EMPLOYEE CONCERNS

SPECIAL PROGRAM

VOLUME 2
ENGINEERING CATEGORY

SUBCATEGORY REPORT 22300
INSTRUMENT SUPPORTS DESIGN

UPDATED

TVA

NUCLEAR POWER

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TVA EMPLOYEE CONCERNS SPECIAL PROGRAM

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REPORT TYPE: SUBCATEGORY REPORT FOR ENGINEERING

REVISION NUMBER: 3

TITLE: INSTRUMENT SUPPORTS DESIGN

REASON FOR REVISION:

1. Revised to incorporate initial SRP and TAS comments and latest element evaluation status.

2. Revised to incorporate additional SRP comments and BLN CAP.

3. Revised to incorporate additional SRP and TAS comments; revised Attachments A and B; added Attachment C (References).

PREPARATION

PREPARED BY: _____ SIGNATURE _____ 10-15-87 DATE

REVIEWS

~~TEG~~: REVIEW COMMITTEE: _____ SIGNATURE _____ 10-15-87 DATE

TAS: _____ SIGNATURE _____ 11/18/87 DATE

CONCURRENCES

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		SRP: _____	11-24-87
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MANAGER OF NUCLEAR POWER DATE

CONCURRENCE (FINAL REPORT ONLY)

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

EXECUTIVE SUMMARY

Subcategory 22300, Instrument Supports Design, addresses five employee concerns about the design and installation of instruments and instrument line support connections. The concerns cited perceived problems with torquing of connection bolts, failure of instrument tubing clamps, adequacy of instrument mounting brackets, and seismic qualification of locally mounted instruments.

The evaluation substantiated the claim that certain deficiencies exist at all four nuclear plants relative to the torquing of bolted connections for instrument line supports.

At the two nuclear plant sites (Sequoyah and Watts Bar) evaluated for the adequacy of instrument mounting brackets, it was determined that the structures were capable of withstanding the most severe loads in Engineering's design bases. However, it also was determined that mounting brackets for safety-related instruments could be subjected to damaging abuse in areas of heavy traffic.

The evaluation found that documentation for the seismic qualification of locally mounted instruments at the Sequoyah plant was incomplete.

Walkdowns, document revisions, retorquing, inspections, and evaluations are necessary to resolve the findings.

The principal causes of the validated issues were ineffective communications, inattention of first- and second-line engineering supervision to the engineering construction interface, and incomplete design detail. Further, TVA's incomplete attempts to perform its corrective actions committed to for element 223.3 reveal continued inattention to detail of first- and second-line supervision.

Beyond the specific issues related to design adequacy of instrument and instrument line supports, the oversights found in a number of TVA design output documents indicate broader deficiencies in Engineering's attention to details. The design of nuclear power plants requires addressing many items not generally considered in nonnuclear applications. Accordingly, there is a need for first- and second-line engineering supervision to be better trained in the special requirements of nuclear power plant design, particularly in the area of design documentation.

A review of the Nuclear Performance Plans (Ref. 4) by the evaluation team revealed that TVA's efforts will be beneficial to its nuclear program when fully implemented. Strengthening the Branch Chiefs' organizations, increasing technical training, and adding the Engineering Assurance organization to perform technical audits are the principal enhancements related to this subcategory that are described in the NPPs.

The findings of this subcategory are combined with those of other subcategory reports and reassessed in the Engineering category evaluation, which has assessed the broader issues identified and has issued the necessary corrective action tracking documents.

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

HISTORY OF REVISION

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

Preface

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

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

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

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

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

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

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

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

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

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

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

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

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

ECSP GLOSSARY OF REPORT TERMS*

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

Class A: Issue cannot be verified as factual

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

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

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

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

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

concern (see "employee concern")

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

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

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

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

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

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

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

K-form (see "employee concern")

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

root cause the underlying reason for a problem.

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

Acronyms

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

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

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

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

CONTENTS

TABLES

1. INTRODUCTION

This subcategory report summarizes and evaluates the results of the ECSP element evaluations prepared under Engineering Subcategory 22300, Instrument Supports Design.

Subcategory 22300 addresses concerns about the design and installation of instruments and instrument lines, along with their respective supports. The concerns cited perceived problems with torquing of support connection bolts, adequacy of instrument mounting brackets, and seismic qualification of locally mounted instruments.

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

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

- Section 2 -- summarizes, by element, the issues stated or implied in the employee concerns and the determination of generic applicability
- Section 3 -- outlines the process followed for the element and subcategory evaluations
- Section 4 -- summarizes, by element, the findings and identifies the negative findings that must be resolved
- Section 5 -- highlights the corrective actions required for resolution of the negative findings cited in Section 4 and relates them to element and to plant site
- Section 6 -- identifies causes of the negative findings
- Section 7 -- assesses the significance of the negative findings
- Attachment A -- lists, by element, each employee concern evaluated in the subcategory. The concern number is given along with notation of any other element or category with which the concern is shared, the plant sites to which it could be applicable are noted, the concern is quoted as received by TVA, and is characterized as safety related, not safety related, or safety significant
- Attachment B -- contains a summary of the element-level evaluations. Each issue is listed, by element number and plant, opposite its corresponding findings and corrective actions. The reader may trace a concern from Attachment A to an issue in Attachment B by using the element number and applicable plant. The

reader may relate a corrective action description in Attachment B to causes and significance in Table 3 by using the CATD number which appears in Attachment B in parentheses at the end of the corrective action description

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

2. SUMMARY OF ISSUES/GENERIC APPLICABILITY

From the concerns, 12 issues were derived for this subcategory. Some of these issues were evaluated for more than one plant, resulting in a total of 31 issue evaluations. Not all issues apply to every plant because not all of the employee concerns, from which they originate, apply to every plant. Applicability determinations of each concern, within each element, were made early in the program, as per ECTG procedure ECTG M.1, Section 7.3, in cooperation with TVA.

The criteria for making the applicability determinations are in ECTG procedure ECTG M.1, Attachment E. The criteria clearly limit the determinations of generic applicability to be based on circumstances where there is "reasonable factual basis (not merely speculation)" for application to additional plants.

2.1 Summary of Issues

A synopsis of the issues, by element, is presented below as an overview. For the unabridged text of the issues, see Attachment B:

2.1.1 Instrument Line Support Connections - Element 223.1

Instrument line support installation requirements and restrictions, particularly those applying to bolt installation and torquing, are not adequately defined.

2.1.2 Instrument Mounting Brackets - Element 223.2

Instrument-mounting brackets are not strong enough either to support instruments under design conditions or to resist abusive treatment.

2.1.3 Local Instrument Seismic Qualification - Element 223.3

Locally mounted instrument installation details are based on "good engineering judgment" without performing seismic analyses or qualification.

2.1.4 Summarized Subcategory Issues

The issue summaries above deal with presumed deficiencies or inadequacies in the design of the supports or mountings of instruments and instrument lines.

As the following sections show, portions of all of the above summarized issues were found to be valid and require corrective action.

2.2 Determination of Generic Applicability

The generic applicability assignments made are given below:

2.2.1 Element 223.1

Concerns IN-85-398-002 and IN-85-398-003 were evaluated at all four plants. Concern PH-85-054-001 was not evaluated at Browns Ferry (BFN) or Bellefonte (BLN) since the drawing series cited in the concern does not exist by number or subject for these plants.

2.2.2 Element 223.2

Concern IN-85-973-002 was evaluated at Sequoyah (SQN) and Watts Bar (WBN) only and was established to be a plant maintenance issue. The concern originated at and was specific to WBN. SQN was also evaluated because it is a sister plant to WBN.

2.2.3 Element 223.3

Concern IN-85-886-N04 was evaluated at SQN only. After evaluation at SQN, the concern was transferred to the Quality Assurance Category for evaluation and determination of generic applicability under Subcategory 80500.

3. EVALUATION PROCESS

This subcategory report is based on the information contained in the applicable element evaluations prepared to address the specific employee concerns related to the issues broadly defined in Section 2. The evaluation process consisted of the following steps:

3.1 Element 223.1

3.1.1 Sequoyah

a. Obtained and reviewed the notes on 47A050 series drawings and typical support drawings (both civil and electrical/instrumentation) for approved and qualified sizes, numbers, and types of clamps for instrument lines (Ref. 9).

b. Determined that Unistrut clamp series P2008-P2102 or other manufacturer equivalent was used of SQN.

c. Determined clamp installation requirements.

d. Obtained and reviewed previous revisions of above documents for evidence of changes in requirements.

e. Reviewed calculations and test results to ensure that the design supports the drawings (Ref. 10).

f. Reviewed applicable NCRs, SCRs, etc., on these issues (Ref. 8).

g. Reviewed TVA SQN GCTG Report GCC-13-59 for Employee Concern PH-85-054-001 (Ref. 13).

h. Reviewed TVA corrective action plans for CATDs 223 01 SQN 01, 02, and 03 (Ref. 14).

