85-091-015 (shared with 20400)	WUN		X			"TVA leaves too many technical decisions up to the crafts' discretion, e.g. craft design the hanger and then engineering does the as-constructed drawing. CI has no further information. Construction Dept. concern." (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 A

EMPLOYEE CONCERNS FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY				CONCERN DESCRIPTION*
			SON	WBN	BFN	BLN	
220.8			-	-			DELETED
220.9	IN-85-316-002	WUN		X			"TVA engineers over design the hardware. Examples: 5"x5"x1/2" tube steel is used to hold up a 1" diameter pipe; also the former practice of slick grinding welds (in '78 through '80). CI has no further information. Const. Dept. concern." (NO)
220.10	IN-85-672-004 (shared with 11100)	WUN		X			"Replacement hangers often differ from the original. Some hangers are removed but not replaced: depending on the engineer. CI declines to provide further information." (SR)
220.11	IN-85-103-002	WBN	X	X	X	X	"In several cases, temperature variations were not considered in pipe/hanger calculations for thermal stress. No further information available in file. Construction department concern." (SR)
220.12	IN-85-103-003 (shared with 20400)	WUN		X			"For Pipe/Hanger calculations, no technical review is performed after checkers have reviewed them. (No further information in file)". (NO)
220.13			-	-			DELETED
220.14			-	-			DELETED

* 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 22000

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

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

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 220.1

- 'A' Series Hanger Drawings and O-50 Notes

SQN

- a. 47A050 notes are contradictory to 'A' series hanger drawings. They allow hangers, box anchors, and structural shapes to be accepted even though they do not conform to the design requirements.
- b. 47A050 notes are written in such a way that they can be misinterpreted.
- c. There are discrepancies between 47A050 notes and other installation documents.

SQN

- a. The 47A050 notes (Ref. 1) were found not to be contradictory to the sample of "A" series drawings (Ref. 9) reviewed by the evaluation team. The primary purpose of the 47A050 notes is to allow flexibility in installation, and hence, flexibility in acceptance inspection.
- b. The evaluation team reviewed the 47A050 notes to determine if they can be misinterpreted. These notes were found to be concise, clear, and easy to interpret.
- c. The evaluation team examined the installation documents, Construction Specification G-43 (Ref. 6) and Modification and Additions Instruction M&AI-11 (Ref. 7). No conflicts were found between the 47A050 notes and these documents. However, G-43 and M&AI-11 have some differences in specifying pipe support location tolerances.

SQN

- a. No corrective action is required.
- b. No corrective action is required.
- c. In its corrective action plan (CAP) for CATD 220 01 SQN 01 (TCAB-015, 11/26/86), TVA is currently reviewing Modification and Additions Instructions (M&AIs) under the specification improvement plan. M&AI-11 and Construction Specification G-43 are included in this review. The differences between M&AI-11 and G-43 will be reconciled.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues	Findings	Corrective Actions
Element 220.1 - WBN	WBN	WBN
a. NRC wrote violations against the 47A050 notes that these notes did not satisfy the inspection criteria as stated in Concern IN-85-010-002.	a. Based on NSRS investigations (NSRS report IN-85-010-002, Ref. 8), no NRC violations against the 47A050 notes were identified. However it was found that prior to 09/85 some of the 47A050 notes did not have adequately documented justification. EN DES calculation WBP 830914230 for the note changes before 10/83 does not provide adequately documented justification for all the notes. TVA has identified the need to provide detailed calculations for the changes to the notes (after 09/85) (Ref. 57), and to adequately document engineering judgment (Ref. 58). No definite commitments were made by TVA concerning documentation of justification for changes made prior to 09/85. Review of six calculations generated after 09/85 (Ref. 12) found them to be complete and adequately documented.	a. In its corrective action plan for CATD 220 01 WBN 01 (TCAB-253 03/11/87), TVA regards the calculations for justification of the 47A050 notes as part of the missing or partial calculations to be addressed in significant condition report (SCR) SCRWBNCB8531 (revision 1, 01/14/86). In implementing action for the SCR, each note will be reviewed for the existence of adequate documented justification (reference TVA/Bechtel telecon IOM 742, 03/05/87). For consistency and ease of future revision, each 47A050 note is to have an individual calculation package (CATD 220 01 WBN 01). If no analysis is required, it will be so stated in the calculation. It is noted that SCRWBNCB8531 pertains to Unit 1 calculations; however, since the notes are common to both Units 1 and 2, a separate review for Unit 2 is not required. An existing note which is found unjustifiable or unacceptable will be documented as a Condition Adverse to Quality (CAQ) and will be resolved by applicable procedures. Notes generated or revised after September 1985 have calculations that contain adequate documented justification. This demonstrates adherence to the requirements of Nuclear Engineering Procedure NEP-3.1 (07/01/86) formerly UEP-07 (Ref. 59), thus preventing recurrence of this deficiency.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000.

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 220.1 - WBN (Continued)

- | | | |
|--|---|--|
| <p>b. 47A050 notes are written in such a way that they are contradictory to 'A' series drawings, and can be misinterpreted as stated in Concerns IN-85-024-001, IN-85-932-001, IN-85-413-001, and IN-85-445-013. Some notes appear to conflict; e.g., notes 30 and 100, cited in Concern IN-85-932-001. The interpretability of the "050" notes causes conflicts between Construction and Inspection as stated in Concern IN-85-413-001.</p> | <p>b. The 47A050 notes (Ref. 2) were found not be contradictory to the sample of "A" series drawings (Ref. 10) reviewed by the evaluation team. A general revision was made to the 47A050 note series drawings in 09/85, to clarify ambiguous notes, resolve conflicting notes (including notes 30 and 100) and remove any that were unnecessary. Although TVA has a training program (Ref. 60) in place to ensure consistent understanding and interpretation of the notes, it was found through site interviews (Ref. 11) that there are still interpretational differences between Construction and Quality Control.</p> | <p>b. In addition to its QA training program, TVA has several other programs established to help resolve 47A050 note interpretational differences. These include IRN trend analysis, DNE/DNC biweekly meetings which have been held for almost 2 years (memorandum L. Roddy to Project Files, 11/20/86)(Ref. 61), and the presence of an onsite engineering team. To make personnel in the Division of Nuclear Quality Assurance (DNQA) and the Division of Nuclear Construction (DNC) further aware of these programs, the Division of Nuclear Engineering (DNE) has committed in the CAP for CATD 220.01 WBN 01 (TCAB-253) to issue a memorandum so stating. For new personnel beginning work in DNQA or DNC(MODS)/DNC and work in an area related to the 47A050 notes, it is standard practice for them to be indoctrinated to the notes.</p> |
| <p>c. 47A050 notes are too numerous and have too much latitude on hanger acceptance criteria as stated in Concern IN-85-932-001 and IN-85-445-013.</p> | <p>c. The 47A050 series drawings consolidate and organize supplementary notes for various types of supports into one convenient set of documents. Because of the broad scope covered, the 47A050 notes are not too numerous.</p> <p>Furthermore, some notes prior to the 09/85 general revision may have had too much latitude on acceptance criteria, but have been revised, and are now reasonable and acceptable. Hence, from the engineering/design standpoint, the notes currently do not have too much latitude on acceptance criteria.</p> | <p>c. No corrective action is required.</p> |

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 220.1 - WBN (Continued)

- | | | |
|--|--|---|
| <p>d. 47A050 notes are routinely changed and utilized to override rejection of unaccepted hangers during installation and inspection activities; (e.g., the hanger cited in Concern IN-85-052-001). This issue is also stated in Concerns IN-85-024-001, IN-85-413-001, and IN-85-445-013. FCR-1-2394 changed notes to allow a greater support length as cited in Concern IN-85-445-013.</p> | <p>d. The primary purpose of the 47A050 notes is to allow flexibility in installation, and hence, flexibility in acceptance inspection. Modifications to the notes are initiated when deemed necessary by Construction (via an FCR) and/or Engineering. The notes are amended for various reasons, such as to provide resolution for a generic installation difficulty, thus reducing the number of future FCRs for a certain condition and the possibility of rejections by IRNs.</p> <p>In the specific situation of the acceptance of pipe supports 2U-68-A46513-32 and 10-68-A465-3-4B, which were incorrectly referenced in concern IN-85-05-001 (actual support number is 47A 465-3-52, Ref. 64), the oversized welds were found to be within the tolerances of 47A050 note 50 and specification G-29C. A conflict between note 50 and QC procedure QCP 4.13 was found (Ref. 8; NSRS report IN-85-532-006). This conflict was resolved and note 50 governs (Ref. 62). QCP 4.13 will be revised to state that the Engineering Drawing (47A050) governs over G-29C (change document WBN RR-403).</p> <p>FCR 1-2394 (Ref. 63) (referenced in concern IN 85-445-013) does not pertain to conduit clear support lengths or the 47A050 notes. TVA was unable to locate an FCR that addresses the specific change in the length between conduit supports.</p> | <p>d. No corrective action is required.</p> |
| <p>e. The 47A050 notes should be discontinued and the design tolerances should be specified in the controlled inspection checklists, as stated in Concern IN-86-249-001.</p> | <p>e. The 47A050 notes are a single document created by Engineering for the use of different groups under Construction (fabrication, installation, and inspection). The evaluation team feels that discontinuance of these notes would cause inefficiencies in terms of implementing a generic change. Furthermore, at this stage of plant development, it is not prudent or beneficial to discontinue the notes.</p> | <p>e. No corrective action is required.</p> |
| <p>f. In some cases, 47A050 notes authorize changes to design drawings prior to generation of a FCR, as stated in Concern PH-85-006-001.</p> | <p>f. If a given deviation/tolerance/change is already allowed by the 47A050 notes, then no additional FCR is required because the notes are supplements to the design drawings. NSRS Report 1-85-14B-WBN (Ref. 8), which addresses concern PH-85-006-001 states that, in some instances, the 47A050 notes are revised via FCRs when Construction requires changes to resolve generic difficulties in installation. The FCRs are approved by Engineering before they are used for QC inspection of hangers. The changes are performed in accordance with applicable design change procedures.</p> | <p>f. No corrective action is required.</p> |

