EMPLOYEE CONCERNS

SPECIAL PROGRAM

VOLUME 2
ENGINEERING CATEGORY

SUBCATEGORY REPORT 21000
ENVIRONMENTAL QUALIFICATION

UPDATED

TVA

NUCLEAR POWER

TVA EMPLOYEE CONCERNS SPECIAL PROGRAM

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2. Revised to incorporate SRP comments on their concurrences.
3. Revised to incorporate additional TAS comments; added Attachment C (References).

PREPARATION

PREPARED BY:

SIGNATURE — DATE: 10/28/87

REVIEWS

~~PEER:~~ REVIEW COMMITTEE:

SIGNATURE — DATE: 10/5/87

TAS:

SIGNATURE — DATE: 11/5/87

CONCURRENCES

SIGNATURE — DATE

CEG-H: — 11-4-87

SRP: SIGNATURE* — DATE: 11-10-87

APPROVED BY:

ECSP MANAGER — DATE: 11/5/87

MANAGER OF NUCLEAR POWER — DATE

CONCURRENCE (FINAL REPORT ONLY)

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

EXECUTIVE SUMMARY

This subcategory report details evaluations and draws conclusions for concerns raised under Engineering Subcategory 21000, Environmental Qualification, in the Employee Concerns Special Program. The evaluations covered five issues related to TVA's four nuclear plants: Sequoyah, Watts Bar, Browns Ferry, and Bellefonte. The issues were derived from a total of eight employee concerns that cited presumed deficiencies or inadequacies in the TVA environmental qualification program.

One issue relates to the location of sensitive instrumentation in a harsh environment and was investigated at both Sequoyah and Watts Bar. The evaluation determined that the condition was known and that the equipment in this area was qualified for the environment in question. No corrective action was required.

The remaining four issues relate to the adequacy of the environmental qualification program. These issues are generic to all four nuclear plants, and their evaluation resulted in essentially the same findings and corrective actions for each plant. The evaluation found that the issues were valid but that the problems had been independently identified by TVA management reviews and that significant corrective action was in progress at each plant except Bellefonte. The environmental qualification program at Bellefonte is on hold pending rescheduling of construction and engineering activities.

TVA management's review of the environmental qualification program determined that existing procedures did not provide the level of documentation or detail required for compliance with 10 CFR 50.49. The root causes for the failure to comply were identified by TVA as a fragmented organization and a lack of management attention. While these problems existed in the TVA environmental qualification program at the time the employee concerns were filed, the program has since undergone a major overhaul. The corrective actions taken to upgrade the environmental qualification program at each plant to comply with 10 CFR 50.49 are broad and comprehensive. The upgrade program includes the preparation and revision of numerous procedures, preparation of a new 10 CFR 50.49 equipment list, and preparation of new environmental qualification packages (binders) for 10 CFR 50.49 equipment. The program at Sequoyah is the most advanced and is the model for the other plants. Full implementation of the upgraded program, as outlined in the nuclear performance plans for all plants, should be sufficient to resolve the issues and concerns raised.

This grouped evaluation at the subcategory level did not find any new or broader issues requiring attention. The causes identified and other evaluation results are being examined from a wider perspective during the Engineering category evaluation.

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 details evaluations and draws conclusions for concerns raised under Engineering Subcategory 21000, Environmental Qualification.

The employee concerns are listed by element number in Attachment A. The plant location where the concern was originally identified and the applicability of the concern to the other TVA plants are also identified.

The top-level requirements for environmental qualification (EQ) are set forth in 10 CFR 50.49. This regulation requires that all plant equipment that is important to safety and is located in a harsh environment be qualified for that environment. Furthermore, documentation demonstrating equipment qualification must be maintained in an auditable file.

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

- Section 2 — summarizes, by element, the issues stated or implied in the employee concerns and addresses the determiniation of generic applicability
- Section 3 -- outlines the process followed for the subcategory evaluation
- Section 4 -- details evaluations of the issues by element and presents the findings
- 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; and 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

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

2. SUMMARY OF ISSUES/GENERIC APPLICABILITY

The eight employee concerns listed in Attachment A (by element) were filed between November 1985 and January 1986. These eight concerns have been examined and the potential negative findings raised by them have been identified as issues. Only five separate issues were identified in this subcategory. An NRC interview of a concerned individual, conducted on February 21, 1986, also explored these issues. This interview added certain details to the more broadly stated concerns. These details, however, did not alter the basic issues to be evaluated and, in and of themselves, did not initiate additional corrective actions.

All concerns discussed herein apply to the EQ program in effect before the shutdown of SQN.

The five issues evaluated under this subcategory are stated fully in Attachment B, which also lists the corresponding findings and corrective actions that are discussed in Sections 4 and 5 of this report. The issues, grouped by element, are summarized below.

2.1 Sensitive Instruments/Harsh Environment - Element 210.1

This issue states that certain sensitive instruments and equipment are located in a harsh environment near the bottom of the reactor vessel. The issue was identified at Watts Bar but was investigated at both Watts Bar and Sequoyah because the Reactor Building arrangements are nearly the same. The issue was not specifically addressed at Browns Ferry and Bellefonte because their reactor systems and building arrangements have little in common with Watts Bar. However, the specific subject matter of this concern is really encapsulated in the more broadly expressed concerns of element 210.2 and is thereby addressed by inference for Browns Ferry and Bellefonte as well.

2.2 Inadequate Environmental Qualification Program - Element 210.2

These four issues state that the EQ program is inadequate and that not all required equipment is qualified. In many cases, qualification records do not exist or are inadequate. Also, the current (i.e., preshutdown for SQN) upgrade program for EQ needs scrutiny. These issues were identified as being generic, and were investigated at all four TVA nuclear plants.

3. EVALUATION PROCESS

The evaluation process for the subcategory consisted of the following steps (element evaluation methodology is described in Subsection 4.4):

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

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

c. Reviewed applicable design documents to develop design understanding and to verify implementation status.

d. Reviewed applicable PSAR, FSAR, Safety Evaluation Report (SER), and SER Supplements to understand scope and basis of NRC review, determine regulatory compliance, and to identify any open issues or TVA commitments related to the design.

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

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

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

h. Prepared other tables, as needed, to permit comparison and identification of common and unique issues, findings, and corrective actions among the four plants.

i. Classified the findings and corrective actions for each element using the ECSP definitions.

j. On the basis of ECSP guidelines, analyzed the collective significance and causes of the findings for each element.

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

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

4. FINDINGS

The findings for each issue in this subcategory are summarized in Attachment B. In the attachment, the findings are listed by element number and by plant.

4.1 Sensitive Equipment/Harsh Environment - Element 210.1

The issue was valid in that sensitive instrumentation is located in the areas described. However, this fact was known, and appropriate measures had been taken under the EQ program in existence at the time SQN was shut down to ensure operability of this equipment in spite of the environmental conditions noted. The present EQ program is adequate to cover safety-related equipment located in the areas identified by the concern (SQN, WBN).

4.2 Inadequate EQ Program - Element 210.2

All four issues raised by these concerns were raised and found valid for the EQ program in existence when SQN was shut down. That overall EQ program had been determined inadequate by TVA management reviews independent of, and before, the filing of the concerns. The present EQ programs at all TVA units, except Bellefonte, have been, or are being, upgraded to comply with 10 CFR 50.49. Under the upgrade program, all equipment required to be qualified is being identified and the documentation is being upgraded as required. The new program and its documentation are being audited initially as part of TVA's QA program as well as by the NRC. This program must be completed before fuel load for each unit. A long-term EQ program is being established to continue this activity in support of replacements and modifications after startup (SQN, WBN, BFN).