3.1.2 Watts Bar

a. Reviewed TVA memos on the issues (Ref. 12).

b. Reviewed 47A050 series drawings to determine clamp installation requirements (Ref. 9).

c. Reviewed applicable nonconformance reports (NCRs), significant condition reports (SCRs), problem identification reports (PIRs), etc. (Ref. 8).

d. Reviewed calculations and test results to ensure that the design supports the drawings (Ref. 10).

e. Reviewed Construction Category Report C017203 (Ref. 13).

f. Reviewed TVA corrective action plans for CATDs 223 01 WBN 01 and 02 (Ref. 14).

3.1.3 Browns Ferry

a. Performed a walkdown of selected areas of the reactor building in order to inspect typical instrument line supports (Ref. 11).

b. Reviewed applicable design criteria and project instructions (Ref. 6).

c. Reviewed applicable nonconformance reports (NCRs), significant condition reports (SCRs), and problem identification reports (PIRs) (Ref. 8).

d. Reviewed typical design drawing and calculation (Ref. 9).

e. Reviewed Construction Category Report C017303-BFN (Ref. 6).

f. Reviewed test report for Unistrut clamps (Ref. 10).

g. Reviewed TVA corrective action plans for CATD 223 01 BFN 01 (Ref. 14).

3.1.4 Bellefonte

a. Reviewed typical design drawings and calculations (Ref. 9).

b. Reviewed applicable design criteria and project instructions.

c. Reviewed applicable nonconformance reports (NCRs), significant condition reports (SCRs), and problem identification reports (PIRs) (Ref. 8).

d. Performed a walkdown of selected areas of the Auxiliary Building, Control Building, and Reactor Building in order to inspect typical instrument line supports (Ref. 11).

e. Reviewed Construction Category Report C017303-BLN (Ref. 13).

f. Reviewed test reports for instrument tubing clamps (Ref. 10).

g. Reviewed the quality control procedures for instrument tubing installation (Ref. 13).

h. Discussed the installation of tubing clamps with field engineers knowledgeable in the installation of these clamps (Ref. 11).

i. Reviewed TVA corrective action plan for CATD 223 01 BLN 01 (Ref. 14).

3.2 Element 223.2 - Sequoyah and Watts Bar

a. Reviewed FSAR and design criteria for TVA's commitments to operating and seismic design requirements for Category I instrument supports (Ref. 5).

b. Obtained and reviewed TVA drawing series 47W600 which shows instrument mounting brackets (Ref. 9).

c. Reviewed various revisions of applicable drawings for evidence of changes in engineering design requirements (Ref. 9).

d. Reviewed seismic qualification test data, which support design, and performed calculations, as needed (Ref. 10).

e. Reviewed TVA corrective action plans for CATDs 223 02 SQN 01 and WBN 01 (Ref. 14).

3.3 Element 223.3 - Sequoyah

a. Reviewed Environmental Qualification (EQ) program commitments (general program for environmental qualification) in SQN Nuclear Performance Plan, Volume II (Ref. 4).

b. Obtained results of Seismic Qualification Review Team (SQRT) audit by NRC.

c. Determined which instrumentation items were covered by SQRT audit.

d. Reviewed FSAR for SQN commitment for instrument seismic qualifications. Reviewed Safety Evaluation Report (SER) in the same sections for results of NRC review (Ref. 5).

e. Reviewed SQN design criteria and other commitments regarding qualification requirements (Ref. 6).

f. Selected and reviewed appropriate samples of qualification documentation (Ref. 10).

g. Obtained and reviewed drawings that show mounting details (Ref. 9).

h. Reviewed TVA corrective action plan for CATD 223 03 SQN 01 (Ref. 14).

3.4 Subcategory 22300

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

b. Prepared other tables, as needed, 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 causes and established the collective significance 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 for each issue from the seven element evaluations for this subcategory are contained in Attachment 8, where they are listed by element number and by plant.

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

4.1 Instrument Line Support Connections - Element 223.1

This element addressed the concern that the design guidance and instructions concerning instrument line support connections were inadequate and the implementation of these instructions produced undesired results. In general, TVA guidance in this area was reasonably clear and technically adequate although some enhancements were necessary at all plants in the area of requirements for bolt tightening. Other findings were that a number of unauthorized Unistrut clamps were in use (SQN, WBN, and BFN), that more specific designation was required with regard to clamp callouts on drawings (SQN), and that some clamp damage resulted from the torquing of one-piece, one-bolt clamps to 6 ft-lb (WBN, BFN, and BLN). Many of these items had prompted TVA corrective action before ECTG investigation.

4.2 Instrument Mounting Brackets - Element 223.2

This element was generally concerned with the degree to which instrument mounting brackets could withstand seismic or other severe design loads and withstand abusive treatment in heavy traffic areas. The review of available documentation and the inspection of instrument mounting brackets confirmed that instrument mounting brackets at SQN and WBN are adequate to meet their most severe specified design conditions. Although these brackets are adequate to support the relatively light instruments, they are not substantial enough to withstand the abusive treatment (i.e., plant personnel stepping on or bumping into brackets) that is inevitable in heavy traffic areas of both plants.

4.3 Local Instrument Seismic Qualification - Element 223.3

This element was concerned with the extent to which engineering judgment was used at SQN in the design of locally mounted instrument installation details without an accompanying seismic analysis or seismic qualification. In general, TVA followed acceptable standard practice in this matter; and items were installed in accord with standard TVA design guidance. However, it was confirmed that documentation is not complete in many areas.

4.4 Summary of Subcategory Findings

A summary of the classified findings is provided in Table 1. Class A and B findings indicate there is no problem and that corrective action is not

required. Class C, D, and E findings require corrective actions. The corrective action class, defined in the Glossary Supplement, is identified in the table by the numeral combined with the finding class.

The summary of findings by classification is given in Table 2. Where more than one corrective action is identified in Table 1 for a single finding (e.g., Element 223.2, Finding b), Table 2 counts only a single classification. Thus Table 2 identifies one finding for each issue evaluated. Of the 35 findings identified in Table 1, 13 require no corrective action. Of the remaining 22 findings, ten had corrective actions initiated before the ECTG evaluation, eight had new corrective actions identified, and four were findings for peripheral issues identified during the ECTG evaluation and requiring corrective actions. From this table, it can be seen that at Watts Bar, where all of the issues were originated, seven issues out of a total of ten were found to be valid and require corrective action, and six of those seven had corrective action initiated before the ECTG evaluation.

5. CORRECTIVE ACTIONS

The general areas of corrective action are described below for each element reviewed for this subcategory. Following this is a summary discussion of the information presented in Table 3.

5.1 Instrument Line Support Connections - Element 223.1

The instructions pertaining to instrument line support connections and the resulting installation were reviewed and considered adequate to satisfactorily meet the design intent and design service. However, several corrective actions were required which are identified in Attachment B. Three principal measures are being taken. First, drawings pertinent to this subject are being revised to better specify approved Unistrut clamp types, while design documents applicable to this subject are being updated to the latest requirements (WBN, BFN, and BLN). Second, corrective actions are under way to walk down or inspect affected plants for nonconforming materials or installations to assure that Unistrut bolts are properly tightened, qualified materials are used, and correct clamp types are installed (SQN, WBN, and BLN). Finally, all unqualified or damaged support clamps will be replaced (SQN and WBN). For BFN these clamps will either be replaced or qualified by special analysis.

5.2 Instrument Mounting Brackets - Element 223.2

Although the design strength of mounting brackets to support instruments was found adequate, findings about damage potential in heavy traffic areas revealed the need for corrective action at both SQN and WBN. For both plants, TVA plans to (1) identify those safety-related instruments that are susceptible to damage from traffic, (2) walk down the areas and inspect for damaged brackets, (3) develop stronger instrument mounting details and replace damaged instrument brackets and those potentially susceptible to damage.

5.3 Local Instrument Seismic Qualification - Element 223.3

This element, which relates only to SQN, concerned the basis for the location and installation of local instruments and the extent or degree to which they were seismically qualified. As noted above in the discussion of findings on this issue, engineering judgment is an acceptable basis for establishing proper qualification of instrumentation equipment, and the TVA practice in this regard is not considered unusual or inappropriate. However, the review of this matter revealed certain situations where some level of documentation might have better explained the installation of certain types of instrumentation equipment. TVA intends to (1) determine the seismic qualification basis for all seismic Category I Instruments, (2) review all safety-related instrument installations to verify that they are properly located and consistent with their seismic qualification, and (3) modify supports or replace instruments as necessary to satisfy qualification requirements.

5.4 Summary of Subcategory Corrective Actions

TVA corrective actions that have been implemented since the concerns were registered have revealed the need for a large number of documentation changes and only a very limited need for plant modifications. The greatest field effort is related to the need to verify the torque values of support connection bolts. Actual plant modifications are identified in Table 3 for Sequoyah, Watts Bar, and Browns Ferry. Although many of these modifications could possibly have been eliminated by performing rigorous engineering analyses to demonstrate the adequacy of the specific installations, TVA has not generally elected to do so.

Table 2 identifies 22 findings that require corrective action. The corrective actions, along with their finding/corrective action classifications, are summarized in Table 3. The corrective action descriptions in Table 3 are a condensation of the more detailed corrective action information provided in Attachment B. The plant or plants to which a corrective action is applicable are shown in the Corrective Action Tracking Document (CATD) column, and are identified by the CATD number.