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues	Findings	Corrective Actions
Element 220.1 - BFN (N/A)	BFN (N/A)	BFN (N/A)
BLN	BLN	BLN
See BLN Element 220.3 peripheral finding "e" for 3GA0059 series notes. (These notes serve the same purpose as the SQH/WBN 47A05U notes.)	(N/A)	(N/A)
***** Element 220.3 - Design of Pipe Supports *****		
SQH	SQH	SQH
a. Seismic supports are designed inadequately.	a. The SQH pipe support design criteria (Ref. 14) adequately address the seismic design requirements. Some calculations (Ref. 18) for seismic supports were observed to be incomplete (they were supplements to the original calculations), and some calculations lacked documentation of engineering judgment used. The supports with complete calculations were found to be adequately designed for seismic design requirements. Punching shear requirements are not included in the pipe support design criteria (reference: Policy Memorandum PM 86-04, Ref. 58). Design requirements for base plates and anchorage bolts (base plate flexibility, maximum unnormalized load, and construction tolerances) were not specifically addressed in this report because the requirements are within the scope of and addressed by Construction Subcategory Report 10400.	a. In its corrective action plan for CATD 220 03 SQH 01 (TCAB-035, 12/18/86), TVA commits to perform calculations for the observations noted in nine pipe supports identified in the Element Report. These calculations will demonstrate that the seismic design criteria have been properly implemented in SQH pipe support designs. Corrective action is provided by the CAP for CATD 220 03 NPS 01 (TCAB-641, 08/06/87). See Bellefonte element 220.3. For applicable corrective action see Construction Subcategory Report 10400.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues

Findings

Corrective Actions

Element 220.3 - SQN (Continued)

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

b. The issue that seismic supports are too rigid has been addressed in NSRS Report No. 1-86-131-SQN (Ref. 13). This report states that:

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

The NSRS report concluded that seismic pipe supports are designed to carry loads based on piping analysis that assumes the supports are rigid. Furthermore, the supports are sufficiently designed to prevent them from breaking loose during a seismic event. The evaluation team concurs with the NSRS report. Rigidity/deflection requirements are properly addressed in the seismic pipe support design criteria.

b. No corrective action is required.

c. No corrective action is required.

c. Pipe support designs are not constructible.

c. Two likely conditions that affect the constructibility of support designs are:

- o Installation interference with other commodities and plant features
- o Incomplete drawings issued to Construction (the issue of incomplete drawings is addressed in detail in element evaluation 222.3)

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

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues	Findings	Corrective Actions
Element 220.3 - SQN (Continued)		
d. Seismic support design criteria are nonexistent.	The evaluation team reviewed a sample of pipe supports drawings to verify if they were complete. The support drawings (Ref. 22) were examined for the presence of correct weld symbols, bill of materials, sufficient dimensional information, and clear design details, etc. The drawings reviewed were found to be basically complete, and therefore, constructible. d. SQN seismic support design criteria have existed since August 1975.	d. No corrective action is required.
WBN	WBN	WBN
a. The pipe supports are not designed adequately.	a. In the evaluation team's review of calculations for 28 pipe supports (Ref. 19), 24 supports were found to be adequately designed based on applicable WBN design criteria. Analysis by the evaluation team of four supports (47A060-3-23, 47A060-70-27, 1-63-404, and 1-74-11) was required because of the application of incorrect loads and load sign combinations. As a result, these four supports were found to have overstressed members, base plates, welds, and anchor bolts exceeding the maximum interaction value. Some of the calculation documentation for the sample of 28 pipe supports was found to be incomplete and/or to contain minor discrepancies (missing documentation for consideration of punching shear, spring top out/bottom out, swing angle, member stresses, etc.). Findings on AISC minimum weld requirements (Ref. 65) and welding on two opposite sides of tubing are addressed in WBN evaluations for elements 222.6(A) and 221.7(A).	a. TVA will re-evaluate the designs of the four pipe supports not meeting code stress allowables in an effort to discover specific causes of their deficiencies. If warranted, the causes are to be referenced in the WBN Pipe Support Design Manual (Ref. 26) for future avoidance. TVA will perform any physical modification required to meet code stress allowables for the four supports. This portion of the corrective action will be initiated and tracked by Problem Identification Report PIR WBN WBP 8731 (02/18/87). In its corrective action plan for CATD 220 03 WBN 01 (TCAB-213, 02/25/87), TVA will ensure that code stress allowables are met for all engineered pipe supports through the Unit 1 Hanger and Analysis Update Program. The scope of this program also includes completion of missing documentation. Unit 2 pipe supports are to be evaluated later under a similar program (also tracked by CATD 220 03 WBN 01). ONE policy memorandum PM 86-04 (Ref. 50) requires that engineering judgment will be properly documented.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

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Issues

Findings

Corrective Actions

Element 220.3 - WBN (Continued)

Design requirements for base plates and anchorage bolts (base plate flexibility, maximum unnormalized load, and construction tolerances) were not specifically addressed in this report because the requirements are within the scope of and addressed by Construction Subcategory Report 10400.

For applicable corrective action, see Construction Subcategory Report 10400.

Punching shear requirements are not included in the pipe support design criteria (reference: Policy Memorandum PM 86-04).

Corrective action is provided by the CAP for CATD 220 03 NPS 01 (TCAB-64), 08/06/87). See Bellefonte element 220.3.

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

b. The issue that seismic supports are too rigid has been addressed in NSRS Report I-86-131-SQH. This report states that:

b. No corrective action is required.

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

The NSRS report concluded that seismic pipe supports are designed to carry loads based on piping analysis that assumes the supports are rigid. Furthermore, the supports are sufficiently designed to prevent them from breaking loose during a seismic event. The evaluation team concurs with the NSRS report. Rigidity/deflection requirements are properly addressed in the seismic pipe support design criteria.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
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Issues	Findings	Corrective Actions
Element 220.3 - WBN (Continued)		
c. Pipe support designs are not constructible.	c. Two likely conditions that affect the constructibility of support designs are: <ul style="list-style-type: none"><li data-bbox="661 440 1266 483">o Installation interference with other commodities and plant features<li data-bbox="661 509 1278 578">o Incomplete drawings issued to Construction (the issue of incomplete drawings is addressed in detail in element evaluation 222.3) <p data-bbox="661 602 1278 764">It is possible that some supports could not be installed during construction because of interference with other commodities. Such interference problems are common during the course of the design and construction of nuclear power plants. Modification of a support design caused by interferences does not indicate a lack of constructibility in the initial design.</p>	c. No corrective action is required.
d. Seismic support design criteria are nonexistent.	d. Watts Bar seismic support design criteria have existed since August 1975.	d. No corrective action is required.