The present EQ program at Sequoyah is being used as a model for the other TVA plants. This program has received thorough scrutiny from the NRC and TVA management. The NRC draft SER for the Sequoyah EQ program is favorable. At Browns Ferry, the planned NRC inspections and regular audits by TVA management should provide the scrutiny required to verify compliance with 10 CFR 50.49. Comparable TVA audits and NRC inspections performed at Watts Bar and Bellefonte (when appropriate) should provide the scrutiny required (SQN, WBN, BFN, BLN).

Because of plant rescheduling and manpower limitations, the EQ program at Bellefonte is on hold and most major systems have been placed under layup conditions.

4.3 Summary of Subcategory Findings

Employee Concern OE-QMS-4 is not addressed in the above discussion because a telecon in the interview file indicated that the concern was "basically resolved and may be considered closed." In addition, it was found that the concern relates to the installation of radio equipment which did not require environmental qualification. This concern was assigned to element 210.2 because the words "equipment qualification" were used in the concern description. No issue has been established to correspond to this concern. The concern is being resolved through a significant condition report which was written for Sequoyah and Watts Bar.

The classified findings are summarized in Table 1. Class A and B findings indicate there is no problem and that corrective action is not required. Class C, D, and E findings require corrective actions. The corrective action class, defined in the Glossary Supplement, is identified in the table by the numeral combined with the finding class. For example, the designation C3 in Table 1 indicates that the evaluated issue was found to be valid (finding Class C) and that a corrective action involving some type of documentation is required (corrective action Class 3).

For element 210.1, while the issue is considered valid, no specific deficiency could be identified and no corrective action was specified. As a result, the finding is classified as B in Table 1.

For element 210.2, as mentioned above, the EQ program had been determined inadequate by TVA independent of, and before, the filing of these concerns. Furthermore, the corrective actions noted above had been initiated before this ECTG evaluation. As a result, in Table 1 the finding for element 210.2 is classified as C. A singular finding is shown since the deficiency is in the overall EQ program and the division of the concerns into four issues is somewhat artificial. With respect to the corrective actions for element 210.2, the deficiencies appear primarily in EQ documentation (corrective action Class 3), but correction of the deficiencies requires significant revision of EQ program procedures (corrective action Class 2), as well. Some modification or replacement of hardware, retraining of personnel, and reanalysis of environmental conditions were also involved for SQN and will likely be required for WBN, BFN, and BLN.

Table 2 summarizes the findings by classification. Where more than one corrective action is identified in Table 1 for a single finding (e.g., element 210.2), Table 2 counts only a single classification. Thus Table 2

identifies one finding for each issue evaluated. Based on the classification of findings described above, two out of six findings require no corrective action. One finding per plant requires corrective action. These corrective actions, as identified in Table 1 and Attachment B, are essentially the same for each of the plants.

4.4 Element Evaluations

This section details the evaluations of the issues under elements 210.1 and 210.2 applicable to each of the four TVA nuclear plants. Supporting rationale and references are provided for the findings, which are summarized in Attachment B.

4.4.1 Element 210.1

The issue described in Section 2 for element 210.1 was identified at WBN and was specifically evaluated for both WBN and SQN because SQN has a similar Reactor Building arrangement.

The issue raised in element 210.1 was not specifically evaluated for BFN and BLN because their plant arrangements are significantly different from those of WBN and SQN. However, this issue was inherently addressed in the evaluation of element 210.2, which addresses the adequacy of the entire EQ program.

What constitutes a "harsh environment" is not as explicitly defined; rather, it is presumed to be one that would be significantly more severe at some point in time as compared to normal plant operations including anticipated occurrences. In addressing this specific concern, the evaluation team applied this meaning to the concerned individual's (CI's) use of the words "harsh environment."

It should be noted that none of the applicable regulatory requirements prohibit equipment, including "sensitive instrumentation," from being placed in harsh environments. The requirements only stipulate that when safety-related electrical equipment is placed in such environments, it must be appropriately qualified.

The area at WBN and SQN specifically referred to in the concern ("the bottom of the reactor and part way up the building") contains flow, pressure, and level transmitters, motor operated flow control valves, position switches, temperature elements, and the associated wire and cable. All of this equipment that is important to safety either has been or is in the process of being qualified as described in the evaluation of element 210.2. The evaluation team could not identify any special or "sensitive" instrumentation in these areas that was not being so addressed.

The areas in question can be considered "harsh." Drawings 47E235 sheets 42 and 45 for WBN (Ref. 2) and 47E235 sheets 44 to 48 for SQN (Ref. 3) identify the areas in question. The concerned individual's reference to "sensitive equipment" is taken to be "electrical equipment important to safety" as defined in 10 CFR 50.49 (Ref. 4). Documents "10 CFR 50.49 Equipment Located in the Reactor Building" for WBN (Ref. 5) and "List of Devices Inside Containment and Lower Compartment" for SQN (Ref. 6) identify the electrical equipment important to safety in the areas in question. Therefore, even though the equipment may be considered "sensitive," successful qualification under the WBN and SQN EQ programs will demonstrate that it can perform its safety functions under the "harsh" environmental conditions stipulated.

4.4.2 Element 210.2

Background. It is apparent from documentation associated with the TVA EQ program (Refs. 7, 8, and 9) that substantial activity and corrective actions were in progress before the employee concerns were filed. To place these concerns in proper context to the present TVA EQ program, an historical perspective of the overall TVA EQ program and how it evolved into the present SQN program is helpful. The most cogent synopsis the evaluation team found was in Section 1.A.2 of the SQN Environmental Qualification Package SQNEQ-GEN-001 (Ref. 10). This is quoted below for the readers' convenience:

> "A.2 TVA EQ History
>
> "In early 1980, with NRC's issuance of IE Bulletin 79-01B and NUREG-0588, TVA reacted with an effort directed at satisfying the licensing issues associated with EQ and relatively little attention was directed toward developing an overall programmatic direction that would satisfy the operational maintenance, inspections, test and engineering documentation requirements over the life of the plant. TVA developed a qualification plan and began to obtain qualified equipment. However, the focus of TVA's efforts was to produce a licensing document, the Electrical Equipment Environmental Qualification Report (EEEQR) rather than to develop a sound engineering basis from which the licensing documents could be derived. There was no indication that operational requirements were considered as an integral part of the program.
>
> "Throughout the early 1980s, there were several attempts to recognize the overall programmatic requirements associated with EQ, but progress suffered due to a general lack of understanding of the full implications of EQ. Also, the program was fragmented with no one in overall charge.
>
> "Audits in both Engineering and Power cited programmatic deficiencies. These audits concluded that TVA's EQ efforts lacked programmatic direction and definition of interdivisional interfaces resulting in a fragmented program with poor overall coordination and communication.

"Subsequently, in the late 1983 to 1984 timeframe, substantial progress was achieved as management began to realize TVA had some problems. EQ coordinator positions were established, first in NUC SVCS, then at the plant sites and in OE to provide a focal point for EQ. An effort was initiated to develop Qualification Maintenance Data Sheets to provide engineering requirements for the maintenance of the qualified status of equipment. However, progress in the development of an overall integrated program was slow and there was still no single entity with overall responsibility for the program. Also, it was questionable whether TVA's equipment qualification files were 'readily auditable' since the files were in several locations and filed under differing schemes.