With respect to corrective actions, Table 3 shows that, of the three elements in this subcategory: 223.1, which applies to all plants, has 15 corrective action descriptions; 223.2, which applies to SQN and WBN, has three corrective action descriptions; and 223.3, which applies to only SQN, has one corrective action description.

The corrective action plans for Sequoyah, Watts Bar, Browns Ferry, and Bellefonte are found to be acceptable by the evaluation team to resolve the findings.

6. CAUSES

Table 3 identifies one or more causes for each problem requiring corrective action and is organized in three major groups: management effectiveness, design process effectiveness, and technical adequacy. For each corrective action description, the closest or most immediate reason for a result is identified. However, in many instances it was observed that the problem resulted from a combination or chain of causes, each of which should be identified. Therefore, more than one cause is identified for those corrective actions.

The causes for problems in the area of instrument supports design generally relate to communications and design details. The greatest number of causes fall in the area of management effectiveness. Detailed bases for selection of the specific causes are provided in Section 6.2 below.

6.1 Major Groupings of Causes

The engineering errors that occurred in the design of instrument line supports were generally those of omission. Procedures that did not adequately define the technical design requirements and first- and second-line engineering supervisors who did not pay sufficient attention to the details of nuclear power plant design. This led to oversights in both verifying the design and properly directing construction regarding the installation. Errors in vendor catalog information were beyond the control of TVA engineers. Accordingly, there are no higher level causes.

In many areas, the TVA design process was sound. However, the design bases for qualified instrument line clamps and their required bolt torquing were unclear; additionally, the design bases for instrument mounting brackets did not address the need to consider abusive treatment in certain high traffic areas. This led to design details not specifying qualified instrument line clamp types and required bolt torquing, and for local instrument seismic qualifications to have been performed using undocumented engineering judgment. As-built reconciliation and verification documentation for both instrument line supports and local instrument seismic qualifications did not properly define and analyze the actual installed configurations. The combination of the above contributed to some uncertainty regarding the design process for this area of review.

The extent to which management, including first- and second-line supervision, is engaged in the design work was examined on the basis of the findings identified. In many areas, supervisory effectiveness was adequate. However, exceptions were noted in the areas of organizational definition, communications, and supervisory familiarity with the rigorous requirements of nuclear power plant design.

6.2 Detailed Bases for Specific Causes

The bases for identifying specific causes follow for each negative finding for which corrective actions are described in Table 3.

6.2.1 Instrument Line Support Connections - Element 223.1

- Provisions for torquing of support clamp bolts were not defined on the SQN construction drawings, indicating insufficient design detail and incomplete communications with the field. The oversight was an error by Engineering.

- Resolution of potential use of unauthorized clamps at SQN, as a result of generic review of WBN SCR 6084-S, during the construction and operating phases of plant life was the resulted from unfocused responsibilities and insufficient communication between Regulatory Licensing, Power Stores, Operations, and Engineering.

- Potential errors at SQN resulting from the broad range of clamp designations could have been prevented had Engineering provided more design detail on the construction drawings. This oversight was an error by Engineering.

- Confusing notes on the instrument support standard drawing for WBN impaired communications of the design requirements to Construction. This could have been prevented by first- and second-line supervision being more attentive in providing Construction with the information necessary to properly construct the instrument supports. In addition, there was insufficient detail in the notes, potentially leading to the use of unqualified clamps.

- Insufficient communication to Construction and incomplete design detail resulted from Engineering's failure to specify bolt torques for instrument line support clamps at WBN. This oversight was an error by Engineering.

- Damage of instrument line clamps at WBN was originally caused by the vendor in specifying an inappropriate torque value for the P2008 series clamp. Subsequent installation and quality control acceptance of such damaged clamps by Construction personnel without feedback to Engineering are indicative of procedures not being followed and lack of proper communications. In addition, sample walkdowns by DNE have indicated that instrument lines were not installed in accordance with design requirements and that there were both insufficient documentation to audit the installation adequacy and inaccurate as-built reconciliation.

- Loose clamps at WBN are the result of a lack of sufficient first- and second-line engineering supervision attention to design detail in providing an adequate design basis for support of instrument lines.

- The need for verifying and correcting the torque values of all Unistrut type clamp bolts at BFN could have been prevented by greater attention from first- and second-line engineering supervision to design detail in providing adequate design bases. This oversight was an error by Engineering.

- The requirements for qualified instrument line clamp types at BFN were not communicated by Engineering to Plant Operations and Construction before November 27, 1985. This omission was a result of lack of sufficient first- and second-line engineering supervision attention to design detail in providing adequate design bases for support of instrument lines.

- Potential damage of instrument line clamps at BFN and BLN originated from an error by the vendor in specifying an inappropriate torque value for the P2008 series clamps.

- Failure to fully specify qualified clamp types in the BFN design criteria and to implement appropriate corrective actions to prevent recurrence arose from incomplete design bases and procedures resulting in lack of sufficient design detail. This oversight could have been prevented by additional attention by first- and second-line engineering supervision to the unique aspects of nuclear plant design.

- Incorrect inspection requirements for supports on five instrument lines at BLN resulted from incomplete information being communicated to Construction and lack of information about the design detail provided by Engineering.

6.2.2 Instrument Mounting Brackets - Element 223.2

In heavy traffic areas, the instrument mounting brackets at WBN and SQN were susceptible to inadvertent abusive treatment and damage from plant personnel. This was primarily caused by engineering design bases not considering bracket loads other than from the attached instruments. The problem could have been minimized if either Construction or Operations had given feedback to Engineering on the bracket's susceptibility.

6.2.3 Local Instrument Seismic Qualification - Element 223.3

The indeterminancy of the seismic qualification of local instruments at SQN was driven by insufficient depth of design details defined by the Civil

Engineering Branch (CEB) and lack of adequate communication of design details, actual furnished components, and installed configurations among the CEB and the Electrical Engineering Branch (EEB), which supplied the instruments, and Construction, which installed them. These were caused by lack of attention to detail by the first- and second-line supervision in each of the three involved groups. The extent of the problems could not readily be established because of incomplete and incorrect as-built reconciliation.

7. COLLECTIVE SIGNIFICANCE

The evaluation team's judgment as to the significance of the corrective actions is indicated in the last three columns of Table 3. Significance is rated in accordance with the types of changes that may be expected to result from the corrective action. The corrective action plan descriptions for elements 223.1 and 223.3 are judged to be individually significant from both licensing and technical standpoints to ensure the functional operability of Category I or Class I instruments and instrument lines during a seismic event. The corrective action plan descriptions for element 223.2 are judged to be individually significant only from a maintenance standpoint.

When all the findings and corrective action descriptions for all four nuclear plants are viewed collectively, the following overall conclusions emerge:

- Although the majority of problems identified may only require changes in design input or output documents, the extent of the evaluations to be performed (including plant walkdowns) indicates the difficulty in determining the acceptability of the as-built instruments, instrument lines, and their supports. These evaluations must be performed before any need for hardware changes can be known. This is reflected in the number of potential changes identified in the last column of Table 3.

- Beyond the specific issues related to the design adequacy of instrumentation supports, there is the broader issue of Engineering's lack of attention to details. The design of nuclear power plants requires the consideration of many unique items not generally considered in nonnuclear applications. Accordingly, there is a need for first- and second-line engineering supervision to be better trained in the special requirements of nuclear power plant design.

Certain aspects of the broader issue regarding management's inattention to detail apparently continue to exist at TVA, as evidenced by its attempt to complete the corrective actions for SQN element 223.3. Review of the corrective action completion notification prepared by TVA revealed that TVA had not performed the corrective actions as defined in its corrective action plan nor documented the engineering judgments made as required by TVA policy [BOS 861222 501].

To address the general programmatic issues of TVA's past difficulties in the nuclear area, the Corporate Nuclear Performance Plan (CNPP) (Ref. 4) was created. In addition, SQN, WBN, and BFN have generated plant-specific nuclear performance plans (NPPs) (Ref. 4) to further define the programmatic actions to be taken for their facilities (BLN is broadly addressed in the CNPP).

In general, TVA senior management has identified the need for strengthening its Engineering organization in response to the requirements of nuclear plant design. The Engineering organization is responsible for the content and quality of the design documents and for ensuring that they conform to sound engineering principles, licensing commitments, and Quality Assurance program requirements. This need for strengthening is based, in part, on deficiencies in design process effectiveness, which are partially illustrated by the cause discussion in Section 6. This need is also partially based on past implementation of the TVA Quality Assurance program. Thus, the need for strengthening the Engineering organization, as indicated by the NPPs, is accomplished primarily through additional training of the DNE personnel to the requirements of that program and to basic management principles.

DNE Nuclear Engineering Procedure NEP-5.2 and policy memo PM 87-35 clearly delineate the responsibility, authority, and accountability of the Project Engineers and Branch Chiefs. The Project Engineer is responsible for work scope, budget, and schedule, and for ensuring that project work is executed according to plan and in conformance with the technical direction of the Branch Chiefs and the requirements of the corporate QA program. The Branch Chiefs are responsible for staffing levels and qualifications of technical personnel on the projects, and for the technical adequacy of the engineering design. The Branch Chiefs are the final technical authority within DNE, and have the authority to stop work that does not conform to established requirements. In the past, Branch Chiefs' authority or resources to fully administer technical reviews was limited. Under the restructured organization, the Branch Chief provides engineers and technical direction for the Project Engineer; the Branch Chief also assesses the need for technical reviews, develops a document review and approval matrix, and schedules reviews as required. These programs have been started but have not, as of this report revision, been fully implemented.