ATTACHMENT B
SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

REVISION NUMBER: 3
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Issues	Findings	Corrective Actions
<p>Element 220.3 - BFN</p> <p>a. Seismic pipe support design criteria are nonexistent. (Concern IN-85-886-001)</p> <p>b. Seismic pipe supports are too rigid and will break loose during a seismic event and will fall on other equipment and damage it. (Concern 00-85-005-008)</p>	<p>BFN</p> <p>a. Seismic design criteria for engineered pipe supports did not exist for BFN prior to 1980. Supports were designed using industry standards. The present BFN criteria BFN-50-724 (Ref. 16) adequately address seismic pipe support design criteria. TVA has not completed its commitment to issue criteria for box anchors and a pipe support handbook.</p> <p>b. The issue that seismic supports are too rigid has been addressed in NSRS Report 1-86-131-SQH. This reports states that:</p> <p style="padding-left: 40px;">"In seismic analysis of piping systems, supports (including snubbers) are assumed to be absolutely rigid (zero deflection under load). The support loads are developed based on an amplified response of the flexible piping. As long as supports are 'more rigid' (have higher frequencies) than the piping or the dominant seismic frequencies, the zero deflection assumption in the analysis does not cause a significant error in support load calculations [The supports are designed taking into account the above described support load,] and the flexibility of the support is maintained by limiting support deflection to 1/16 inch under the design load."</p> <p>The NSRS report concluded that seismic pipe supports are designed to carry loads based on piping analysis that assumes the supports are rigid. Furthermore, the supports are sufficiently designed to prevent them from breaking loose during a seismic event. The evaluation team concurs with the NSRS report. Rigidity/deflection requirements are properly addressed in the seismic pipe support design criteria.</p> <p>Because of the absence of deflection/rigidity requirements in key design criteria (BFN-50-706), seismic pipe supports may have been designed not "rigid" enough to validate pipe stress analysis rigidity assumptions. (This condition has also been identified by a SCR BFN CEB 8508 and an NRC finding, Ref. 66.)</p>	<p>BFN</p> <p>a. In its corrective action plan for CATD 220 03 BFN 01 (TCAB-441, 07/18/87), TVA commits to issue BFN Box Anchor Design Criteria and Pipe Support Design Handbook by 08/31/87. The handbook will address deflection/rigidity and punching shear requirements.</p> <p>b. TVA also commits (under CAP for CATD 220 03 BFN 01, TCAB-441) to revise BFN-50-706, "General Design Criteria for the Torus Integrity Long-Term Program," to include deflection/rigidity and punching shear requirements. BFN has also initiated the Calculation Verification Review Program (Ref. 49) to review pipe support calculations. (This program documents corrective action for several Conditions Adverse to Quality, CAQs, SCRs, and PIRS. The program is tracked by these documents.) If required, pipe supports will be modified. Under this review, the pipe supports (including RCIC H62 unit 3 and RCIC R51 unit 2) will be evaluated for punching shear and deflection/rigidity requirements. Revision of criteria BFN-50-0706 and issuance of the Pipe Support Design Handbook will prevent recurrence.</p>

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SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
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Issues

Findings

Corrective Actions

Element 220.3 - BFN

BFN

Seismic pipe supports except those under the LTTIP will be evaluated for deflection/rigidity requirements specified in BFN-50-724 under the IEB 79-02/79-14 program (Ref. 67). Currently LTTIP criteria contain no pipe support deflection/rigidity requirements. BFN CEB has committed to evaluate LTTIP pipe support calculation for BFN-50-724 deflection/rigidity requirement under its internal calculation verification review program. This will establish the validity of the pipe stress analysis rigidity assumptions and accuracy of the pipe support loads.

c. Seismic pipe supports are designed inadequately. (Concern 00-85-005-008)

c. From the evaluation team's review of calculations for 31 pipe supports from this element (Refs. 20 and 21) and 10 from subcategory 22100 for element 221.7, supports were found to be adequate for the specified loads. Although the pipe supports were found to be adequate, their associated calculations were found to be incomplete and/or contained minor discrepancies (punching shear is not considered for tube-to-tube connections, and baseplate flexibility is not considered in the evaluation of anchor bolts). The calculation for support RHR R159 unit 3 did not state the basis for the assumption used to qualify the shear force on the anchor bolts, and did not provide analyses for the critical baseplates.

The evaluation team's findings are consistent with findings from various NRC reports (Ref. 66), an NSRS report (Ref. 68), SCRs (Ref. 69), and PIRs (Ref. 69). In addition, these documents also state there is a lack of adequate checking.

Baseplate flexibility and anchorage bolt requirements will be addressed in Construction Subcategory Report 10400, R1.

c. TVA will revise the calculation for pipe support RHR R159 unit 3 to provide analysis for the critical base plates in sections A405 and B405 of the drawing and to incorporate all applicable assumptions used to qualify the shear force on the anchor bolts (CAP, TCAB-44) for CATD 220 03 BFN 01).

BFN has committed to implement corrective action for these identified deficiencies through its IEB 79-02/79-14 program and its instruction for the calculation verification review program (for LTTIP).

For applicable corrective action, see Construction Subcategory Report 10400.

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SUMMARY OF ISSUES, FINDINGS, AND CORRECTIVE ACTIONS
FOR SUBCATEGORY 22000

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Issues	Findings	Corrective Actions
Element 220.3 - BFN (Continued)		
d. Pipe support designs are not constructible. (Concern IN-85-886-001)	d. Two likely conditions that affect the constructibility of support designs are: <ul style="list-style-type: none"><li data-bbox="716 431 1342 475">o Installation interference with other commodities and plant features<li data-bbox="716 502 1353 571">o Incomplete drawings issued to Construction (the issue of incomplete drawings is addressed in detail in subcategory report 25500 for element 222.3. <p data-bbox="716 591 1353 761">It is possible that some supports could not be installed during construction because of interference with other commodities. Such interference problems are common during the course of the design and construction of nuclear power plants. Modification of a support design caused by interferences does not indicate a lack of constructibility in the initial design.</p>	d. No corrective action is required.
BLN	BLN	BLN
a. Seismic pipe supports are designed inadequately.	a. In the evaluation team's review of calculations for 22 pipe supports (Ref. 21), the supports were found to be adequately designed in accordance with applicable BLN pipe support design criteria. It was found that BLN criteria and FSAR specified design loads and allowable stresses deviated from the ASME Section III-1974 NF code (Ref. 51). These deviations were identified and addressed by NCR BLN CEB8110 (Ref. 70). The final report for NCR BLN CEB8110 was transmitted to the NRC for review. The NRC reviewed and approved the design loads and allowable stresses in this final report (Ref. 71). It was noted that provision for upset primary plus secondary were inadvertently left off FSAR Table 3.9.3-37. However, these provisions are included in BLN pipe support criteria, and hence (TVA states that) this condition is considered in the pipe support design.	a. In its corrective action plan (TCAB-638, 08/06/87) for CATD 220 03 BLN 01, TVA commits to revise FSAR Table 3.9.3-37 (Amendment 24) in the annual FSAR update to include design load and allowable stress for upset primary plus secondary. It is noted that this information was included on the revision of the table before Amendment 24.

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Element 220.3 - BLN (Continued)

The documentation of the calculations for the sample of 22 pipe supports were found to be incomplete and/or contained minor discrepancies. Lack of computer input/output data was a consistent observation.

TVA also commits to retrieve the computer output from ITT Grinell for the eight subject pipe supports (via procurement request M-1937). TVA's contract 820732 with ITT Grinell, states that the vendor (ITT) will retain a calculation file, including computer output five years after shipment of the final item on the contract or two years after commercial operation, whichever is later. (CATD 220 03 BLN 01)

A design deficiency was observed for the weld calculation between item 1 and item 3 for pipe support 1GN-MPHG-0054. The weld design length used in the calculation is greater than the actual installed weld which was performed according to normal site practice.

Corrective action for the identified weld condition between item 1 and item 3 for pipe support 1GN-MPHG-0054 will be provided by Condition Adverse to Quality Report CAQR BLF 870098 [RIMS 805 870612 318]. This CAQR initiates action to identify, review, and modify if necessary, tube steel members with this weld condition.

In addition, a procedural deficiency in the calculation for pipe support USA-MPHG-0073 was observed due to the lack of continuity and clarity of status for the sheets. This is addressed in subcategory 24600 for Bellefonte element 205.1.

For applicable corrective action see Subcategory Report 24600.

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Issues

Findings

Corrective Actions

Element 220.3 - BLN (Continued)

Design requirements for base plates and anchorage bolts (base plate flexibility, MWL, and construction tolerances) were not specifically addressed in this report as the requirements are within the scope of and addressed by Construction Subcategory Report 10400.

Punching shear was not considered in the pipe support calculation for all four plants. This requirement was generally not included in the design criteria.

For applicable corrective action, see Construction Subcategory Report 10400.

In the CAP for CATD 220 03 NPS 01 (TCAB-64), 08/06/87), TVA commits to include the punching shear requirement in Civil Design standard DS-C1.6.1 which covers all plants and applicable design criteria. This action will prevent recurrence.

A generic evaluation, covering all plants, was performed (in accordance with TVA memorandum 01/31/86, RIMs B41 860131 018) to review previously generated calculations for punching shear. The results indicated that in some areas punching shear was not considered. CAQRs were written to address the problem areas.

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

b. The issue that seismic supports are too rigid has been addressed in NSRS Report I-86-131-SQH. This report states that:

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

b. No corrective action is required.