"There was a recognition that an upgrade and consolidation of the qualification files was needed, and proposed method was put forth for approval to proceed. Sequoyah Nuclear Plant had decided to proceed with the proposal in phases just prior to the Management Review that was begun on July 19, 1985.

"The Management Review produced several observations on the EQ activities for Browns Ferry, Sequoyah, and Watts Bar Nuclear Plants. These observations are delineated in [Ref. 11]."

Reference 11 transmitted the report, "Management Review of Environmental Qualification Activities And Documentation For Conformance with 10 CFR 50.49 - September 25, 1985." This report was prepared by a team of WesTec Services, Incorporated, and TVA personnel who performed an overall review of TVA EQ activities and documentation to establish TVA's generic compliance to 10 CFR 50.49 and NUREG-0588.

On August 21 and 22, 1985, TVA shut down SQN and:

"as a result of the Management Review of TVA's Environmental Qualification Program, the Environmental Qualification Project was established and charged with the objective of developing an Environmental Qualification Documentation Program to verify that all plant equipment covered under 10 CFR 50.49 is qualified for its application and meets its specified performance requirements when subjected to the conditions predicted to be present when it must perform its safety function up to the end of its qualified life." (Ref. 10)

In January 1986, after initial issue of the SQN EQ binders was completed, emphasis was directed toward completion of a similar program for WBN, utilizing essentially the same EQ project that had developed the program for SQN (Ref. 12). The BFN units have remained shut down since March 1985 as a result of a variety of TVA and NRC concerns, including the environmental

qualification of equipment. In January 1986, an environmental qualification project was established for BFN. This program was modeled after the one being implemented at SQN. No upgrade of the BLN EQ program has been scheduled to date because of an indeterminate plant restart schedule and manpower limitations.

The employee concerns addressed herein were not filed until December 1985, 4 months after the SQN shutdown. The employee concerns address the conditions that led to the shutdown and do not challenge the TVA EQ program that was put in place to correct the situation. Nevertheless, the evaluation team reviewed the TVA EQ program activities independently to ensure that the concerns raised were really addressed in the TVA EQ program.

NRC Investigative Interview. On February 21, 1986, the NRC staff conducted an investigative interview of TVA personnel. Portions of this interview covered subject matter relative to these concerns. The interview transcript was forwarded to TVA on June 23, 1986, with a request that the concerns discussed therein be evaluated (Ref. 13). This transcript was reviewed by the evaluation team. The issue of equipment qualification is discussed on pages 89 through 99 of the NRC interview transcript. Salient portions of this transcript, which expand on the concerns under element 210.2, are extracted and quoted below:

From page 91

"TVA has bought a lot of equipment knowing full well that it needs to be qualified, but have made the judgment that they will qualify later and they never do. They would take the responsibility for qualifying it. . . In some cases they bought and stored it and drew out of those stored inventories, making an assumption that it was okay to use it whether it was qualified or not. In some cases they have attached paperwork to it after the fact, without doing any analyses or testing."

From pages 93 and 94

"Some of the stuff that I looked at physically sitting out at Phipps Bend subsequently was moved to other sites. Boxes of equipment sitting there for years that never had receipt inspection done on the quality of the equipment or whether it was even specific equipment ordered or the right equipment and it was never maintained during that period for any long-term storage requirements. . . . Some of it was not even verified as qualified. . . . It was just oftentime coupled with unqualified untraceable stuff and they mixed inventories and used it at will. . . . In many cases the qualification was done to one environment and then used at another environment."

From page 98

"A standard way of doing business with TVA is to accept stuff and not necessarily look to see if what they got was acceptable. If the vendor told them it was qualified, it was good enough for them. . . . this WesTec report which you probably have read concerning the TVA qualification, I had run into practically everything they said there including looking at equipment across the board. I have seen it all and a lot more than what they stated in there. I agree with it."

The statements from page 98 of the NRC transcript indicate that the WesTec report, which initiated EQ activities resulting in the present program, was sufficiently thorough to gain the interviewee's agreement and acceptance. The statements from page 91 merely add more specific detail as to practices that are already covered by the more general scope of the concerns under element 210.2. The statements from pages 93 and 94, however, suggest two entirely new concerns: improper storage and misapplication of equipment that is otherwise properly qualified.

Although site storage is outside the scope of an engineering concern, the evaluation team felt that, since it came up in this investigation and since it could be covered within the scope of the element 210.2 issues, investigation and disposition under this element would not be unreasonable. Improper storage of environmentally qualified equipment from cancelled sites (e.g., Hartsville, Phipps Bend, and Yellow Creek) that may have been used on operational units is addressed in Quality Assurance Deviation Report PPS-A-86-001 (Ref. 14). This resulted in corrective actions in response to Significant Condition Report (SCR) GENIRP 8601, which is applicable to WBN, SQN, BFN, and BLN (Ref. 15). Reviews were conducted at the Hartsville, Phipps Bend, and Yellow Creek distribution centers for equipment and materials transferred to WBN, SQN, BFN, or BLN with the result that "the equipment and materials were determined to be acceptable or not affected by the SCR and, in all cases, it was determined not to be reportable to the NRC" (Ref. 16). Closure of SCR GENIRP 8601 was completed on February 2, 1987 (Ref. 17). This issue was resolved in accordance with TVA QA procedures.

The testimony also suggests that equipment qualified for one application may have been used in another where its qualification parameters were inappropriate. In such cases, the qualification paperwork will appear to be in place and in compliance with program requirements but the equipment could actually be unqualified because it was transferred for use in a different portion of the plant or to a different plant entirely. This is an engineering matter within the scope of the element 210.2 issues, and is treated accordingly under this element evaluation as an additional concern.

Evaluation Results. The specific concerns under element 210.2 were addressed and validated in the March 12, 1986, NSRS Report I-85-225-SQN (Ref. 18), which relied heavily on the report "Management Review of Environmental Qualification (EQ) Activities and Documentation for Compliance with 10 CFR 50.49," dated September 25, 1985. The conclusions of this Management Review, as paraphrased in the NSRS Investigation Report I-85-225-SQN responding to these employee concerns, are:

> "Based on its review of the TVA EQ program at Knoxville and BFN, the team concluded that qualification has not been established for many equipment items. In general, the EQ files were found to be incomplete and not readily auditable; where technical information could be found the majority of it was scattered and not easily retrievable. The team believed that this situation was due to the fragmented nature of the program and the lack of overall cohesive direction of the effort. This fragmentation was evidenced by the team's observations of inconsistent approaches to qualification by various organizations, lack of detailed review, and poor documentation. The team believed that the identified deficiencies were significant, systematic, and pervasive, in that the same type of deficiencies could be expected to be found in other EQ files. The team recommended that TVA place the highest priority on the expeditious resolution of these issues."

The issues outlined above caused TVA to shut down the Sequoyah Nuclear Plant and to develop a comprehensive EQ program. This EQ program effort is outlined in the SQN, WBN, and BFN Nuclear Performance Plans (NPPs) (Refs. 1, 19, and 20). Review of the documentation associated with the EQ program activities shows that the issues raised by these employee concerns were known and in the process of being resolved well before the concerns themselves were initially filed in December 1985 (Refs. 7, 8, 9, and 10). Since these issues were identified independently of the ECTG Program and corrective actions were instituted to address the concerns, as pointed out in the quoted statement above, the evaluation team concluded that NSRS Report I-85-225-SQN constituted a complete response to these employee concerns.