An independent audit on the effectiveness of the implementation of the total Quality Assurance program is instituted by Engineering management, as a management tool, to additionally ensure that management policy is being enforced. This audit function is provided by the Engineering Assurance (EA) organization.

The findings of this subcategory are combined with those of other subcategory reports and reassessed in the Engineering category evaluation, which has assessed the broader issues identified and has issued the necessary corrective action tracking documents.

TABLE 1

CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

	Element	Issue/ Finding**	Finding/Corrective Action Class* SQN	WBN	BFN	BLN
223.1	Instrument Line Support Connections	a	A -	C3 C6	D1 D6	C7 -
		b	C1	C6	D1	D6
		c	A -	C6 -	C1 C6	A -
		d	C1 -	C1 C6	A -	A -
		e	A	A	A	A
		f	A -	A -	E3 E6	- -
		g	E6	-	-	-
		h	E3	-	-	-
223.2	Instrument Mounting Bracket***	a	A	A	-	-
		b	D1 D6	C1 C6	- -	- -
		c	D1 D6	C1 C6	- -	- -
		d	-	E6	-	-

* Explanation of classes is on the next page.
** Defined for each plant in Attachment B.
*** After evaluation of SQN and WBN, the evaluation team established that this is a plant maintenance issue and does not represent a safety concern. Accordingly, a review of BFN and BLN was not performed.

Table 1 (Cont'd)

	Element	Issue/ Finding**	Finding/Corrective Action Class* SQN	WBN	BFN	BLN
223.3	Instrument Seismic Qualification***	a	D6	-	-	-
		b	D6	-	-	-
		c	D6	-	-	-

*Classification of Findings and Corrective Actions

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

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

**Defined for each plant in Attachment B.

*** Reviewed for SQN only, reassigned by TVA to Subcategory 80500 for other plants.

TABLE 2

FINDINGS SUMMARY

Classification of Findings	Plant SQN	WBN	BFN	BLN	Total
A. Issue not valid. No corrective action required.	5	3	2	3	13
B. Issue valid but consequences acceptable. No corrective action required.	-	-	-	-	0
C. Issue valid. Corrective action initiated before ECTG evaluation.	2	6	1	1	10
D. Issue valid. Corrective action taken as a result of ECTG evaluation.	5	-	2	1	8
E. Peripheral issue uncovered during ECTG evaluation. Corrective action required.	2	1	1	-	4
Total	14	10	6	5	35

TABLE 3
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES
SUBCATEGORY 22300

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CATD	CAUSES OF NEGATIVE FINDINGS*																	Significance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS							DESIGN PROCESS EFFECTIVENESS							TECHNICAL ADEQUACY					
				1 Fragmented Organization	2 Inadequate Q-trng	3 Inadequate Procedures	4 Procedures Not Followed	5 Inadequate Communication	6 Untimely Res of Issues	7 Lack of Mgt Atten	8 Inadequate Design Bases	9 Inadequate Calcs	10 Inadequate As-blt Reconcil.	11 Lack of Design Detail	12 Engrg Judgmt not Documented	13 Design/Crit Commit Not Met	14 Insuf. Verif Documentation	15 Stds Not Followed	16 Engrg Error	17 Vendor Error	D	M	H
223.1	C1	Tighten originally installed Unistrut bolts per ECNs 6690 and 6791.	SQN 02					X						X					X		A	-	A
	E6	Replace all unauthorized clamps, if any, with approved clamps resulting from the long-term torque inspection program.	SQN 01	X				X		X											A	-	A
	E3	Revise drawings in the 47A051, 47A052, and 47A054 series to call out specific approved Unistrut clamp designations.	SQN 03											X					X		A	-	-
	C3	Revise the notes for the 47A050 series drawings to reduce the potential for confusion. Corrective action was completed. Therefore, no CATD was generated.	(WBN)					X		X											A	-	-
	C6	Perform a random sample inspection at WBN to verify that no unqualified materials were used. Corrective action was completed. Therefore, no CATD was generated.	(WBN)					X		X				X							A	-	-
	C6	Respond to NCR WBN SMP 8230. Corrective action was completed. Therefore, no CATD was generated.	(WBN)					X						X					X		A	A	-
	C6	Walk down all unit 1 instrument line supports and resolve discrepancies.	WBN 01 WBN 02				X	X					X							X	A	P	P

* Defined in the Glossary Supplement.

** Defined in Table 1.

TABLE 3
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES
SUBCATEGORY 22300

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CATD	CAUSES OF NEGATIVE FINDINGS*																	Significance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS							DESIGN PROCESS EFFECTIVENESS							TECHNICAL ADEQUACY					
				1 Fragmented Organization	2 Inadequate Q-trng	3 Inadequate Procedures	4 Procedures Not Followed	5 Inadequate Communication	6 Untimely Res of Issues	7 Lack of Mgt Atten	8 Inadequate Design Bases	9 Inadequate Calcs	10 Inadequate As-blt Reconcil.	11 Lack of Design Detail	12 Engrg Judgmt not Documented	13 Design/Crit Commit Not Met	14 Insuf. Verif Documentation	15 Stds Not Followed	16 Engrg Error	17 Vendor Error	D	M	N
	C1	Retorque loosened bolts on instrument support clamps.	WBN 01								X			X							A	-	A
	D1, C1	Verify correct torque of all Unistrut-type clamp bolts.	BFN 01								X			X					X		A	-	A
	D6, C6	Perform evaluation to verify that correct Unistrut clamp types are installed.	BFN 01					X			X			X							A	P	P
	D1	Replace all Unistrut P2008-P2020 series clamp types with qualified ones.	BFN 01																	X	A	P	A
	E3	Revise Design Criteria BFN-50-0710 to refer to latest requirements.	BFN 01			X					X			X							A	-	-
	E6	Implement corrective actions to prevent recurrence of concerns regarding proper clamp types and bolt torquing.	BFN 01			X					X			X							A	-	-
	C7	Provide QC reinspection for five instrument lines.	BLN 01					X						X							A	P	P
	D6	Revise drawings 5B0925-10-17 and 5G80925-10-129 to eliminate Unistrut P2008-P2020 series clamp.	BLN 01																	X	A	-	-
223.2	D1, C1	Modify safety-related instrument brackets that are susceptible to damage.	SQN 01 WBN 01	X				X			X										A	-	A

* Defined in the Glossary Supplement.

** Defined in Table 1.

TABLE 3
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES
SUBCATEGORY 22300

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CATD	CAUSES OF NEGATIVE FINDINGS*																	Significance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS							DESIGN PROCESS EFFECTIVENESS							TECHNICAL ADEQUACY					
				1 Fragmented Organization	2 Inadequate Q-trng	3 Inadequate Procedures	4 Procedures Not Followed	5 Inadequate Communication	6 Untimely Res of Issues	7 Lack of Mgt Atten	8 Inadequate Design Bases	9 Inadequate Calcs	10 Inadequate As-blt Reconcil.	11 Lack of Design Detail	12 Engrg Judgmt not Documented	13 Design/Crit Commit Not Met	14 Insuf. Verif Documentation	15 Stds Not Followed	16 Engrg Error	17 Vendor Error	D	M	H
	D6, C6	Identify safety-related instruments mounted on light-gauge brackets and susceptible to damage from traffic.	SUN 01 WBN 01	X				X			X										A	P	-
	E6	Evaluate similar problems based on feedback from DNC and Plant Operations.	WBN 01	X				X			X										P	P	P
223.3	D6	Identify all safety-related instruments and verify that they have been properly qualified.	SUN 01					X					X	X							A	P	P
			TOTALS	4	-	2	1	12	-	3	8	-	2	11	-	-	-	-	4	3			

* Defined in the Glossary Supplement.