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Issues	Findings	Corrective Actions
Element 220.3 - BLN (Continued)		
c. Seismic pipe support designs are not constructible.	<p>The NSRS report concluded that seismic pipe supports are designed to carry loads based on piping analysis that assumes the supports are rigid. Furthermore, the supports are sufficiently designed to prevent them from breaking loose during a seismic event. The evaluation team concurs with the NSRS report. Rigidity/deflection requirements are properly addressed in the seismic pipe support design criteria.</p> <p>c. Two likely conditions that affect the constructibility of support designs are:</p> <ul style="list-style-type: none">o Installation interference with other commodities and plant featureso Incomplete drawings issued to Construction (the issue of incomplete drawings is addressed in detail in subcategory report 25500 for element 222.3) <p>It is possible that some supports could not be installed during construction because of interference with other commodities. Such interference problems are common during the course of the design and construction of nuclear power plants. Modification of a support design caused by interferences does not indicate a lack of constructibility in the initial design.</p>	c. No corrective action is required.
d. Seismic pipe support design criteria are nonexistent.	d. BLN seismic support design criteria have existed since 1976.	d. No corrective action is required.

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Issues	Findings	Corrective Actions
Element 220.3 - BLN (Continued)		
e. Peripheral finding - (same as 220.3 issue "b") BLN field option and tolerance notes (3GA0059 series) can be misinterpreted.	e. The 3GA0059 series drawings (Ref. 3) were found to contain reasonable and clear field option and tolerance notes. Some notes did not have adequately documented justification.	e. TVA has initiated corrective action through CAQR BLF 870126 [RIMS BOS 870714 303] as part of CAP for CATD 220 03 BLN 01. DNE commits to review the 3GA0059 series notes and provide calculations and/or technical justification for those notes which have no documented technical justification.

Element 220.6 - Revisions to Hanger Design		

SQM	SQM	SQM
(N/A)	(N/A)	(N/A)
WBN	WBN	WBN
a. Pipe support designs are inadequately controlled and have as many as 100 revisions.	a. Watts Bar followed "900-Series" for numbering the revisions of pipe support drawings. First revision made by Watts Bar after taking over the design responsibility from the contractor (Bergen Paterson or EDS) are numbered 901 and so on. During the review of approximately 11,300 pipe support design drawings, from WBN's hanger tracking problem report (Ref. 26), three supports were observed with 11 revisions and five with 10 revisions and another with 7 revisions. No pipe support design drawing had anywhere near a current revision number approaching a magnitude of 100. All pipe support design drawing revisions were either the result of an Engineering Change Notice (ECN), a Field Change Request (FCR), or other justifiable reasons such as changes in design loads or changes in location plan dimensions. All revisions reviewed show evidence that they were adequately controlled through microfilming.	a. No corrective action is required.

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Issues	Findings	Corrective Actions
Element 220.6 - BFH	BFH	
(N/A)	(N/A)	BFH
BLN	BLN	(N/A)
(N/A)	(N/A)	BLN

Element 220.7 - Installation-related Technical Decisions		

SQM	SQM	SQM
(N/A)	(N/A)	(N/A)
WBN	WBN	WBN
a. The crafts assume too much responsibility for originating design.	a. There is no evidence that the crafts or anyone else in TVA's Construction organization has assumed responsibilities beyond those called for in the applicable FCR procedure (Ref. 29).	a. No corrective action is required.
b. Engineering follows up on these designs by revising the affected design drawing per the as-built condition, without engineering review and approval.	b. There is no evidence that Engineering limited its activity to simply revising the design drawing without applying the required analysis or review of the support redesign.	b. No corrective action is required.
BFH	BFH	BFH
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)

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Issues	Findings	Corrective Actions
***** Element 220.9 - Over-sizing of Pipe Support Steel and Slick Grinding of welds *****		
SQN	SQN	SQN
(N/A)	(N/A)	(N/A)
WBN	WBN	WBN
a. Economy is not considered in the sizing of pipe support frame members during the design process.	<p>a. To keep the designs simple, TVA's small pipe standards (Ref. 72) have, at times, specified using larger structural members instead of making unique designs. This practice has been found to be economical in that it saves a great deal of valuable time in design and analysis.</p> <p>Furthermore, TVA provides guidelines that allow construction to make substitutions for structural members shown on design drawings, depending upon the availability of material or for any other valid reason. Such a substitution may result in a larger member than would be required if a unique calculation were performed for this particular situation.</p>	a. No corrective action is required.
b. The former practice of slick grinding welds is unnecessary.	<p>b. With regard to the former practice of slick grinding of welds, a TVA interoffice memorandum (Ref. 30) acknowledged that this practice "has been an area of confusion in the past and this practice has not been required by Engineering, but has been performed by Construction at WBN because of the misconceptions of requirements."</p>	b. No corrective action is required.
BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)

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Issues	Findings	Corrective Actions
***** Element 220.10 - Replacement Hangers *****		
SQN	SQN	SQN
(N/A)	(N/A)	(N/A)
WBN	WBN	WBN
a. The installed pipe supports have often been modified and in some cases deleted (removed but not replaced).	a. TVA has a procedure (Quality Control Procedure QCP-4.23-3, Ref. 32) that specifies the inspection and documentation requirements of the location and orientation of pipe supports. This procedure verifies that the pipe supports are installed within the limits of the specified tolerances. The evaluation team selected and examined ten examples of safety-related piping problems (Ref. 33) where support changes occurred (including deletions). In all instances, the pipe support changes were justified by FCRs/ECNs.	a. No corrective action is required.
BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)
***** Element 220.11 - Temperature Variation Considerations *****		
SQN	SQN	SQN
a. The expansion of structural members restrained between two rigid points (such as concrete surfaces) will cause additional loading on members.	a. The lack of consideration for temperature variation in the SQN pipe support design would cause additional loading on members restrained between two rigid points. The proposed SQN corrective action plan will adequately address the temperature variation issues for pipe support design.	a. In its corrective action plan for CATD 220-11 SQN 01 (TCAB-003, 11/07/86), TVA will identify steel structures with design features that restrain thermal growth. These structures will be evaluated for their ability to resist temperature expansion by using the structural design will be modified if the ultimate design capacity of the concrete structure (the fixed points) is exceeded, or

THIS ITEM PARTIALLY COMPLETED
AT SQN DATE: 2-24-88

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Element 220.11- SQM (Continued)		
b. The thermal expansion of pipe will impose loads on the pipe supports.	b. The pipe expansion imposed loads on pipe supports are considered in the SQM pipe support design.	- The steel structure is overstressed and this overstressing cannot be justified. b. No corrective action is required.
WBN	WBN	WBN
a. The expansion of structural members restrained between two rigid points (such as concrete surfaces) will cause additional loading on members.	a. The lack of consideration for temperature variation in the watts Bar pipe support design would cause additional loading on members restrained between two rigid points. The proposed corrective action plan to Watts Bar problem identification report PIR WBNCEB8536 (Ref. 36) will adequately address the temperature variation issue for pipe support design.	a. No additional corrective action is required beyond the corrective action plan to PIR WBN CEB 8536. CATD 220 11 WBN 01 is provided only for ECTG tracking of the corrective action of PIR WBN CEB 8536.
b. The thermal expansion of pipe will impose loads on the pipe supports.	b. The pipe expansion imposed loads on pipe supports are considered in the Watts Bar pipe support design.	b. No corrective action is required.
BFN	BFN	BFN
a. The expansion of structural members restrained between two rigid points (such as concrete surfaces) will cause additional loading on members.	a. Although the ASME code does not require evaluation of thermal stress in pipe support structural members, the evaluation team considers it prudent to evaluate thermal stress in any support structural member that is attached at both ends to a concrete surface. However, no members (pipe support or otherwise) of this nature were found at BFN, based on evaluations performed by both TVA and the evaluation team.	a. No corrective action is required.