While the NSRS and TVA/WesTec reports did not specifically address BLN, the observed deficiencies were identified as "systematic and pervasive." Therefore, the same deficiencies are assumed to exist at BLN as at WBN, SQN, and BFN.

TVA's success in implementing corrective actions at SQN, which serves as the model for WBN, BFN, and BLN, is substantiated by the NRC as a result of EQ program inspections which began in January 1986 (Ref. 21) and continued into

August 1986 (Refs. 22, 23, and 24). In its EQ inspection report, the NRC addressed these employee concerns as well as the TVA/WesTec report and found that:

> "In addition to the above inspection scope, your corrective actions taken with regard to the findings of the TVA/WesTec Report were reviewed. The inspection determined that the EQ Program which you are implementing is adequately addressing the findings of the report.
>
> "The inspection also reviewed a sample of employee concerns relative to your EQ program to evaluate whether the concerns had been resolved from the technical standpoint. No deficiencies were identified during the inspection relative to the concerns reviewed."

The program for environmental qualification of electrical/I&C equipment and components was reviewed to establish its adequacy in response to the NRC interview transcript and the general context of the employee concerns. The evaluation team independently reviewed SQN EQ Binders SQNEQ-IFT-001, SQNEQ-MOT-003, and SQNEQ-MOV-005 (Refs. 7, 8, and 25) against the requirements of IEEE STD 323-1974. Sufficient compliance within the framework of the SQN regulatory requirements was established to conclude that the present EQ program activities are resolving the issues raised under element 210.2.

The principal means of upgrading the EQ program at each plant has been the EQ Project. The original EQ Project was formed in September 1985 to develop and restructure the SQN EQ program. In January 1986, after initial issue of the SQN EQ binders was completed, similar programs were established for WBN and BFN. The WBN program utilized personnel from the SQN EQ project while at BFN contract personnel predominated.

The EQ programs at WBN and BFN are not as advanced as that at SQN, but they are being modeled after the SQN program. The review of EQ procedures and documentation at WBN (Refs. 26, 27, 28, 29, and 30) and BFN (Refs. 31, 32, 33, and 34) indicates that the essential elements of the SQN EQ program are contained in the WBN and BFN EQ programs. The WBN and BFN projects are committed to compliance with 10 CFR 50.49 before fuel load. (Refs. 19 and 20). In July 1985, TVA terminated ongoing EQ work at BLN being done by an outside contractor (Ref. 35). Engineering and construction at BLN have been essentially on hold since about mid-1985.

A significant condition report (SCR BLN EEB8543) was issued against the BLN EQ program on December 9, 1985 (Ref. 36). The subject condition is stated as follows:

"There is no methodology document which defines the requirements for environmental qualification of electrical equipment in harsh environments and outlines a program for achieving and maintaining compliance with 10 CFR 50.49 for Bellefonte Nuclear Plant."

The engineering report (Ref. 37) associated with this SCR makes the following statement with respect to the status of the program:

"TVA has notified the NRC of our intent to meet the requirements of 10 CFR 50.49 for BLN (re: L44 850225 801). Also, the list of BLN commitments to NRC maintained by the Nuclear Licensing Branch (Chattanooga) contains and follows the commitment to provide EQ documentation before fuel loading. Since neither TVA nor 10 CFR 50.49 established a schedule by which plants under construction are to comply with 10 CFR 50.49, TVA has not missed a commitment to the NRC, nor are we in noncompliance with 10 CFR 50.49.

"TVA has not established an EQ program for BLN to date because of manpower limitations. Since the plant schedule has been stretched out, there will be adequate time in the future to establish an EQ program that will not impact OL schedule. Additionally, the BLN program will be able to take advantage of the SQN and WBN program experience."

The SCR corrective actions are stated as follows:

- "OE-DETS-NEB will ensure that procedural requirements are issued to establish an EQ program for BLN that fulfills the requirements of 10 CFR 50.49 by fuel load.

- "OE-DETS-NEB will ensure that the issued EQ program procedures for BLN described . . . above are maintained so that the requirements of 10 CFR 50.49 continue to be fulfilled."

Implementing these actions, with a program similar to that at SQN, would resolve the issues under element 210.2 at BLN.

The issue of potential misapplication of environmentally qualified equipment acquired from cancelled sites, as raised in the NRC interview transcript, is also known and has been resolved as part of the comprehensive EQ program effort for WBN, SQN, and BFN. Part of the review for suitability of application in an operating unit is a cross comparison of the environmental qualifications for the equipment and conditions calculated for the plant. Review of the WBN, SQN, and BFN EQ binders (Refs. 7, 8, 25, 27, 28, 29, 30, 31, and 32) indicates that this evaluation is performed as a routine activity irrespective of the acquisition source. It is expected that the same program will eventually be applied at BLN.

The facts that the entire TVA EQ program activity has been conducted and implemented under close NRC inspection (Refs. 21, 22, and 24) and that the sampled review conducted by the evaluation team detected no significant discrepancies, support the general conclusion of adequacy and regulatory conformance exists throughout the entire the EQ program. Further substantiation of this conclusion is found in the NRC draft SQN EQ program Safety Evaluation Report (Ref. 38) which contains the following statements.

> "On the basis of the above evaluation, the staff has reached the following conclusions with regard to the qualification of electric equipment important to safety within the scope of 10 CFR 50.49:
>
> "(1) The Sequoyah electrical equipment environmental qualification program complies with the requirements of 10 CFR 50.49.
>
> "(2) TVA's proposed resolutions for each of the environmental qualification deficiencies identified in the staff's SER and the FRC TER are acceptable.
>
> "The staff's findings regarding compliance with 10 CFR 50.49 rely on certain modifications/replacements that must be completed for the affected equipment to be qualified. In all cases, TVA is aware of what modifications or replacements are required. However, as a confirmatory action, prior to restart, TVA will be required to certify that the .... issues [noted herein] have been completed or resolved."

For DNE activities at SQN, a long-term EQ program is being established (Refs. 9, 39, and 40). The position of EQ coordinator for plant activities has been established with reporting responsibilities to the plant maintenance superintendent. The EQ coordinator is responsible for implementation of the site EQ program and for ensuring compliance with 10 CFR 50.49 is maintained. The program will be in place and functioning before SQN startup. The SQN-specific DNE procedure (Ref. 40) is based on the DNE procedure (Ref. 41) applicable to all TVA units for long-term EQ program requirements. This broader DNE procedure (Ref. 41) will be used to establish long-term EQ programs at WBN, BFN, and BLN before startup. The use of a common DNE-level procedure should result in long-term EQ programs at WBN, BFN, and BLN that are similar to the one at SQN. In addition, the EQ program for each plant will continue to be scrutinized by internal TVA quality assurance organizations (i.e., QA as supported by EA) and the NRC.

5. CORRECTIVE ACTIONS

Table 1 identifies a total of eight corrective actions for element 210.2 but none for element 210.1. The corrective actions, along with their finding/corrective action classifications, are summarized in Table 3. The

corrective action descriptions in the table are a condensation of the more detailed corrective action information provided in Attachment B. The plants to which the corrective actions are applicable are identified by the Corrective Action Tracking Document (CATD) column where the applicable plant is identified by the CATD number.