** Defined in Table 1.

GLOSSARY SUPPLEMENT
FOR THE ENGINEERING CATEGORY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Hardware - physical plant changes

2. Procedure - changed or generated a procedure

3. Documentation - affected QA records

4. Training - required personnel education

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

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

7. Other - items not listed above

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

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

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

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

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

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

ATTACHMENT A

EMPLOYEE CONCERNS
FOR SUBCATEGORY 22300

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 22300

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY SQN	WBN	BFN	BLN	CONCERN DESCRIPTION*
223.1	IN-85-398-003	WBN	X	X	X	X	"Bolts for Unistrut Clamps were not required to be torqued prior to 6-1-85, Unit #1. Unit #2 bolts have an option to be torqued to 6 ft. lbs. Half moon clamps flatten during a 6 ft. lb. torque. If torquing is an option on Unit #2, why wasn't it an option on Unit #1, and when should the option be applied? CI knows that this was not a procedural requirement on units. . . ." (SR/SS)
	PH-85-054-001	WBN	X	X			"The notes on the 47A050 series drawings were really confusing to the Q.C. inspection personnel. Much confusion existed between the size, number and type of instrumentation support clamps which were acceptable by the 050 series notes and what type clamp was called for on the typical support drawing. . . ." (SR/SS)
	IN-85-398-002	WBN	X	X	X	X	"Inconsistent hanger torquing: until 6-1-85 no instrumentation hanger bolts were torqued. From that date, bolts were required to be torqued to 6 ft.lb. This amount of torque flattens half moon clamps and damages clamp nose. 3-4 months ago, hanger inspectors randomly inspected unknown [number] of bolts and 40% failed (possibly 80 tested). CI questions corrective action for 10-20 thousand not tested. New 050 notes (early July '85) permits hand-tightening then turning 1/2 turn with wrench. But this can leave the tubing loose. (Both Units). . . ." (SR/SS)
223.2	IN-85-973-002 (shared with 70600)	WBN	X	X			"Typical instrument mounting brackets consisting of thin gauge, perforated sheetmetal (or similar material) are not strong enough to support the instruments (generic for typical mounts). Constant bumping into, leaning against, and sitting on these brackets/instr. causes damage to both brackets and instruments. CI could not provide specific instrument numbers, locations, etc., but stated all such installations should be subject to re-design. This was reported to manager (known) but no action was taken." (SR/SS)
223.3	IN-85-886-N04 (Reassigned to 80500 for WBN, BFN and BLN)	WBN	X				NRC identified the following concern related to IN-85-886-001 from review of QIC file. "On unit 1, local instruments were installed using 'Good Eng. Judgment' and no seismic analysis was done." (SR/SS)

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

ATTACHMENT B

SUMMARY OF ISSUES, FINDINGS, AND
CORRECTIVE ACTIONS FOR
SUBCATEGORY 22300

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

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

Issues	Findings	Corrective Actions
********** Element 223.1 - Instrument Line Support Connections **********		
SQN	SQN	SQN
a. The notes on the 47A050 series drawings for typical supports describing sizes, numbers, and types of instrument line support connections were confusing to QC inspection personnel.	a. The notes on the 4/A050 series drawings are not confusing for SQN instrument line support connections. On WBN where the concern was raised, TVA had approximately 180 notes on its drawing series. SQN has only 56. Therefore, interpretation is easier and proper implementation is achievable at SQN.	a. None required.
b. Bolts for instrument line clamps were not torqued before 06/01/85.	b. As stated in NCR SQN SWP 8305, instrument line clamps did not have specified torques before 02/83; however, the TVA bolt tightening program under specification No. M2C-946 issued 06/25/86 establishes torque requirements.	b. TVA will tighten originally installed Unistrut bolts for instrument line clamps under the program described in Engineering Change Notices 6690 and 6791. This action will assure adequate bolt installation. (CATD SQN 02) This is a post-restart corrective action.
c. The bolts were over-torqued to 6 ft-lb. after 06/01/85 causing damage to clamps.	c. SQN did not specify a 6 ft-lb value of torque for single-hole clamps on the 4/A050 series drawings. Thus, bolts were not overtorqued and clamps were not damaged because of torquing.	c. None required.
d. Forty percent of clamps failed random inspection (possibly 80 visually examined).	d. In a sampling program resulting from disposition of SCR SQN CEB 8612, a high percentage of clamps were found to have bolts which turned at less than the presently prescribed torque, although the clamps could support the tubing. Moreover, the bolt tightening program undertaken by TVA to close out the above SCR addresses the issue by assuring adequate bolt installation to meet design loadings for seismic Category I and I(L) instrument line supports.	d. See Corrective Action "b."
e. The new requirement is for bolts to be hand-tightened followed by a half-turn with wrench. This may be inadequate.	e. The new bolt tightening requirement has been verified as part of the disposition for SCR SQN CEB 8612. Drawing 4/A050-17 defines the requirements, and tests ensure the installation's meeting the design requirements.	e. None required.
f. The torque requirements for Unit 1 are different from those for Unit 2.	f. The same drawing series (4/A050) defines the requirements for both units. Therefore, once the torque requirements were established for SQN, they have been identified for both units.	f. None required.

Issues	Findings	Corrective Actions
Element 223.1 - SQN (Continued)		
g. Not defined	g. The documented evidence for the SQN response to WBN SCR 6084-S dated 12/13/85 identifying 17 types of unauthorized Unistrut clamps is being completed by TVA.	g. A review of the WBN SCR 6084-S based on the SQN construction contract records recently indicated that some of the unauthorized clamps were also received at the SQN site. However, the results of the samples taken in April 1986 did not identify any unauthorized clamps. Therefore, there is a high probability that the unauthorized clamps were not used for Category I instrument piping. Furthermore, under the long-term torque inspection program (Engineering Change Notice 6690), TVA will replace all unauthorized clamps, if any, with approved clamps. (CATD SQN 01) TVA has not completed corrective actions at this time.
h. Not defined	h. A few drawings in the 47A051, 47A052, and 47A054 series have a broad range of clamp callouts that need to be replaced with specific designations.	h. TVA will revise those drawings in the 47A051, 74A052, and 47A054 series with a broad range of Unistrut clamp callouts with the specific approved clamp designations. (CATD SQN 03) This is a post-restart corrective action.
WBN	WBN	WBN
a. The notes on the 47A050 series drawings for typical supports describing sizes, numbers, and types of instrument line support connections were confusing to QC inspection personnel.	a. The 47A050 series drawings include approximately 180 notes which were originally not arranged by subject. This condition could result in confusion and the subsequent installation of unqualified clamps. NCR 6084, R0 and R1 for WBN document the existence of an unqualified instrument line clamp for unit 2. As a result of this discrepancy, TVA deleted any reference to unqualified clamp types in the applicable design drawings. TVA also inspected a random sample of 378 clamp supports for unit 2 and found no unqualified clamps. Therefore, TVA concluded that there is 95 percent confidence that 95 percent or more of the qualified clamp types have been installed on unit 2 supports. For unit 1, TVA inspected a random sample of 787 clamp supports and found no unqualified clamps. Therefore, TVA concluded that this item is not applicable to unit 1.	a. Prior to ECTG evaluation, WBN revised notes on 47A050 series drawings and performed a random sample inspection to verify that no unqualified materials were used. Therefore, no further corrective actions are required.

Issues	Findings	Corrective Actions
Element 223.1 - WBN (Continued)		
b. Bolts for instrument line clamps were not torqued before 06/01/85.	b. Bolt tightening requirements were added via ECN 2904 to the 47A050 series drawings in 02/83 in response to NCR WBN SWP 8230. A review of construction procedures used prior to 02/83 determined that final documentation based on adequate installation requirements existed for all bolted connections except for conduit and instrument line clamps finalized before 1980. A TVA evaluation concluded that there is 95 percent confidence that less than 5 percent of the conduit and instrument line clamp bolts finalized before 1980 may not be fully tightened.	b. Prior to ECTG evaluation, bolt tightening requirements were added to 47A050 series drawings and installations made prior to 1980 were evaluated by sampling to verify acceptability. Therefore, no further corrective actions are required.
c. The bolts were over-torqued to 6 ft-lb after 06/01/85 causing damage to clamps.	c. By observing actual installations, TVA confirmed that torquing of one-piece, one-bolt clamps (Unistrut P2008 series or equivalent) to 6 ft-lb damaged them. This was corrected by revising the tightening requirements to "1/2 turn past handtight" as specified by Note 166 of drawing 47A050-1J3 in response to PIR WBN CEB 8639. In addition, TVA is reinspecting and repairing any damaged one-piece, one-bolt clamps in accordance with work plan NW334P-2 for unit 1 and PIR WBN CEB 8639 for unit 2.	c. To close out PIR WBN CEB 8639, TVA will walk down all one-piece, one-bolt instrument line support clamps and will replace any damaged clamps found during the walkdown. For unit 1, the action is being implemented and tracked as a part of NCR W-334-P. For unit 2, the action is being implemented and tracked by PIR WBN CEB 8639. (CATD WBN 02)
d. Forty percent of clamps failed random inspection (possibly 80 visually examined).	d. TVA discovered problems with the installation of instrumentation and instrument lines and, on 10/25/85, placed an administrative "hold" on this activity until the necessary corrective actions could be determined. NCR W-334-P, RO for WBN specifies discrepancies found with documentation on instrument lines and their supports. To better understand the extent of the problems, a random sample of 60 unit 1 supports was inspected by TVA. Eleven clamps or bolts were found to be loose or damaged. Reinspection and retorquing of bolts for all unit 1 instrument line clamps are being performed in accordance with Work Plan NW334P-2.	d. To close out NCR W-334-P, TVA will walk down all unit 1 instrument line supports and will resolve all discrepancies found during the walkdowns. Details of the walkdown requirements are given in TVA memos (04-09-86, [B26 860409 007] and 09-17-86, [B26 860917 052]). (CATD WBN 01)
e. The new requirement is for bolts to be hand-tightened followed by a half-turn with wrench. This may be inadequate.	e. Laboratory tests, described in TVA memo [SHE 790710 001], establish the clamp load capacities on the basis of tightening values similar to those given in Note 166 of drawing 47A050-1J3. These tightening values provide adequate clamp load capacities and preclude clamp damage.	e. None required.
f. The torque requirements for Unit 1 are different from those for Unit 2.	f. The bolt tightening requirements, given in terms of handtight plus turn-of-the-nut, were established in 02/83. Effective 06/01/85, these requirements were replaced with torque values for two hole clamps. For one-piece, one-bolt clamps, the tightening requirement was handtight plus 1/2 turn with the option to torque to 6 ft-lb. In 04/86, the optional torque value for one-piece, one-bolt clamps was deleted to avoid clamp damage. Each of the above options was defined in drawing series 47A050 which is applicable to both units 1 and 2.	f. None required.