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Element 220.11 - BFN (Continued)		
<p>b. The thermal expansion of pipe will impose loads on the pipe supports.</p> <p>NOTE: Although the following issue is not directly related to the statement of concern, which was originated at Watts Bar, the evaluation team considered it appropriate to address it within the context of applying the concern to Browns Ferry.</p> <p>c. A detailed inspection and design review is required for all pipe supports subjected to elevated temperature effects resulting from the March 22, 1975 fire at BFN.</p>	<p>b. The pipe expansion-imposed loads on pipe supports are considered in the BFN pipe support design.</p> <p>c. The criteria (BFN-SO-D703 and BFN-SO-D705, Ref. 16) for evaluating structural steel components and piping subjected to the 03/22/75 fire are adequate to establish which structural members (including pipe support framing) have been damaged because of a high-temperature environment and were, therefore, subject to replacement.</p>	<p>b. No corrective action is required.</p> <p>c. No corrective action is required.</p>
BLN	BLN	BLN
<p>a. The expansion of structural members restrained between two rigid points (such as concrete surfaces) will cause additional loading on members.</p> <p>b. The thermal expansion of pipe will impose loads on the pipe supports.</p>	<p>a. BLN has committed to evaluate the embedments for thermal expansion loads. However, to date, this task has not been completed.</p> <p>b. The pipe supports are adequately designed for the loads from the piping thermal analysis.</p>	<p>a. No additional corrective action is required beyond the corrective action plan to PIR BLN CEB 8512 (Ref. 55).</p> <p>b. No corrective action is required.</p>

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Issues	Findings	Corrective Actions
<p>***** Element 220.12 - Technical Review *****</p>		
<p>SQN (N/A) MBN</p>	<p>SQN (N/A) MBN</p>	<p>SQN (N/A) MBN</p>
<p>a. Technical review is not performed after checkers have reviewed pipe support calculations.</p>	<p>a. In response to Issue "a," the evaluation team determined the following:</p> <ul style="list-style-type: none"> o TVA design calculations procedure EN DES-EP 3.03 (Ref. 46) and Office of Engineering Procedure OEP-10 (Ref. 46) require the section supervisor, by signing at the "submitted" block of the calculation cover sheet, to attest that the calculations are performed and checked by technically qualified persons. Additional technical review after the checker's review is not mandated by these procedures. o TVA procedures EN DES-EP 3.03 and OEP-10 meet the requirements for design verification as specified by 10 CFR 50, Appendix B (Ref. 4) and ANSI N45.2.11-1974 (Ref. 5). o In addition, the TVA (civil engineering branch chief) had conducted independent technical review (Ref. 48) of pipe support calculations to verify technical adequacy and compliance with pertinent controlling documents/procedures. o The evaluation team reviewed 20 randomly selected pipe support calculations (Ref. 47) from safety-related piping systems from both units and determined that they comply with the requirements of procedures EN DES-EP 3.03 and OEP-10. 	<p>a. No corrective action is required.</p>

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Element 220.12 - BFN	BFN	BFN
(N/A)	(N/A)	(N/A)
BLN	BLN	BLN
(N/A)	(N/A)	(N/A)

ATTACHMENT C

REFERENCES

1. SQN 47A050 series notes, Drawings 47A050-1 through 23A, "Mechanical Hanger Drawing General Notes"

47A050-1/R2 through 7	47A050-14/R1
47A050-1A/R0	47A050-15/R1
47A050-2/R0 through 6	47A050-16/R1
47A050-2A/R0 and 1	47A050-16A/R1
47A050-2B/R0	47A050-17/R0
47A050-3/R2 through 6	47A050-18/R0
47A050-4/R5	47A050-19/R0
47A050-5/R	47A050-19A/R0
47A050-6/R8	47A050-19B/R0
47A050-6A/R1	47A050-20/R0
47A050-6B/R0	47A050-21/R0
47A050-7/R0, 1, 3 through 6	47A050-22/R0
47A050-8/R0	47A050-23/R0
47A050-9/R6	47A050-23A/R0
47A050-10/R0	
47A050-11/R1	
47A050-12/R1	
47A050-13/R1	

2. WBN 47A050 series notes, Drawings 47A050-1 through 1V1, "Mechanical Hanger Drawing General Notes"

47A050-1/R8	47A050-1M4/R3
47A050-1A/R6	47A050-1M5/R3
47A050-1A1/R5	47A050-1M6/R2
47A050-1B/R9	47A050-1M7/R1
47A050-1B1/R2	47A050-1M8/R1
47A050-1B2/R3	47A050-1N/R9
47A050-1B3/R3	47A050-1N1/R1
47A050-1B4/R2	47A050-1N2/R3
47A050-1C/R9	47A050-1P/R5
47A050-1C1/R3	47A050-1Q/R7
47A050-1D/R14	47A050-1Q1/R3
47A050-1E/R15	47A050-1Q2/R4
47A050-1F/R10	47A050-1Q3/R2
47A050-1G/R9	47A050-1Q4/R3
47A050-1H/R7	47A050-1Q5/R2
47A050-1H1/R1	47A050-1Q6/R1
47A050-1J/R12	47A050-1Q7/R3

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47A050-1J1/R2
47A050-1J3/R2
47A050-1K/R10
47A050-1K1/R2
47A050-1K2/R1
47A050-1L/R10
47A050-1L1/R1
47A050-1M/R9
47A050-1M1/R1
47A050-1M3/R3

47A050-1Q8/R3
47A050-1Q9/R3
47A050-1Q10/R5
47A050-1R/R5
47A050-1S/R4
47A050-1S1/R1
47A050-1S2/R1
47A050-1U/R6
47A050-1U3/R2
47A050-1V/R8
47A050-1V1/R1

3. BLN "3GA0059" series notes: Drawings 3GA0059-00-1 through -41, "[BLN] Notes for Field Fabrication and Installation of Pipe Supports in Category I Structures"

3GA0059-00-01/R15
3GA0059-00-1A/RO
3GA0059-00-1B/RO
3GA0059-00-1C/RO
3GA0059-00-02/R11
3GA0059-00-03/R6
3GA0059-00-04/R12
3GA0059-00-04A/RO
3GA0059-00-04B/RO
3GA0059-00-05/R14
3GA0059-00-06/R12
3GA0059-00-06A/R1
3GA0059-00-6B/RO
3GA0059-00-07/R9
3GA0059-00-08/R9
3GA0059-00-09/R7
3GA0059-00-10/R9
3GA0059-00-10A/RO
3GA0059-00-11/R6
3GA0059-00-12/R5
3GA0059-00-13/R7
3GA0059-00-13A/RO
3GA0059-00-14/R12
3GA0059-00-14A/R1
3GA0059-00-15/R9
3GA0059-00-16/R8
3GA0059-00-17/R5
3GA0059-00-18/R7

3GA0059-00-19/R9
3GA0059-00-20/R8
3GA0059-00-21/R4
3GA0059-00-22/R2
3GA0059-00-23/R2
3GA0059-00-24/R2
3GA0059-00-24A/R3
3GA0059-00-25/R3
3GA0059-00-25A/RO
3GA0059-00-26/R3
3GA0059-00-26A/RO
3GA0059-00-27/R2
3GA0059-00-28/R4
3GA0059-00-28A/RO
3GA0059-00-29/R1
3GA0059-00-30/R3
3GA0059-00-30A/RO
3GA0059-00-30B/RO
3GA0059-00-31/R1
3GA0059-00-32/R1
3GA0059-00-33/R1
3GA0059-00-34/R2
3GA0059-00-35/RO
3GA0059-00-36/RO
3GA0059-00-37/R1
3GA0059-00-38/R2
3GA0059-00-39/R1
3GA0059-00-40/RO
3GA0059-00-41/R1

4. Nuclear Regulatory Commission - Regulations 10 CFR 50, Appendix B

5. ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants"
6. General Construction Specification G-43, for support and installation of piping systems in Category 1 structures, Rev. 8, (08/08/85)
7. SQN Modification and Additions Instruction, M&AI-11 for fabrication, installation, and documentation of seismic supports and supports attached to seismic Category 1 structures, Rev. 12, (03/14/86)
8. NSRS Reports for Concerns in WBN Element 220.1:
 - NSRS Report I-85-124-WBN, ERT Item IN-85-052-001, "47A050 Drawing Notes," (07/03/85)
 - NSRS Report I-85-148-WBN, ERT Item PH-85-006-001, "Fuel Load-47A050 Notes," (08/09/85)
 - NSRS Report I-85-157-WBN, Employee Concern IN-85-010-002, "Hanger Quality Control 47A050 Notes (Evaluations) Did Not Satisfy Inspection Criteria," (11/22/85)
 - NSRS Report I-85-234-WBN, ERT Item IN-85-532-006 - "47A050 Notes," (08/16/85)
 - NSRS Report I-85-160-WBN, ERT Item IN-85-413-001, "47A050 Notes - Fuel Load," (08/09/85)
 - NSRS Report I-85-374-WBN, Employee Concern IN-85-445-013, "Drawing Notes in the 47-A050 Series are Hard to Use," (10/10/85)
 - NSRS Report I-85-110-WBN, "Employee Concern IN-85-024-001," (07/01/85)
9. SQN Pipe support drawings:

1-MSH-165/R4	2-CSH-14/R906
1-MSM-300/R905	1-FPCH-527/R2
1-AFDH-369/R906	1-RCH-136/R4
1-FDH-45/R1	1-SIH-365/R2.
2-VHIH-144/R902	1-CH-78/R2
2-SGBH-70/R1	2-CVCH-614/R904
2-CCH-372/R2	2-CVCH-813/R0
1-CSH-44/R904	