As noted earlier, TVA had initiated corrective action on its environmental qualification program before the beginning of this ECTG evaluation. TVA's upgrade program for EQ is outlined in the Sequoyah Nuclear Performance Plan (Ref. 3). The upgrade program is essentially the same for each of the TVA plants. TVA's corrective action for the ECTG findings of the referenced element reports is to complete the implementation of the upgrade program at each plant. For the purposes of this subcategory evaluation, TVA's corrective action has been broken into its two main components: (1) upgrading program procedures, and (2) upgrading program documentation. As a result, a total of eight corrective actions are identified in Table 1 for element 210.2.

A special EQ program was established at each plant (except Bellefonte) to review all activities affecting EQ, including procurement, storage, and maintenance procedures; environmental drawings and calculations; 10 CFR 50.49 equipment list; and EQ documentation; and to revise or restructure these, as appropriate. A key feature of the upgrade program is the collection of EQ documentation into controlled binders to provide a central auditable file to demonstrate qualification as required by 10 CFR 50.49.

The evaluation team findings regarding the completion status of the SQN corrective action plan (CAP) for SQN Element Report 210.2 (Ref. 42) are documented in the "ECTG Verification Closeout Checklist" (Ref. 43). This report states:

> "The evaluation team concluded that the EQ program that was established and the procedures that control its continuing activities adequately resolve the employee concerns discussed in SQN Element Report 210.2 and, subject to completion of the remaining open items, satisfy the CAP commitments as outlined in revision 1 of the NPP."

6. CAUSES

Table 3 identifies the causes for each finding requiring corrective action. An attempt was made to identify only the most direct precedent condition that led to each finding; however, in this instance it appeared that the problem resulted from a combination of causes, so each is identified. In all cases, the experience of the evaluation team was used to establish the cause.

The causes identified in Table 3 relate to the conditions that existed at the time the employee concerns were filed. As noted above, the TVA EQ program had been determined inadequate by a TVA management review independent of, and before, these concerns were filed. A brief summary of the conditions in that time frame is found in the Sequoyah Nuclear Performance Plan (Ref. 1). This is quoted below for the reader's convenience:

> "The cause for the failure to comply in a timely fashion with 10 CFR 50.49 requirements was a lack of management attention to the environmental qualification program. As a result, responsibility and authority [were] not clearly defined and thus the level of documentation and attention to detail required for compliance was not recognized. Additionally, there was a failure to stay informed of the performance of the remainder of the nuclear utility industry in this program area. These factors were further compounded by an organizational structure which made communication and cooperation between design and operational personnel difficult."

This summary identifies the root causes for the failure of the TVA EQ program to comply with 10 CFR 50.49. The TVA management review mentioned above had identified a number of deficiencies in the program, including inconsistent approaches to qualification by various organizations, lack of detailed review, and poor documentation. EQ files were found, in general, to be incomplete and not readily auditable. As a result, qualification had not been established for many equipment items. The root causes for these problems are identified by TVA as a "Lack of Management Attention" and "Fragmented Organization." The evaluation team's independent review in response to these employee concerns confirms the validity of TVA's prior finding. Again, these observations do not reflect the current status of the EQ program at TVA, because, subsequent to the management review in 1985, the program has undergone a major revision.

7. COLLECTIVE SIGNIFICANCE

The issues raised by the employee concerns in this subcategory were identified and validated by TVA management reviews independent of, and before, the concerns were filed. Subsequently, TVA has conducted a major revision or upgrade of its EQ program. The upgrade program for environmental qualification is addressed specifically in Section III, Special Programs, of the Nuclear Performance Plan for each plant. The broader issues of a "Fragmented Organization" and "Lack of Management Attention," which were largely responsible for the programmatic deficiencies of the old environmental qualification program, are addressed partly in Section III and, more generally, in the balance of this nuclear performance plan. The upgraded program is currently being implemented, with some minor variations, at

Sequoyah, Watts Bar, and Browns Ferry. Additionally, TVA has committed to implementing an equivalent program at Bellefonte after engineering resumes there. The current plan at each plant is to implement the program on a unit-by-unit basis rather than for the entire plant at once.

The EQ program at Sequoyah has progressed the farthest and, in fact, is nearly complete. The Sequoyah program has been subjected to thorough scrutiny by TVA management and the NRC. The NRC review has led to a favorable draft SER on that EQ program, subject to the TVA completion of a number of open items. Full implementation of this program at each of the TVA plants should be sufficient to resolve the issues and concerns raised.

The evaluation team's conclusion as to the significance of the findings and associated corrective actions is indicated in Table 3 in the last three columns. Significance is rated in accordance with the type of changes that resulted from the corrective actions. The EQ upgrade program has resulted in extensive changes to EQ-related documentation including: the preparation or revision of numerous procedures; preparation of a new 10 CFR 50.49 equipment list; the collection of qualification records into auditable EQ documentation packages (binders); and the reevaluation of these records to establish equipment qualification in the current plant configuration. As a result of the reevaluation, some equipment modification or replacement has been required at SQN and is likely at WBN, BFN, and BLN. These hardware changes are reflected in the open items sections of the EQ binders.

The EQ upgrade program is a large effort that has required roughly one hundred engineering man-years per plant and is still ongoing. The effort to date has been focused on the first unit at each plant to be started. The upgrade effort required before startup of subsequent units should be substantially less, but still significant. The staffing level required to maintain equipment qualification in the long term will be significantly higher under the new program than under the old one. Currently, the EQ effort is focused on Sequoyah unit 2 and Browns Ferry unit 2. EQ program implementations at Watts Bar and Bellefonte are presently lower priority items and awaiting successful conclucions of the Sequoyah and Browns Ferry programs so that experienced manpower can be used at these follow on plants. Nearly half the individuals currently involved are contract personnel (roughly 90 percent at Browns Ferry and somewhat less at Sequoyah). Thus, there is significant potential for a loss of experience and continuity in this area, particularly at Browns Ferry. The impact or this situation, or the manner in which it is accommodated, remains to be seen.

TABLE 1

CLASSIFICATION OF FINDINGS AND CORRECTIVE ACTIONS

	Element	Issue/ Finding**	Finding/Corrective Action Class* SQN	WBN	BFN	BLN
210.1	Sensitive Instruments/ Harsh Environments	a	B	B	-	-
210.2	Inadequate Environmental Qualification Program	***	C2 C3	C2 C3	C2 C3	C2 C3

*Classification of Findings and Corrective Actions

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

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

**Defined for each plant in Attachment B.
*** Issues a, b, c, and d, as listed in Attachment B, are essentially the same and are, therefore, treated as a single issue.

TABLE 2

FINDINGS SUMMARY

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

TABLE 3
MATRIX OF ELEMENTS, CORRECTIVE ACTIONS, AND CAUSES
SUBCATEGORY 21000

ELEM	FINDING/ CORRECTIVE ACTION CLASS.**	CORRECTIVE ACTION	CATD	CAUSES OF NEGATIVE FINDINGS *																		Significance of Corrective Actions*		
				MANAGEMENT EFFECTIVENESS							DESIGN PROCESS EFFECTIVENESS							TECHNICAL ADEQUACY					
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
				Fragmented Organization	Inadequate Q-trng	Inadequate Procedures	Procedures Not Followed	Inadequate Communication	Untimely Res of Issues	Lack of Mgt Atten	Inadequate Design Bases	Inadequate Calcs	Inadequate As-blt Reconcil.	Lack of Design Detail	Engrg Judgmt not Documented	Design Crit/ Commit Not Met	Insuf. Verif Documentation	Stds Not Followed	Engrg Error	Vendor Error	D	H	H
210.2	C2	Upgrade EQ program procedures.	SUN 01			X								X			X				-	-	-
			WBN 01																				
			BFN 01																				
			BLN 01																				
	C3	Upgrade equipment EQ documentation.	SUN 01			X								X			X				A	-	A
			WBN 01																				
			BFN 01																				
			BLN 01																				
			TOTALS			2								2			2						

* Defined in the Glossary Supplement.