Issues	Findings	Corrective Actions
Element 223.1 - BFN	BFN	BFN
a. Bolts for instrument line clamps were not torqued before 06/01/85.	a. As identified in NCR BFN BWP 8305, bolt-tightening requirements for instrument line clamps for units 1, 2, and 3 were not specified before 02/83. General Construction Specification G-53, R4, issued in 01/84 defined torquing requirements. However, these tightening requirements do not accurately simulate the tightening values used in the laboratory tests which established the clamp load capacities. TVA has not completed the required corrective action for NCR BFN BWP 8305 to determine the adequacy of bolt tightness for instrument line clamps installed before 01/84. The recommended method of determining the adequacy of instrument piping and tubing clamp bolt tightness given in Design Criteria BFN-50-D/10 by shaking the pipe adjacent to the support may be adequate for tubing, but may not be adequate for piping and has not been substantiated by DNE. Current TVA corrective actions do not include an evaluation of qualified clamp type use and correct bolt-tightening installation based on as-built information. Since 11/27/85, DNE has issued individual support detail drawings. A DNE review of 394 individual support detail drawings revealed that 74 drawings specify the use of Unistrut clamps. Of these 74 drawings, DNE found that 66 drawings specify proper bolt-tightening requirements, but that 8 drawings do not specify them.	a. Verify or correct installed torque values of all Unistrut-type clamps for Class I instrument tubing and small bore piping. Torque values will be verified against appropriate load rating test information. Write a CAQR to address concerns relating to the completeness of the corrective action in NCR BFN BWP 8305, R1. Verify or correct installed clamp types of all Unistrut-type clamps for Class I instrument tubing and small bore piping. Clamp types will be verified against qualified clamp types which have load rating test information. Clamps which do not have load rating test information will be replaced or qualified by special analysis. (CATD BFN 01)
b. The bolts were over-torqued to 6 ft-lb after 06/01/85 causing damage to clamps.	b. The design documents did not prohibit the use of one-piece, one-bolt clamps (Unistrut P2008-P2020 series) for units 1, 2, and 3. Thus, this clamp type, which is susceptible to damage from overtorquing, may have been used. Unistrut Corporation's design bolt torque for 1/4-inch-diameter clamp bolts (including bolts for P2008-P2020 series clamps) is 6 ft-lb. Torquing of bolts for P2008-P2020 series clamps to 6 ft-lb will cause damage to the clamps. DNE has not evaluated the as-built usage of this clamp type for installations prior to 11/27/85.	b. Replace all installed Unistrut P2008-P2020 series or similar clamps with qualified clamp types. (CAID BFN 01)
c. Forty percent of clamps failed random inspection (possibly 80 visually examined).	c. Project Instruction BFEP PI 86-29 requires a sample inspection of 64 small bore pipe supports in order to address the issues of SCR BFN CEB 8520. This inspection was not completed since the engineering evaluation of the initial inspection results showed pipe stresses larger than the allowable values.	c. See Corrective Action "a."

Issues	Findings	Corrective Actions
Element 223.1 - BFN (Continued)		
d. The new requirement is for bolts to be hand-tightened followed by a half-turn with wrench. This may be inadequate.	d. Since 11/27/85, DNE has been issuing individual support detail drawings. A review by DNE of 394 individual support detail drawings revealed 74 drawings that specified the use of Unistrut clamps. Of these 74 drawings, one drawing specified the use of Unistrut P2008-P2020 series clamps. This drawing specified a bolt-tightening requirement of "finger tight plus 1/4 turn." The evaluation team considers this to be an acceptable bolt-tightening requirement because it properly simulates the laboratory test conditions defined in TVA memo R. O. Lane to T. B. Northern, Jr., (07/10/79) and used for establishing the clamp allowable loads.	d. None required.
e. The torque requirements for each unit are different.	e. Bolt-tightening requirements for instrument line clamps were not specified before 01/84. Since 01/84, general bolt-tightening requirements have been defined in General Construction Specification G-53, R4, for units 1, 2, and 3. Since 11/27/85, these requirements for instrument line clamps have been specified on individual support design drawings.	e. None required.
f. Not defined	f. In addition, during the investigation, the evaluation team found that there are no design criteria or other design documents which identify all qualified instrument line clamp types and require that only these qualified clamp types be used for units 1, 2, and 3. Therefore, for supports installed before 11/27/85, unqualified clamps could have been used. For supports installed after 11/27/85, the use of qualified clamp types has been verified by DNE on the basis of a review of individual support detail drawings.	f. Revise Design Criteria BFN-50-0710 to refer to current qualification and evaluation criteria. Implement the corrective actions required to prevent recurrence of concerns regarding proper clamp types and proper clamp bolt tightness. (CATD BFN 01)
BLN	BLN	BLN
a. Bolts for instrument line clamps were not torqued before 06/01/85.	a. Bolt tightening requirements were added to the 5680925 drawings on 02-25-80. On the basis of a review of construction inspection records (QC Inspection Status, Computer Print-out BINJAN84, 05/15/87), it was determined that five lines accepted before this date have not been reinspected.	a. Perform a walkdown of instrument tubing lines 01X-LLPC-008A-N, -008B-N, -008C-N, -008D-N, and -008E-N to determine whether one-piece, one-hole clamps (Mark No. H-64) were used. (CATD BLN 01)

Issues	Findings	Corrective Actions
Element 223.1 - BLN (Continued)		
b. The bolts were over-torqued to 6 ft-lb after 06/01/85 causing damage to clamps.	b. Torquing of one-piece, one-bolt (Unistrut P2008 series) tubing clamps to 6 ft-lb damages them. Two details on the Bellefonte drawings allow the use of these clamps (drawings 5GB0925-10-17 and 5GB0925-10-129). Their bolts are required to be torqued to 6 to 7 ft-lbs (drawing 5GB0925-10-02). Thus, the potential for over-torquing P2008 series clamps exists at BLN; however, on the basis of discussions with knowledgable TVA engineers and field walkdowns, it appears that TVA has used other, approved methods of securing the tubing to its supports.	b. Revise drawings 5GB0925-10-17 and 5GB0925-10-129 to eliminate the use of Mark No. H-64 clamps. (CAID BLN 01)
c. Forty percent of clamps failed random inspection (possibly 80 visually examined).	c. Random inspections of installed tubing clamps have not been performed at BLN because no problems requiring resolution via random reinspections have been identified. Additionally, field walkdowns by the evaluation team have not revealed any discrepancies.	c. None required.
d. The new requirement is for bolts to be hand-tightened followed by a half-turn with wrench. This may be inadequate.	d. The half-turn method of tightening tubing clamp bolts is not used at BLN. As specified on drawing 5GB0925-10-02 bolts are to be tightened using specified torque values.	d. None required.
e. The torque requirements for each unit are different.	e. Torque requirements are given on drawing 5GB0925-10-02 and are identical for both BLN units.	e. None required.
********** Element 223.2 - Instrument Mounting Bracket **********		
SQN	SQN	SQN
a. Instrument mounting brackets are not strong enough to support instruments.	a. Design Criteria SQN-DC-V-10.3 and 10.4 articulate the requirements for instrument mounting brackets at SQN. Based on review of drawings, plant walkdowns and performing a sample calculation it was determined that the mounting brackets are adequate to meet their most severe design conditions.	a. None required.
b. In heavy traffic areas, the brackets are susceptible to abusive treatment which causes damage to brackets and instruments.	b. In heavy traffic areas, the issue that the brackets are susceptible to abusive treatment resulting in damage to brackets and instruments is valid as documented in WBN NCR 6296, RO, for similar installations at WBN.	b. TVA ONE will compile a list of safety-related instruments mounted on light-gage brackets similar to those identified in the element report. ONE will identify locations of the instruments and consider their susceptability in view of the