10. WBN Pipe Support Drawings:

47A463-2-38/R1	47A400-6-319/R1
47A400-6-85/R0	47A060-70-27/R3
47A060-63-39/R0	47A427-8-38/R1
47A435-10-21/R3	47A437-2-22/R1
47A400-6-101/R1	47A400-1-32/R1

11. IOM 1891 (09/23/87) WBN Site Interviews Conducted by Bechtel.

12. Calculations for the selected WBN 47A050 notes:

<u>Note Number</u>	<u>Calculation Rev.</u>	<u>Calculation RIMS Number</u>
50	2	B41 860616 900
128	0	B41 860909 900
132	0	B41 851230 904
165	1	B41 860707 902
165	3	B41 861002 900
227	0	B41 860311 916

13. NSRS Report 1-86-131-SQN, "Seismic Supports Are Not Designed Properly Because They Are Rigid," (10/28/85)

14. SQN Pipe Support Design Criteria:

Detailed Design Criteria SQN-DC-V-24.1, "Location and Design of Piping Supports and Supplemental Steel in Category I Structures," Rev. 0, (6/23/86)

CEB-SQN-100(CEB-80-75), "Guidelines for Design of Component Supports for TVA Class A through D," Rev. 3, (01/19/81), Rev. 0, (03/10/75)

Detailed Design Criteria SQN-DC-V-2.14, "Piping System Anchors Installed in Category I Structures," Rev. 0, (06/30/86)

15. WBN Pipe Support Design Criteria:

WB-DC-40-31.9, "Detailed Design Criteria for Location and Design of Piping Supports and Supplemental Steel in Category I Structures," [ESB 840411 209], Rev. 0, (08/29/75); Rev. 5, (04/09/84)

WB-DC-40-31.15, "Detailed Design Criteria for Piping System Anchors Installed in Category I Structures," [ECB 841226 502], Rev. 0, (01/27/77); Rev. 3, (12/14/84)

WB-DC-40-31.7, "Detailed Design Criteria for Analysis of Category I and I(L) Piping Systems," [B42 870129 501], Rev. 0, (01/30/76); R7, (01/21/86)

WB-DC-40-31.3, "Detailed Design Criteria for the Assignment of Responsibility for Analyses, Support, and Fabrication of Piping Systems," [ESB 841012 201], Rev. 0, (09/25/75); Rev. 2, (10/04/84)

16. BFN Pipe Support Design Criteria:

BFN-50-D706, "General Design Criteria for the Torus Integrity Long-Term Program," [ESB 840621 205], Rev. 0, (07/24/80), Rev. 1, (06/20/84)

BFN-50-D707, "Detailed Design Criteria for Analysis of As-Built Piping Systems," [B42 850501 501], Rev. 0, (08/11/80); Rev. 3, (04/17/75)

BFN-50-D711, "Detailed Design Criteria for Analysis of Torus Attached Piping (Long-Term Torus Integrity Program)," [B42 850719 502], Rev. 0, (07/27/82); Rev. 2, (07/12/85)

BFN-50-724, "Detailed Design Criteria for Class I Seismic Pipe Support Design," [B05 861002 500], (09/26/86)

Design Criteria BFN-50-754, "Miscellaneous Steel components for Class I and II Structures," [B05 861110 503], (11/10/86)

17. BLN Pipe Support Design Criteria:

N4-50-D711 [BLN] "General Design Criteria for Detailed Analysis and Seismic Qualification of Category I and I(L) Piping Systems," [B42 851112 524], Rev. 0, (08/08/75); Rev. 3, (10/17/85)

N4-50-D717 [BLN] "General Design Criteria for Design of Safety-Related Piping Supports and Supplemental Steel," [B42 851112 525], Rev. 0 (06/10/76); Rev. 4, (10/22/85)

N4-50-D725 [BLN] "General Design Criteria for Assignment of Responsibility for Analysis, Support, and Fabrication of Piping Systems," [ESB 831115 217], Rev. 0, (01/27/76); Rev. 1, (11/19/83)

N4-50-D730 [BLN] "Detailed Design Criteria for Piping System Anchors Installed in Category I Structures," [B42 850501 504], Rev. 0, (04/13/78); Rev. 1, (04/19/85)

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18. SQN Pipe Support Drawings and Calculations:

SUPPORT			Calc.
Sheet No.	Mark No.	Rev.	Rev.
2-H1-315	2-MSH-315	903	0
2-H1-348	2-MSH-348	902	0
1-H10-511	1-CCH-470	909	0
1-H20-451	1-SIH-437	7	0
1-H3-367	1-AFDH-328	906	0
1-H3-369	1-AFDH-329	906	0
1-H34-100	1-CVCH-100	901	0
2-H36-302	2-RCH-302	905	0
1-H45-130	1-UHIH-130	908	0
2-H47-290	2-SGBH-290	904	0
2-H50-6	2-FPCH-6	2	0
2-H63-449	2-RHR-449	904	1
1-H47-262	1-SGBH-262	903	0
1-H36-106	1-RCH-106	909	4
2-H21-5	2-CSH-5	908	0

19. WBN Pipe Support Drawings and Calculations:

Support	Rev.	Calc. Rev.	Calc. RIMS No.
47A437-2-22	1	1	B41 860807 854
47A427-8-38	1	1	B41 850827 802
67-1 ERCW-R212	902	2	WBP 840329 013
47A400-6-97	1	1	WBP 840510 016
47A400-6-361	0	0	B41 850509 967
47A400-6-96	0	1	WBP 831027 085
63-1SIS-V132	1	0	CEB 850228 956
47A465-2-38	1	1	CEB 850126 833
47A400-1-32	1	0	B41 850417 953
47A400-6-333	0	0	B41 850509 955
1-03A-586	901	0	WBP 841109 006
1-03A-587	1	0	WBP 841109 005
1-62A-328	1	0	WBP 841114 115
1-63-033	903	1	WBP 841105 062
1-63-320	2	1	WBP 841108 005
1-68-131	904	2	WBP 841109 025
1-70-005	1	0	WBP 841029 403

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<u>Support</u>	<u>Rev.</u>	<u>Calc. Rev.</u>	<u>Calc. RIMS No.</u>
1-87-068	906	3	WBP 840725 019
47A400-11-30	2	0	WBP 840202 075
1-03A-471	906	2	CEB 850205 920
47A400-1-1	1	1	CEB 850119 809
1-74-11	907	1	WBP 840124 027
47A060-3-23	2	1	B41 850927 807
47A060-70-27	3	2	WBP 840417 010
1-63-404	904	0	WBP 840110 044
2-70-804	901	0	B41 860213 954
47A435-10-21	3	3	WBP 841123 001
1-70-867	0	0	WBP 841123 002

20. 8FN Pipe Support Drawings and Calculations:

<u>Support Number</u>	<u>Drawing Number</u>	<u>Rev. No.</u>	<u>Calculation Number.</u>	<u>Rev. No.</u>	<u>RIMS Number</u>
RHR H4	47B451-182	0	BWPC20841 H4	0	BWP 830825 118
RHR R93	47B452-67	2	TDPC20106 R93	3	BWP 840425 102
RHR H343	47B452-159	1	TDPC20105 H343	2	BWP 840425 103
RHR H328	47B452-102	0	TDPC20536 H328	1	BWP 831110 110
RHR R159	47B452-134 47B452-405	1 0	TDPC20466 R159	1	BWP 831215 109
RHR R58	47B452-133	2	TDPC20465 R58	2	BWP 831220 116
Core Spray H23	47B458-91	0	BWPC30100 H23	1	BWP 840404 112
Core Spray H56	47B458-50	1	TDPC20305 H56	2	BWP 840710 11?
Core Spray R43	47B458-150	0	BWPC30109 R43	1	BWP 830919 113
Core Spray H69	47B458-433	5	BWPC30400 H69	5	B22 860718 108
RCIC H62	47A456-304	2	TDPC20558 H62	1	BWP 831108 10?
RCIC R46	47B456-106	0	BWPC30363 R46	0	BWP 840404 106
RCIC R51	47B456-80	5	TDPC20600 R51	3	B22 860117 124

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<u>Support Number</u>	<u>Drawing Number</u>	<u>Rev. No.</u>	<u>Calculation Number</u>	<u>Rev. No.</u>	<u>RIMS Number</u>
HPCI H169B	47A455-320B	1	TDPC20256 H169B	1	BFP 850129 108
HPIC R91	47B455-58	1	TDPC20507 R91	1	BWP 840706 101
HPIC H186	47B455-51	1	TDPC20243 H186	1	BFP 850129 106
Drywell and Torus Purge R32	47A920-52	0	BWPC20787 R32	0	BWP 830620 112
Drywell and Torus Purge R5	47B920-39 47B920-79	2 0	TDPC20342 R5	2	BWP 831215 107
RWCU R2 Unit 1	47A406-2 47A406-16	2 0	BWPC30283 R2	2	BFP 841005 104
RWCU R2 Unit 3	47A406-14	1	BWPC30407 R2	1	B22 850802 114
HPCI R86	47B455-52	5	TDPC20445 R86	3	B22 850701 102