** Defined in Table 1.

GLOSSARY SUPPLEMENT
FOR THE ENGINEERING CATEGORY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Hardware - physical plant changes

2. Procedure - changed or generated a procedure

3. Documentation - affected QA records

4. Training - required personnel education

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

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

7. Other - items not listed above

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

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

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

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

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

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

ATTACHMENT A

EMPLOYEE CONCERNS
FOR SUBCATEGORY 21000

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; and 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 21000

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY SQN	WBN	BFN	BLN	CONCERN DESCRIPTION*
210.1	IN-85-068-002	WBN	X	X	See 210.2	See 210.2	"Sensitive equipment, i.e., instruments and instrument panels are located in a harsh environment. CI stated that the location of this equipment is in the bottom of the reactor and part way up the building. Unit not specified." (SS)
210.2	WI-85-100-005	WBN	X	X	X	X	"Environmental qualification of electrical and I&C equipment and components is inadequate. Qualification was often not done, or if it was done, records do not exist in many cases, which results in modification or replacement. Current upgrade program for environmental qualifications needs scrutiny. CI has no further information. Anonymous concern via letter." (SR)
	XX-85-122-014	SQN	X	X	X	X	"Environmental qualification of electrical and I&C equipment and components is inadequate. Qualification was often not done, or if it was done, records do not exist in many cases, which results in modification or replacement. Current upgrade program for environmental qualifications needs scrutiny. CI has no further information. Anonymous concern via letter." (SS)
	XX-85-122-015	BLN	X	X	X	X	"Environmental qualification of electrical and I&C equipment and components is inadequate. Qualification was often not done, or if it was done, records do not exist in many cases, which results in modification or replacement. Current upgrade program for environmental qualifications needs scrutiny. CI has no further information. Anonymous concern via letter." (SR)
	XX-85-122-016	BFN	X	X	X	X	"Environmental qualification of electrical and I&C equipment and components is inadequate. Qualification was often not done, or if it was done, records do not exist in many cases, which results in modification or replacement. Current upgrade program for environmental qualifications needs scrutiny. CI has no further information. Anonymous concern via letter." (SR)
	HI-85-077-N13	WBN	X	X	X	X	"NRC identified the following concern from review of the QTC file: 'Inadequate environmental qualification/documentations.'" (SR)

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

ELEMENT	CONCERN NUMBER	PLANT LOCATION	APPLICABILITY SQN	WBN	BFN	BLN	CONCERN DESCRIPTION*
210.2 (Cont'd)	XX-85-094-013	SQN	X	X	X	X	"Sequoyah: It is the quality problems regarding environmental qualification of components per NU REG 0588 that made the Sequoyah plant shut down. CI has no specifics or hardware details." (NO)
	OE-QMS-4	WBN	X	X	X	X	"Individual had information that might be helpful in the equipment qualification effort." (SS)
210.3			-	-	DELETED		

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

ATTACHMENT B

SUMMARY OF ISSUES, FINDINGS, AND
CORRECTIVE ACTIONS FOR
SUBCATEGORY 21000

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.

Issues	Findings	Corrective Actions
********** Element 210.1 - Sensitive Equipment Located in Harsh Environments **********		
SQN a. Certain sensitive equipment, such as instruments and instrument panels, is located in a harsh environment near the lower portion of the reactor.	SQN a. The concern does not specifically identify any safety-related equipment of a unique or "sensitive" nature that is not already being covered in the SQN EQP. The areas in question can be considered "harsh." Therefore, safety-related instrumentation in these areas must be appropriately qualified. The SQN EQP presently in place adequately covers the equipment located in the areas referred to by the CI and as more accurately identified by Sheets 44 to 48 of SQN Drawing 47E235, "Environmental Data, Environment - Harsh," and "Sequoyah Nuclear Plant - Units 1 and 2, Equipment Requiring Qualification under 10CFR50.49 List." These conclusions are supported in the evaluation of element 210.7 for SQN.	SQN a. None required.
WBN a. Certain sensitive equipment, such as instruments and instrument panels, is located in a harsh environment near the lower portion of the reactor.	WBN a. The areas in question can be considered "harsh" as identified by WBN Drawings 47E235-47 and 47E235-45. The concerned individual's reference to "sensitive equipment," which he later defines as "instruments and instrument panels," is taken to be "electrical equipment important to safety" as defined in 10CFR50.49. Therefore, drawing these references together means that safety-related instrumentation in these areas must be appropriately qualified. The TVA Environmental Qualification Program (EQP) presently in place is based on compliance with 10CFR50.49. Review of the document, "10CFR50.49 Equipment Located in the Reactor Building - Watts Bar Nuclear Plant," (02/12/87), shows the inclusion of the electrical equipment important to safety in the areas identified. Therefore, even though the equipment may be considered "sensitive," successful qualification under the WBN EQP will demonstrate that it can perform its safety functions under the "harsh" environmental conditions stipulated.	WBN a. None required.

Issues	Findings	Corrective Actions
Element 210.1 - BFN	BFN	BFN
(Combined with 210.2)	(Combined with 210.2)	(Combined with 210.2)
BLN	BLN	BLN
(Combined with 210.2)	(Combined with 210.2)	(Combined with 210.2)

****
Element 210.2 - Inadequate Environmental Qualification Program
****

Issues	Findings	Corrective Actions
SQN	SQN	SQN
	All the issues raised by these concerns were valid for the old EQ program in effect in August 1985, but were also adequately addressed in Investigation Report I-85-225-SQN, Environmental Qualification/Electrical/I&C Equipment/Components," (03/12/86).	
a. The environmental qualification (EQ) program at Sequoyah is inadequate.	a. The old SQN EQ program had been determined inadequate by TVA management reviews independent of and prior to the filing of these concerns.	a. Corrective Action Tracking Document (CATD) 210 02 SQN 01 was forwarded to TVA on 09/30/86. This CATD required completion of an environmental qualification program as outlined in the SQN Nuclear Performance Plan prior to SQN restart. On 11/05/86, a Corrective Action Plan responding to this CATD was received by the ECTG. The corrective actions outlined therein and the materials attached to it demonstrate that corrective actions initiated under the TVA EQ Program are sufficient to resolve these employee concerns. No additional corrective actions are necessary. These actions are satisfactory to the evaluation team.