Issues	Findings	Corrective Actions
Element 223.2 - SQN (Continued)		
		general traffic pattern. They will also develop and obtain approval for a field walkdown procedure. Subsequently, they will perform the walkdown and identify any deficiencies. As a result, TVA will initiate corrective action for each deficiency and develop stronger mounting details for replacing the instrument brackets. (CATD SQN 01) This is a post-restart corrective action.
c. All such installations should be redesigned.	c. If the walkdown discloses damaged brackets, they should be strengthened or protected.	c. See Corrective Action "b."
WBN	WBN	WBN
a. Instrument mounting brackets are not strong enough to support instruments.	a. Design Criteria WB-DC-40-27, 31.1, and 31.2 articulate the requirements for instrument mounting brackets at WBN. Laboratory testing (Wyle test report 42807-1, 08/26/74) and TVA Calculation 841 860429 902 confirm that the mounting brackets are adequate to meet their most severe design conditions.	a. None required.
b. In heavy traffic areas, the brackets are susceptible to abusive treatment which causes damage to brackets and instruments.	b. In heavy traffic areas, the issue that the brackets are susceptible to abusive treatment resulting in damage to brackets and instruments is valid as documented in NCRs 6287 and 6296. However, this is a plant maintenance issue for improved plant maintenance of the seismic instrument installation. This issue is being addressed by TVA by the action plans attached to TVA memos from Curtis to "Those Listed" (01/08/86 and 03/26/86), and the closure of NCRs 6287 and 6296.	b. TVA will ensure that the action plans committed to be performed in the attachment "C" to the Instrument Project Final Report are completed. These included satisfactory closures of NCRs 6296 (Unit 1) and 6287 (Unit 2). NCR 6287, R1 (07/08/86) was revised to provide a disposition of bracket replacement as a plant enhancement. WBN-DNC will track NCR 6287 to completion and closure by means of Tracking and Reporting of Open Items (TROI). In addition, TVA will inspect instrument mounting brackets for existing or potential mounting bracket damage during performance of a planned field walkdown of instrumentation. TVA will make an assessment of any damage and, if required, DNE/CEB will redesign and replace the brackets. TVA will issue ECNs for the work and track their closures. (CATD WBN 01)

Issues	Findings	Corrective Actions
Element 223.2 - WBN (Continued)		
c. All such installations should be redesigned.	c. As documented in the disposition of NCRs 6296 and 6287, construction or Plant Operations, or both, will replace those 1/8-inch brackets shown on detail B19 of drawing 4/W600-19 with the more rugged 1/4-inch bracket shown on detail B321 of drawing 4/W600-321 and drawing 4/A061-16 to enhance plant maintenance.	c. See Corrective Action "b."
d. Not defined	d. If similar problems are identified on the basis of appropriate feedback from ONC and Plant Operations, ONE should evaluate those problems in the same fasnion as discussed in finding "c" above.	d. See Correction Action "b."
BFN	BFN	BFN
(Not to be evaluated)		
BLN	BLN	BLN
(Not to be evaluated)		
********** Element 223.3 - Instrument Seismic Qualification **********		
SQN	SQN	SQN
a. Local instruments were installed based on "Good Engineering Judgment."	a. A sample inspection of three instruments was performed to determine the extent and acceptability of seismic qualification at SQN. The local panel-mounted pressure transmitters (1-PI-1-30 and 1-PI-1-26C) were installed in accordance with the design drawing, which is based on documented engineering calculations and evaluations. The local field-mounted temperature switch (1-TS-30-[illegible]) was installed without a design drawing mounting detail or a documented evidence of application of good engineering judgment which is integral to the engineering process industry-wide. Current requirements in the nuclear industry are to justify such judgment with technical documentation. Based on review of the recent calculation by the evaluation team, the temperature switch has now been determined to be adequate.	a. TVA will obtain a list of SQN Units 1 and 2 safety-related instruments from Sequoyah Critical Structure, Systems, and Components (CSSC) List. The list will be evaluated against TVA commitments made in Element Report 209 (B). TVA will perform a drawing search and field inspection as well as a seismic qualification documentation search. This process will establish completeness of design, verify as-built installations, and ensure the existence of adequate seismic qualification documentation of all Unit 2 safety-related instruments required for safe shutdown, to mitigate core damage, or to prevent releases in excess of 10CFR100 limits (FSAR Chapter 15 events) before

THIS ITEM PARTIALLY COMPLETED
SQN
IVA 22288

Issues	Findings	Corrective Actions

Element 223.3 - SQN (Continued)

Unit 2 restart. All other Unit 2 safety-related instruments and all Unit 1 safety-related instruments will be subjected to the same document search and field inspection process after Unit 2 restart. These post-Unit 2 restart activities will be performed before restart of Unit 1.

The field inspection will be performed in accordance with procedures approved by Plant Operation Review Committee (PORC), or generic procedures that cover walkdowns, surveys, and field inspections, or procedures endorsed by Quality Assurance (QA). A condition adverse to quality report (CAQR) will be initiated and corrective actions will be provided for each incompletely documented or nonconforming installation. In addition, TVA indicated that other design change audits have resulted in the following actions that would preclude recurrence of the findings:

- o TVA design interface document, CEB-DI 121.03, "Seismic Design, Review and Control," has been recently revised (05/86) to refine and strengthen the seismic design review process to ensure adequate seismic design qualification of instruments and their installations. SQN seismic review process of instruments is in accordance with CEB-DI 121.03.

- o Revision 2 of Sequoyah Engineering Procedure SQEP-13 issued on 12/86 and current revision 3 (05/87) require walkdowns before initiating an engineering change notice (ECN). This procedure provides a mechanism to identify potential installation problems in the design of mounting detail for future installation of instruments.

(CATD SQN 01)

Issues	Findings	Corrective Actions
Element 223.3 - SQN (Continued)		
		THIS ITEM PARTIALLY COMPLETED AT SQN QIT 22288
		TVA has submitted its corrective action completion verification information to accomplish closure of the corrective actions. Verification of completion has revealed that inadequate scoping and undocumented engineering judgement were used by TVA in completing the activity. Accordingly, the corrective actions were determined to not be adequate.
b. No seismic analysis was done for different types of installation of local instruments.	b. The local panels where both pressure transmitters were mounted were qualified by testing and/or analysis. The as-built installation of local field-mounted temperature switch 1-TS-30-103 lacked seismic analysis or other evaluation at the start of this report investigation as indicated in finding a. above. The design mounting bracket of the Foxboro transmitter shown on alternate Section A1-A1 of Detail B19, Drawing 4/M600-19 is more flexible than the qualified approximately 1-inch deep bracket. The evaluation team performed a qualification calculation for alternate Section A1-A1 and determined that this detail is adequate.	b. See Corrective Action "a."
c. No seismic analysis was done for local instruments.	c. Instruments may be acceptably qualified to meet seismic requirement by analysis, testing, a combination of both, or similarity. Both pressure transmitters, 1-PT-1-30 and 1-PT-1-26C, were seismically qualified by testing. The function of the transmitters was acceptable during and after seismic testing, according to documented information provided by TVA. Temperature switch 1-TS-30-103 (Fenwal Model 18003-7) was judged seismically qualified by TVA in 1975 based on similarity to another temperature switch (Fenwal Model 17002-40) tested by General Electric. A 1982 test report by Wyle Labs indicated that the function of the temperature switch was acceptable during and after seismic testing. The test results indicate adequate seismic qualification for temperature switch Fenwal Model 18023-7. Since Fenwal Model 18003-7 is the same in form, fit, and function as Model 18023-7, temperature switch 1-TS-30-103 is seismically qualified by similarity.	c. See Corrective Action "a."

Issues	Findings	Corrective Actions
Element 223.3 - WBN	WBN	WBN
(Not to be evaluated in this subcategory)		
BFN	BFN	BFN
(Not to be evaluated in this subcategory)		
BLN	BLN	BLN
(Not to be evaluated in this subcategory)		

ATTACHMENT C

REFERENCES

1. Element Report 223.1, "Instrument Line Support Connections" for Sequoyah, Rev. 1 (12/31/86)

2. Element Report 223.2, "Instrument Mounting Brackets" for Sequoyah, Rev. 1 (04/13/87)

3. Element Report 223.3, "Local Instrument Seismic Qualification" for Sequoyah, Rev. 2 (05/14/87)

4. TVA Nuclear Performance Plan:

   Revised Corporate Nuclear Performance Plan, Volume 1, Rev. 4 (03/87)
   Revised Sequoyah Nuclear Performance Plan, Volume 2 (03/87)
   Browns Ferry Nuclear Performance Plan, Volume 3 (09/86)
   Watts Bar Nuclear Performance Plan, Volume 4 (03/87)

5. Licensing Documents:

   NRC's NUREG-0011, Safety Evaluation Report related to operation of Sequoyah Nuclear Plant Units 1 and 2, (03/79)

   SQN FSAR update through Amendment 3, Section 3.10, "Seismic Design of Category I Instrumentation and Electrical Equipment"

   WBN FSAR through Amendment 54, Dated 01/09/85 Section 3.10, "Seismic Design of Category I Instrumentation and Electrical Equipment," including Table 3.10.4

6. Design Criteria:

   TVA SQN, "Design Criteria for Mechanical Auxiliary Instrumentation Room Panels," SQN-DC-V-10.3, Rev. 0

   TVA SQN, "Design Criteria for Mechanical Local Panel for Class I Equipment," SQN-DC-V-10.4, Rev. 0

   Design Criteria WB-DC-40-27, "Mechanical Local Panels for Class I Equipment," Rev. 1

   Design Criteria WB-DC-40-31.1, "Seismically Qualifying Mechanical and Electrical Equipment Devices," Rev. 0

Design Criteria WB-DC-40-31.2, "Seismic Qualification of Category I Fluid System Components and Electrical or Mechanical Equipment," Rev. 2