21. 8LN Pipe Support Drawings and Calculation:

<u>Support Number</u>	<u>Drawing Revision Number</u>	<u>Calculation Revision Number</u>	<u>Calculation RIMS Number</u>
1CA-MPHG-0225	901	1	B21 850730 228
2CA-MPHG-0050	3	0	B44 860204 452
2CF-MPHG-0239	4	0	B44 860228 464
2CR-MPHG-0107 SHT 1	0	0	B44 860302 453
2CR-MPHG-0107 SHT 2	0	0	B44 851212 478
1GN-MPHG-0054	0	0	B21 850605 402
1KC-MPHG-0036 SHT 1	902	1	BLP 850128 266
2KC-MPHG-0322 SHT 2	1	0	B44 860306 476
2KC-MPHG-0381	6	0	B44 860306 474
2KC-MPHG-0391	6	0	B44 860324 462
1KC-MPHG-0884	0	0	B21 870403 200
2ND-MPHG-0549	1	0	B44 860619 480

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<u>Support Number</u>	<u>Drawing Revision Number</u>	<u>Calculation Revision Number</u>	<u>Calculation RIMS Number</u>
1ND-MPHG-0580 SHT 2	901	1	BLP 840914 209
1ND-MPHG-0580 SHT 3	901	0	MEB 820816 922
ONM-MPHG-0517	904	2	BLP 840829 221
2NS-MPHG-0004	4	0	844 860507 476
1RK-MPHG-0026 SHT 2	3	0	MEB 830308 471
OSA-MPHG-0073	902	1	821 850426 229
1SM-MPHG-0281	6	0	844 850918 474
1SM-MPHG-0285	901	1	821 860716 242
OWD-MPHG-0040	901	0	MEB 830523 496
1WD-MPHG-0420 SHT 1	1	0	844 851214 473

22. SQN Pipe Support Drawings, Revision 0:

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

23. WBN Pipe Support Drawings:

Support (Revision 0)

47A060-63-39
47A400-1-21
47A400-6-69
47A400-6-72
47A400-6-85
47A400-6-94
47A400-6-281
47A400-6-308
47A400-6-376
47A400-7-17
47A400-13-1
47A400-13-9
47A400-13-21

24. Bechtel Study Calculations (Job No. 16985-026) to support evaluations.

SQN Calculation PD-220-33 Rev. 0 (09/23/87) Supports 2-MSH-315
2-MSH-348
1-AFDH-328
1-CVCH-100
2-RCH-302
1-UHIH-130
2-SGBH-290
2-RHR-449
2-CSH-5

WBN Calculation PD-220-18 Rev. 0 (08/20/87) Support 47A060-3-23
PD-220-19 Rev. 0 (08/20/87) Support 1-74-11
PD-220-20 Rev. 0 (08/20/87) Support 47A060-70-27
PD-220-21 Rev. 0 (08/20/87) Support 1-63-404
PD-220-22 Rev. 0 (08/20/87) Support 47A400-11-30

BFN Calculation PD-220-23 Rev. 0 (08/24/87) Support RHR R159 Unit 3

BLN Calculation PD-220-24 Rev. 0 (08/24/87) Support OSA-MPHG-0073
PD-220-25 Rev. 0 (08/24/87) Support 2ND-MPHG-0549
PD-220-26 Rev. 0 (08/24/87) Support 2RK-MPHG-0026, Sheet 2
PD-220-27 Rev. 0 (08/24/87) Support 2NS-MPHG-0004
PD-220-28 Rev. 0 (08/24/87) Support 2KC-MPHG-0391
PD-220-29 Rev. 0 (08/24/87) Support 2KC-MPHG-0381
PD-220-30 Rev. 0 (08/24/87) Support 1KC-MPHG-0036, Sheet 1
PD-220-31 Rev. 0 (08/24/87) Support 2CF-MPHG-0054

25. Bechtel Study Calculation (Job No. 16985-026) to Support Evaluations.
Includes BLN site interview information on welding of two sides of tube
steel.

Calculation PD-220-32 Rev. 0 (08/24/87) Support 1GN-MPHG-0054

26. WBN Pipe Support Design Manual, Vol. 1 to 4, (05/18/82); Rev. 5,
(02/24/86)

27. Engineering Procedure EN DES-EP 4.03 for field change requests initiated
by construction [ECB 841203 502], Rev. 11, (11/21/84), Rev. 0, (09/28/73)

Engineering Procedure EN DES-EP 4.35 for Revising Vendor Drawings,
[ESS 811207 206], Rev. 1, (12/14/81); Rev. 0, (09/02/80)

28. Office of Engineering/Watts Bar Engineering Project (OE/WBEP) Hanger
Tracking Program Report for Units 1 and 2, (run date 03/06/86)

-
29. TVA Office of Engineering (OE) Procedures Manual: OEP-11, "Change Control," (04/26/85)
- TVA Office of Construction WBN Quality Control Instruction: QCI-1.13, "Preparation and Documentation of Field Change Requests," (06/17/80), Rev. 14 (10/25/85)
- TVA Office of Construction WBN Quality Control Procedure: QCP-4.23-8, "Support Final Inspection," Rev. 0 (07/10/82); Rev. 7 (01/30/85)
- TVA Office of Engineering (OE) WBN Project Procedure: WBEP-EP 43.03, "Field Change Requests," Rev. 0, (09/27/83)
- TVA Division of Engineering Design (EN DES) Engineering Procedure: EN DES-EP 4.03, "Field Change Requests Initiated by CONST," Rev. 0 (09/28/73); Rev. 11 (11/12/84)
30. TVA IOM from R. W. Cantrell to W. H. Thompson, "Employee Concern Program" IN-85-316-002," (01/24/86)
31. TVA, Piping Analysis and Hanger Design Meeting, [C24 851106 600], (11/06/85)
32. TVA, Quality Control Procedure QCP-4.23-3, Support Location and Orientation, Rev. 5, (08/30/85)
33. WBN Calculation N3-78-5A
- TVA drawing 85 M 47W454-203, R4
TVA drawing 85 M 47W454-203, R5
TVA drawing 85 M 47B454-360, R2
TVA drawing 85 M 47B454-360, R3
TVA ECN 3213, 01/17/83
TVA NCR WBNSWP8252 R1
TVA NCR WBNSWP4164 R
- WBN Calculation N3-61-1R
- TVA drawing 85 M 47W462-100, R5
TVA drawing 85 M 47W462-100, R6
TVA drawing 85 M 47B462-102, R1
TVA drawing 85 M 47B462-102, R2
TVA ECN 3608, 03/25/83
TVA NCR WBNCB8221, R2, 01/27/87

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WBN Calculation N3-62-5A

TVA drawing 85 47W555-203, R3
TVA drawing 85 47W555-203, R4
TVA drawing 85 M 47B555-434, R0
TVA drawing 85 M 47B555-434, R1
TVA FCR H-7062, 05/26/82
TVA ECN 3088, 10/22/82

WBN Calculation N3-67-6R

TVA drawing 85 M 47W450-241, R1
TVA drawing 85 M 47W450-241, R2
TVA drawing 85 M 47B450-573, R0
TVA drawing 85 M 47B450-573, R1
TVA ECN 2756, 10/14/81
TVA ECN 3049, 01/22/82
TVA ECN 3217, 01/22/82

WBN Calculation N3-72-2A

TVA drawing 85 M 47W437-200, R6
TVA drawing 85 M 47B437-376, R0
TVA drawing 85 M 47B437-376, R1
TVA ECN 3482, 08/11/82

WBN Calculation 200-04-01

TVA drawing 85 M 47W464-248, R0
TVA drawing 85 M 47B464-655, R1
TVA drawing 85 M 47B464-621, R0
TVA drawing 85 M 47B464-621, R1
EDS drawing 0600200-04-01, R2
TVA ECN 3792, 08/16/83

WBN Calculation 200-07-04

TVA drawing 85 M 47W400-211, R2
TVA drawing 85 M 47B400-384, R0
TVA drawing 85 M 47B400-384, R1
TVA drawing 85 M 47B400-385, R0
TVA drawing 85 M 47B400-385, R1
TVA drawing 85 M 47B400-391, R0
TVA drawing 85 M 47B400-391, R1
TVA ECN 3371, 08/20/82
TVA ECN 3481, 11/22/82
TVA ECN 3621, 01/26/83

WBN Calculation 200-8-10

TVA drawing 47W406-328, R0
TVA drawing 47B406-611, R0
EDS drawing 0600200-08-10, R5
TVA ECN 3474, 06/07/82