Issues	Findings	Corrective Actions
Element 210.2 - SQN (Continued)		
b. Not all required equipment was qualified.	b. All equipment required to be qualified in accordance with 10CFR50.49 is presently under review which must be completed prior to SQN restart. A long-term EQ program has been established to continue this activity in support of replacement and modifications after restart.	b. Same as "a" above.
c. Qualification records do not exist or are inadequate in many cases.	c. Records and related documentation files demonstrating the adequacy of the SQN EQ Program are being developed and audited by TVA management and the NRC. These files will be completed prior to restart and maintained by the longer term EQ Program.	c. Same as "a" above.
d. Current upgrade program for EQ needs scrutiny.	d. The SQN EQ Program is inspected regularly by the NRC and audited by TVA management.	d. Same as "a" above.
WBN	WBN	WBN
a. The environmental qualification program at Watts Bar is inadequate	a. As identified in Sequoyah Element Report 210.02, the old TVA environmental qualification (EQ) program had deficiencies that required corrective action. Since many of these corrective actions were equally germane to Watts Bar, the concerns as stated were valid. An EQ corrective action program equivalent to the program at SQN is now being put into effect at WBN. However, at present, the WBN EQ program has a substantial list of open items to be closed and a number of ONQA and ONE-EA surveillance issues to be resolved.	a. CAID 210 02 WBN 01 states that an EQ program that reflects the SQN EQ Program has not been fully implemented at Watts Bar. TVA's corrective action plan (TCAB-297, 03/16/87) outlines the plan and applicable procedures for completing implementation of the EQ program before fuel load for each unit at Watts Bar. These actions are satisfactory to the evaluation team.

Issues	Findings	Corrective Actions
Element 210.2 - WBN (Continued)		
b. Not all required equipment was qualified.	b. Much of the equipment qualified under the SQN EQ program is the same as the equipment used at Watts Bar. The SQN environmental qualification of this equipment, which was conducted under close inspection by the NRC and TVA management, has been applied to the WBN equipment as applicable. WBN equipment or conditions that are different from SQN are being appropriately qualified under the WBN EQ program. All equipment qualifications necessary for compliance with 10CFR50.49 will be completed to the satisfaction of the NRC prior to WBN fuel load.	b. Same as "a" above.
c. Qualification records do not exist or are inadequate in many cases.	c. The WBN DNE and Watts Bar Engineering Project (WBEP) have procedures requiring development and retention of auditable files supporting the qualification of equipment under the jurisdiction of 10CFR50.49. TVA management will conduct audits of these files to ensure that these procedures are implemented properly. TVA DNQA's 1987 audit schedule identifies Audit Module 36 to cover Construction's and Operation's EQ of safety-related equipment. Included in this annual audit are the requirements that: o "All applicable SR equipment has been identified," o "Equipment documentation demonstrates qualification of equipment to expected seismic and environmental conditions," and o "An adequate interface between the Division of Nuclear Engineering (DNE) and the Office of Nuclear Power (DNP) has been defined in QA procedures."	c. Same as "a" above.

Issues	Findings	Corrective Actions
Element 210.2 - WBN (Continued)		
d. The current upgrade program for EQ needs scrutiny.	d. Audits and other verification activities by TVA management and QA, similar to those conducted on SQN, will provide the scrutiny required to assure successful completion of the WBN EQ program. In a 03/10/87 teleconference it was established that a complete and integrated audit schedule for the WBN DNE, WBEP, Operations, and Construction organizations by EA and DNQA is being implemented to assure the level of scrutiny required to meet 10CFR50.49.	d. Same as "a" above.
BFN	BFN All four issues raised by these concerns were valid for the old EQ Program, but were also adequately addressed by the TVA-NSRS Investigative Report I-85-225-SQN, "Environmental Qualification/Electrical/I&C Equipment/Components," (03/17/86), and the BFN Nuclear Performance Plan.	BFN
a. The environmental qualification (EQ) program at Browns Ferry is inadequate.	a. The old BFN EQ program had been determined inadequate by TVA management reviews independent of and before these concerns were filed.	a. CATD 210 02 BFN 01 states that no auditable EQ documentation is currently available and that compliance with 10 CFR 50.49 must be established by appropriate review before BFN restart. TVA's corrective action plan (TCAB-446, 07/21/87) outlines the plan and applicable procedures for bringing BFN into compliance with 10 CFR 50.49, including the preparation of auditable EQ documentation. Furthermore, the CAP commits TVA to full implementation of this program for each unit before restart of that unit. This CAP is acceptable to the evaluation team.
b. Not all required equipment was qualified.	b. All equipment required to be qualified is being identified and the documentation is being upgraded in accordance with 10 CFR 50.49. This program must be completed before BFN restart. A long-term EQ program will be established to continue this activity in support of replacements and modifications after restart.	b. Same as "a" above.
c. Qualification records do not exist or are inadequate in many cases.	c. Records and related documentation files demonstrating the adequacy of the BFN EQ program are being developed. These records are being audited by TVA management and the NRC. Also, these files will be completed before restart and maintained by the longer term EQ program.	c. Same as "a" above.

Issues	Findings	Corrective Actions
Element 210.2 - WBN (Continued)		
d. The current upgrade program for EQ needs scrutiny.	d. The BFN EQ program is modeled after the SQN EQ program which received thorough scrutiny from the NRC and TVA management. Planned NRC inspections and regular audits by TVA management should provide the scrutiny required to meet 10 CFR 50.49 at BFN.	d. Same as "a" above.
BLN	BLN All four issues raised by these concerns were valid for the old EQ program. However; they had been identified previously by the TVA NSRS Investigative Report 1-85-275-SQN, "Environmental Qualification/Electrical/I&C Equipment/Components," (03/12/86).	BLN
a. The environmental qualification (EQ) program at Bellefonte is inadequate.	a. Along with SQN, WBN, and BFN, the old BLN EQ program had been determined inadequate by TVA management reviews independent of, and prior to, the filing of these concerns. However, unlike the situation at other TVA units, there is no current effort to upgrade the EQ program at BLN. Instead, the EQ program is on hold and most major systems have been placed under layup conditions. Equipment layup is performed under a controlled program with TVA management reviews and audits.	a. CATD 210 02 BLN 01 states that an EQ program comparable to the one at SQN has not been implemented at BLN. TVA's CAP (TCAB-604, 07/20/87) commits TVA to implementation of an upgraded EQ program at BLN for each unit before that unit loads fuel. The SQN EQ program will be used as a model, along with any lessons learned at SQN, WBN, and BFN. Although little is currently being done on the EQ program for BLN, joint UNQA/EA audits will be performed on a periodic basis to monitor the status of the program. This CAP is acceptable to the evaluation team.
b. Not all required equipment was qualified.	b. All equipment required to be qualified by 10 CFR 50.49 will be identified and qualified before fuel load. However, as a result of plant rescheduling and manpower limitations, this activity is currently on hold.	b. Same as "a" above.
c. Qualification records do not exist or are inadequate in many cases.	c. Records and related documentation files demonstrating the adequacy of the BLN EQ program will be developed as required by 10 CFR 50.49. These records will be audited by TVA management and the NRC, as appropriate. However, as a result of plant rescheduling and manpower limitations, this documentation activity is also on hold.	c. Same as "a" above.
d. The current upgrade program for EQ needs scrutiny.	d. There is no upgrade program for EQ at BLN at this time. TVA is committed to upgrading the EQ program when resources permit, building on the experience gained at SQN, WBN, and BFN. Audits by TVA management and NRC inspections comparable to those provided at SQN and BFN will provide the scrutiny required.	d. Same as "a" above.