Design Criteria BFN-50-D710, "Field Inspection of Instrument Lines," Rev. 0 (11/07/80)

7. Calculations:

"Seismic Analysis of Instrumentation Rack Frame of Drawing 47W352," (06/29/72)

"Temperature Switch Mount Evaluation," [B25 861031 800]

"NRC WBN SWP 8230 Evaluation," Rev. 1, [B26 850305 076], (03/05/85)

Calculation B41 860429 902

8. Conditions Adverse to Quality:

NCR WBN SWP 8230, [SWP 821208 033], (12/06/82)

NCR BFN BWP 8305, Rev. 0, [BWP 830216 006], (02/15/83)

NCR 6084, Rev. 0, [C24 850606 100], (05/23/85)

NCR 6296 Rev. 0, "Transmitter Mounting Brackets," (09/03/85)

NCR 6084, Rev. 1, [B26 851220 011], (12/10/85)

NCR BFN BWP 8305, Rev. 1, [B41 851213 007], (12/13/85)

PIR WBN CEB 8639, [B41 860401 019], (03/19/86)

SCR BFN CEB 8520, Rev. 0, [B41 851112 016], (11/12/85)

CAQ Engineering Report for SCR SQN CEB 8612, (06/03/86)

9. Drawings:

Sequoyah

47A050 - 1 (Rev. 2 through 7) Mechanical Hanger Drawing General Notes
- 1A (Rev. 0)
- 2 (Rev. 1 through 6)
- 2A through 23A (Revisions as of 08/24/86)

47A051 - Series (Revisions as of 08/24/86) Mechanical Seismic Supports - Instrument Sensing Lines

47A052 - Series (Revisions as of 08/24/86) Mechanical Seismic Supports - Radiation Monitoring and Sampling

47A054 - Series (Revisions as of 08/24/86) Mechanical Seismic Supports - Control Air Lines

47B601-1 - 18 (Rev. 52) Mechanical Instrument Tabulation

47B601-1 - 21 (Rev. 52) Mechanical Instrument Tabulation

47B601-30- 21 (Rev. 53) Mechanical Instrument Tabulation

47W352 - 3 (Rev. 0) Mechanical Instrument and Controls Panel-Seismic Test

47W600 - Series (Revisions as of 09/20/86) Mechanical Instrument and Controls

Watts Bar

47A061 - Series Sheets 1 through 16 (All Rev. 0)

47W600 - 19 (Rev. 5)

321 (Rev. 1)

Browns Ferry

47B2650 - 340 (Rev. 0) Mechanical RPV Sensing Lines Pipe Supports

Bellefonte

5GB0925-I0-02 (Rev. 14) General Installation Notes (Including Bolt Torque Values)

-05 (Rev.6) Channel Nuts and Bolts Assemblies

-10 (VOIDED on 03/14/83) Tube Anchor Assemblies

-17 (Rev. 4) Tube Guide Assemblies

-129 (Rev. 1) Notes for Heat-Traced Tubing

-130 (Rev. 2) Support Details for Heat-Traced Tubing

10. Test Reports:

Wyle Laboratories Test Report No. 42377-1, "Seismic Simulation Test Program on Instrumentation Rack," (11/08/72)

Action Environmental Testing Corp. Test Report No. T3-1091, "Seismic Vibration Test of E10 Series Transmitters," (12/73)

Wyle Laboratories Report No. 42807-1, "Seismic Simulation Test Program on an Instrumentation Rack," [no RIMS number], (08/26/74)

Wyle Laboratories Report No. 17509-1, "Qualification Plan for Fenwal Temperature Switches," Rev. C, (05/07/82)

Instrument Tube Clamp Load Testing, [B46 850411 002], (04/12/85)

Instrument Tube Clamp Load Testing - Additional Testing, [B46 850814 002], (08/16/85)

11. Walkdowns and Trip Reports:

Walkdown in the Sequoyah Unit 1 Reactor and Auxiliary Buildings, by the evaluation team on 09/18/86

Sequoyah Trip Report for September 19 and 20, 1986, IOM 563

Letter BLT-150, Browns Ferry Trip Report by N. G. Shah and R. G. Roberts on 03/03/87-03/06/87 (03/19/87)

Bellefonte Trip Report of 05/12/87-05/15/87, BLT-232, (06/04/87)

12. TVA Memos and Letters:

TVA letter to Wolfe and Mann Manufacturing Company, from F. W. Chandler to D. M. Salisbury on TVA contract 72C33-92800 transmitting approval of Wyle Laboratories Test Report No. 42807-1, (11/19/74)

TVA memo from F. W. Chandler to R. G. Domer with attached, "GE Seismic Test Results, 225A6290, on Fenwal Switch 17002-40," (06/24/75)

TVA memo from R. O. Lane to T. B. Northern, Jr., "Watts Bar Nuclear Plant - Testing of Unistrut Clamps," [SME 790710 001], (07/10/79)

TVA memo from F. H. Coleman to CEB files, "Seismic Qualification of Foxboro Series E10 Transmitters" for WBN Contract 828973, [CEB 810903 252], (09/03/81)

TVA memo from G. Wadewitz to J. W. Coan transmitting NCR 6287, Rev. 0, [B26 850906 003], (09/05/85)

TVA memo from G. Wadewitz to J. W. Coan transmitting NCR 6296, Rev. 0, [B26 850912 009], (09/10/85)

TVA memo from J. W. Coan to G. Wadewitz transmitting NCR 6287, Rev. 0, [B26 850923 009], (09/19/85)

TVA memo from J. W. Coan to G. Wadewitz transmitting NCR 6296, Rev. 0, [B26 851021 005], (09/21/85)

TVA memo from R. B. Barnett to J. P. Vineyard, "NCR SQN SWP 8305 - Bolt Tightening Requirements," [B41 851009 001], (10/09/85)

TVA memo from J. C. Standifer to G. Wadewitz, "WBN Non-ASME Significant NCR 6084 R1 and SCR 6084-S R0," [826 860121 128], (01/21/86)

TVA memo from R. O. Barnett to J. P. Vineyard, "SQN SCR SQN CEB 8612 Specific Bolt Tightening Instructions," [B41 860220 005], (02/19/86)

TVA memo from R. W. Cantrell to Those Listed, "DNE Interim Order - Supplement to NEP-3.1," [B05 861222 501], (12/22/86)

13. Miscellaneous:

Construction Category Element Report C017303-BLN, Instrument Line Clamps, (10/16/86)

Appendix F of Sequoyah Nuclear Plant Quality Assurance Manual, "Design Criteria for Qualification of Seismic Class I and Class II Mechanical and Electrical Equipment," Rev. 2, (01/24/83)

TVA Design Interface Document CEB-DI 121.03, Rev. 1, "Seismic Design, Review, and Control," (05/16/86)

Project Instruction BFEP PI 86-29, "Procedure for Sampling of Class I Small Bore Piping," Rev. 0, [B22 861010 301], (10/10/86)

General Construction Specification G-53, "ASME Section III and Non-ASME Section III (Including AISC, ANSI/ASME B31.1, and ANSI B31.5) Bolting Material," Rev. 4, (01/12/84)

TVA SQN Construction Specification N2C-946, "Requirements for Tightening of Non-high Strength Bolts in Friction-type Connections," Rev. 0

TVA SQN ECN 6690 - Bolt Torque Requirements, [B25 860515 515]

- TVA SQN GCTG Report GCC-13-59, (06/06/86)

  Workplans NW334P-1 and NW334P-2 describing the action plan to resolve the problems associated with clamp installation and bolt torquing, [no RIMS number], (01/08/86) and [no RIMS number], (02/07/86)

  Quality Control Procedure 4.3, "Instrument Tubing Installation," Rev. 0, [BLN 810105 389], (05/01/79)

  Quality Control Procedure 4.3, "Instrument Tubing Installation," Rev. 13, [C20 860612 461], (06/25/85)

  Quality Control Inspection Status, Computer Print-out BINJAN84, [no RIMS number], (05/15/87)

  Vendor Drawing, Fenwal Drawing 18003-7, Rev. 8/7 (06/21/68)

  Westinghouse Topical Report WCAP-8541, "Seismic and Environmental Testing of Foxboro Transmitters," (07/75)

14. Corrective Action Tracking Documents and Corrective Action Plans:

  CATD 233 01 SQN 01 (10/24/86) and CAP (01/12/87)

  CATD 233 01 SQN 02 (10/24/86) and CAP (01/12/87)

  CATD 233 01 SQN 03 (10/24/86) and CAP (01/12/87)

  CATD 233 01 WBN 01 (02/07/87) and CAP (04/09/87)

  CATD 233 01 WBN 02 (02/05/87) and CAP (04/09/87)

  CATD 233 01 BFN 01 (04/16/87) and CAP (06/27/87)

  CATD 233 01 BLN 01 (06/18/87) and CAP (08/11/87)

  CATD 233 02 SQN 01 (04/11/87) and CAP (03/25/87)

  CATD 233 02 WBN 01 (01/30/87) and CAP (04/09/87)

  CATD 233 03 SQN 01 (11/20/86) and CAP (12/03/86)