WBN Calculation 200-09-05

TVA drawing 85 M 47B435-469, R2
TVA drawing 85 M 47B435-469, R3
TVA drawing 85 M 47B435-563, R1
TVA drawing 85 M 47W435-217, R9
TVA ECN 3614, 05/14/84

WBN Calculation 200-13-06

TVA drawing 85 M 47W465-203, R3
TVA drawing 85 M 47B465-370, R1
TVA drawing 85 M 47B465-370, R2
TVA ECN 4153, 10/03/83

34. Design Criteria - SQN-DC-V-1.3.3.1, "General Design Criteria for Additions after November 14, 1979 - Reinforced Concrete, Structural, and Miscellaneous Steel," [ESB 840918 209] Rev. 4 (09/4/84), Rev. 0, (08/11/80)

Design Criteria - SQN-DC-V-24.1, "Location and Design of Piping Supports and Supplemental Steel in Category I Structures," [B05 860703 501] Rev. 0 (06/23/86)

Design Criteria CEB 76-5, "Alternate Criteria for Piping Analysis and Support," [CEB 830613 026] Rev. 0 (12/15/81); Rev. 3 (06/13/83)

Nuclear Performance Plan (NPP), Volume II, Revision 1; [L44 860714 800], (07/14/86)

35. ASME B&PV Code Section III, Division 1, Subsection NF, 1983 edition, "Components Supports"
36. Problem Identification Report No. PIR WBNCEB8536, [B41 851112 026], (10/31/85)

37. Design Criteria WB-DC-20-1.1, "General Design Criteria for Additions after July 23, 1979 - Reinforced Concrete, Structural, and Miscellaneous Steel," Rev. 6, (07/24/85)
38. ASME B&PV Code Section III, Division 1, 1971 edition up to and including summer of 1973 addenda, Subsection NF, 1974 edition, entitled "Component Supports," [no RIMS number]
39. Telecon between TVA and Bechtel, (03/21/87), (IOM 784)
Telecon between TVA and Bechtel, (03/31/87), (IOM 886)
Telecon between TVA and Bechtel, (04/06/87), (IOM 887)
40. Design Criteria BFN-50-D703, "Evaluating Structural Steel Components Subjected to the Environmental Effects of the March 22, 1975 Fire," (05/08/75, Rev. 0) [ESS 810617 206], Rev. 1, (08/27/75)
Design Criteria BFN-50-D705, "Evaluating Mechanical Piping, HVAC Ducting, Conduit, and Piping Components Subjected to the Environmental Effects of the March 22, 1975 Fire," (05/08/75) Rev. 0, [ESS 810617 208], Rev. 3, (12/17/75)
41. Design Specification BLNP-DS-1915-2992-00, "BLP Units 1 and 2 ASME Section III and B31.1 Seismic Support," [53 820732], (04/11/78)
Engineering Procedure BLEP-06, "Component Supports - Analysis, Design, Procurement, Fabrication, and Installation," [ESB 831019 205], Rev. 3, (11/01/83)
42. BLN List of Drawings Identified for PIR BLN CEB8512, (06/05/87)
43. Policy Memorandum PM-86-11 (CEB), "All Nuclear Plants - Design/Reevaluation of Steel Structures for Normal Operating Thermal Loads," [B41 860627 003], (06/27/86)
44. BLN Support Drawings - showing structural member end restraints:
 - OKE-MPHG-0460, R6
 - ONM-MPHG-0531, R3
 - OVK-MPHG-0370, R3
 - 1CR-MPHG-0257, R1
 - 1NP-MPHG-1017, R3
 - 1SM-MPHG-0002, R8
45. WBNP FSAR QA Chapter 17 (Paragraph 17.1.3.3 of TVA-TR 75-1A, Rev. 8)

46. EN DES-EP 3.03, "Design Calculations," [ESB 840426 210], Rev. 8, (04/24/84); Rev. 0, (08/22/74)

Office of Engineering Procedure (OEP) 10, [no RIMS number], Rev. 0, (04/26/85)

47. Support Calculations:

47A450-21-128, R2	1-87-68, R3	47A400-6-333, R0
47A437-3-1, R3	47A400-1-1, R1	1-03A-586, R0
47A437-2-22, R1	47A400-11-30, R0	1-62A-328, R0
47A427-8-38, R1	67-1ERCW-R212, R2	1-63-033, R1
47A400-6-361, R0	1-01A-309, R2	1-68-131, R2
47A400-6-97, R1	1-03A-471, R2	1-63-320, R1
72-1CS-R116, R1	63,1S1S-V132, R0	

48. Documentation Pertaining to WBN Technical Audit:

TVA (WBN) letter to Gilbert, "Design Review for Piping Analysis and Pipe Supports," [B41 851121 031], (11/18/85)

Gilbert response to TVA (WBN) letter 85-127, [B26 851213 010], (12/11/85)

Impell response to TVA (WBN) letter 85-119, "Analysis and Support Design Review Responses," (08/26/85)

Impell response to TVA (WBN) letter 85-126, "Analysis and Support Design Review Responses," (11/18/85)

Letter from R. O. Hernandez to T. C. Cruise, "Impell's Comments on TVA's Review of Their Pipe Support Designs," (10/23/85)

Letter from R. O. Hernandez to R. G. Pratt, "Design Review of Unit 2 Impell Pipe Supports," (01/26/86)

49. BFN Proposed Instruction for the Calculation Verification Review Program [no RIMS number], (11/86); Rev. 1, (03/31/87)
50. TVA memo from W. C. Drotleff (DNE) to Those Listed, "Policy Memorandum PM86-04 (DNE) - Engineering Judgment," [B20 860424 001], (04/25/86)
51. American Society of Mechanical Engineering (ASME) Boiler and Pressure Vessel Code, Section III - Division 1, "Rules for Construction of Nuclear Power Plant Components - Subsection NF - Component Supports," 1974 edition through 1976 summer addenda.

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52. BLN Final Safety Analysis Report (FSAR) through Amendment 27, Section 3.9, "Mechanical Systems and Components," (06/20/86) including Table 9.9.3-37
53. TVA memo from W. R. Brown to J. L. McAnally, "Transmittal of ECSP Reports and Corrective Action Tracking Documents - (CATDs) Watts Bar Nuclear Plant Subcategory - Construction - Embeds - RO," (Construction Subcategory Report 10400, RO), [T25 870210 861], (02/10/87)
54. Preliminary Copy of WBN Project Procedure WBEP-SEP 86-02, "Unit 1 Hanger and Analysis Update Program," (02/09/87)
55. TVA Civil Design Standard DS-C1.6.1 "General Design Information - Structural Steel Design Scope," current revision Rev. 1 (06/08/81) [ESS 810608 227]
56. Problem Identification Report (PIR) BLN CEB8512, [B41 851118 010], (11/05/85)
57. TVA memo from J. C. Standifer (WBN Project Manager) to R. G. Domer (Acting Director of Engineering Projects Nuclear), "Employee Concern IN-85-052-001," [no RIMS number], (12/23/85)
58. TVA memo from W. C. Drotleff to Those Listed, "Policy Memorandum PM86-04 (DNE) - Engineering Judgment," [B20 860424 001], (04/25/86)
59. Nuclear Engineering Procedure NEP-3.1 (formerly OEP-07), "Calculations - All Nuclear Plants," Rev. 0 (07/01/86)
60. Training records for "Watts Bar Nuclear Plant - Quality Assurance Training (in the practical application of the 47A050 notes)," (09/19/85)
61. TVA memo from L. C. M. Roddye, (WBN Principal Engineer Support Design, Section 3) to Watts Bar Engineering Project Files, "Watts Bar Nuclear Plant - SCR WBN CEB 8569 - Additional Justification for Non Generic Determination," [B22 861120 016], (11/20/86)
62. TVA memo from G. Wadewitz (WBN Project Manager) to W. T. Cottle (WBN Acting Site Director), "Watts Bar Nuclear Plant-Request for Investigation/Evaluation (for concern IN-85-532-006)," RFI WBN-288, [no RIMS number], (12/19/85)
63. FCR I-2394, [B26 850927 019], (08/05/85)
64. Pipe Support Drawing, Rev. 1, and Calculation, Rev. 1, for 47A465-3-52, [B41 850711 811], (calculation date 08/10/85)

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65. American Institute of Steel Construction (AISC), Manual of Steel Construction 7th edition (1973) and 8th edition (1980)
66. Letter from D. M. Verrelli (NRC) to H. G. Parris (TVA) "Reports Nos. 50-259/85-21, 50-260/85-21, and 50-296/85-21," [A02 850502 003], (04/26/85)
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69. BFN Significant Condition Reports (SCR):

<u>SCR No.</u>	<u>RIMS</u>	<u>Date</u>
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SCR BFN CEB 8512	841 860905 021	08/29/85
SCR BFN CEB 8607 RO	841 860218 006	02/10/86
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