ATTACHMENT C

REFERENCES

1. Sequoyah Nuclear Performance Plan, Section III, "Special Programs," (07/14/86)

2. TVA Watts Bar Drawing 47E235, Sheets 42 and 45, "Environmental Data, Environment-Harsh"

3. TVA Sequoyah Drawing 47E235, Sheets 44 through 48, "Environmental Data, Environment-Harsh"

4. 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants"

5. Watts Bar Nuclear Plant, "10 CFR 50.49 Equipment Located in the Reactor Building," (02/12/87)

6. Sequoyah Nuclear Plant, "List of Devices Inside Containment and Lower Compartment," (09/11/86)

7. Sequoyah Nuclear Plant Environmental Qualification Package, SQNEQ-IFT-001, "Gould Flow Transmitters," (12/11/85)

8. Sequoyah Nuclear Plant Environmental Qualification Package, SQNEQ-MOT-003, "Joy Fan/Reliance Electric-Induction Motor, Type RN Insulation - Inside Containment," (12/08/85)

9. Sequoyah Nuclear Plant Standard Procedure SQA 173, "Sequoyah Nuclear Plant 10CFR50.49 Environmental Program," Rev. 1, (11/18/85)

10. Sequoyah Nuclear Plant Environmental Qualification Package, SQNEQ-GEN-001, (03/02/86)

11. TVA memo from J. W. Hutton to Darling and Abercrombie, "Management Review of Environmental Qualification (EQ) Activities and Documentation for Compliance with 10 CFR 50.49," [B70 85092 007], (09/26/85)

12. TVA memo from M. L. Rayfield to R. G. Domer, "Watts Bar Environmental Qualification Project (EQP) Transition Plan," [B26 0623 035], (06/23/86)

13. Letter from B. J. Youngblood, NRC, to S. A. White, TVA, with the attached transcript of the investigative interview conducted by the NRC on 02/21/86 at the First Tennessee Bank Building in Knoxville, TN, [B45 860714 832], (06/25/86)

14. Quality Assurance Deviation Report PPS-A-86-0001, Rev. 0, [L19 860530 900], (07/15/86)

15. TVA memo from L. Tummel to D. W. Wilson, "Hartsville, Phipps Bend, and Yellow Creek Storage Facilities - Significant Condition Report (SCR) No. GENIRP 8601," [B24 860911 003], (09/11/86)

16. TVA memo from L. Tummel to E. R. McWherter, "Significant Condition Report (SCR) GENIRP 8601 R1," [B24 861120 002], (11/20/86)

17. TVA memo from C. A. Chandley to Those Listed, "Browns Ferry, Sequoyah, Watts Bar, Bellefonte Nuclear Plants, and Hartsville and Phipps Bend Distribution Centers - Significant Condition Report (SCR) No. GENIRP 8601 R1," [B44 870202 012], (02/02/87)

18. NSRS Investigative Report I-85-225-SQN, "Environmental Qualification/Electrical/I&C Equipment/Components," (03/12/86)

19. Watts Bar Nuclear Performance Plan (Draft), Section III, "Special Programs," (05/06/87)

20. Browns Ferry Nuclear Plant Performance Plan, Section III, "Special Programs," (revised 09/02/86)

21. Letter from Taylor, NRC, to TVA, "Equipment Qualification for SQN," [A02 860214 009], (02/11/86)

22. Letter from Taylor, NRC, to TVA, "Equipment Qualification (EQ) Inspection of SQN," [A02 860303 005], (02/25/86)

23. Letter from Zech, NRC, to TVA, "Equipment Qualification Inspection - SQN," [A02 860620 005], (06/13/86)

24. Letter from Heishman, NRC, to TVA, "Inspection Nos. 50-327/86-01; 50-3289/86-01," [A02 860821 010], (08/15/86)

25. Sequoyah Nuclear Plant Environmental Qualification Package, SQNEQ-MOV-005, Vols. I and II, "Limitorque Actuators Outside Containment with Brakes," (02/25/86)

26. Watts Bar Environmental Qualification Project - Project Manual, WBN-EQP-01, Rev. 1 [B71 860725 500], (07/25/86)

27. Watts Bar Nuclear Plant, Unit 1, EQ Documentation Package, WBNEQ-GEN-001, Rev. 0 [B71 860930 572], (09/30/86, Tabs A and B and Open Items only)

28. Watts Bar Nuclear Plant, Unit 1, EQ Documentation Package, WBNEQ-1PT-001, "Westinghouse Pressure Transmitters," Rev. 0, [B71 860930 573], (09/30/86, Tabs A and B and Open Items only)

29. Watts Bar Nuclear Plant, Unit 1, EQ Documentation Package, WBNEQ-MOV-003, "Limitorque Motorized Valve Actuators," Rev. 0, [B71 860930 590], (09/30/86, Tabs A and B and Open Items only)

30. Watts Bar Nuclear Plant, Unit 1, EQ Documentation Package, WBNEQ-MOT-002, "Joy Fan/Reliance Electric Induction Motor, Type RN Insulation, Inside Containment," Rev. 0, [B71 860930 533], (09/30/86, Tabs A and B and Open Items only)

31. Browns Ferry EQ Documentation Package, BFN2EQ-MOT-001, "GE RHR and Core Spray Pump Motors," Draft Rev. 0, (03/09/87, Tabs A and B and Open Items only)

32. Browns Ferry EQ Documentation Package, BFN2EQ-XMTR-005, "Rosemont Pressure Transmitters," Draft Rev. 0, (03/09/87, Tabs A and B and Open Items only)

33. Browns Ferry Engineering Project Procedures, BFEP-PI-87-01 through 23 and 28 for environmental qualification, Rev. 0, (issued 03/18/87)

34. Browns Ferry Environmental Qualification Project - Project Manual, BFN-EQP-01, Rev. 0, (09/23/86), (superseded by BFEP-PPI-87-01, etc.)

35. Letter from J. O. Vantrease, Impell, to J. Cox, TVA, "Bellefonte Nuclear Plant, NSSS Environmental Qualification Program, Project Status - July 31, 1985," [B45 851114 953], (09/31/85)

36. Significant Condition Report, BLN EEB 8543, Bellefonte Nuclear Plant, Units 1 and 2, "There is no methodology document . . . for Environmental Qualification . . ." [B43 851212 903], (12/09/85)

37. TVA memo from J. A. Raulston to D. T. Clift, "Bellefonte Nuclear Plant - Engineering Report (ER) for Significant Condition Report (SCR) BLN EEB 8543," [B45 860128 256], (01/28/86)

38. Letter from B. J. Youngblood, NRC, to S. A. White, TVA, "Transmittal of Draft Safety Evaluation on Equipment Qualification for Sequoyah, Units 1 and 2," (12/05/86)

39. TVA memo from J. A. Kirkebo (Eng. and Tech. Services) to R. G. Domer (Proj. Eng.), "Organization for Maintaining the Environmental Qualification Program for Electrical Equipment under 10 CFR 50.49," [B45 860329 251], (09/04/86)

40. Sequoyah Engineering Administrative Instruction SQEP-AI-08A, "10 CFR 50.49 Program Requirements for Environmental Qualification of Electrical Equipment," Rev. 2, (05/27/87)

41. TVA memo from R. C. Weir to Those Listed, "Bellefonte, Browns Ferry, Sequoyah, and Watts Bar Nuclear Plants - Issuance of Nuclear Engineering Branch's (NEB) Discipline Interface Procedure (DI) 125.01 R1, Program Requirements for Environmental Qualification of Electrical Equipment in Harsh Environments," [B45 870317 263], (03/17/87)

42. Sequoyah Element Report 210.2, "Inadequate Environmental Qualification Program," Rev. 2, (01/27/86)

43. Letter from G. L. Parkinson (Bechtel) to G. R. McNutt (TVA), CATD 210 02 SQN 01 ECTG Verification Closeout Checklist, BLT-497, (09/23/87)