III. CORRECTIVE ACTIONS

1.0 INTRODUCTION

Through the issue discovery process and the Systematic Evaluation, a number of nonconforming issues were identified at WBN. With the effort of the WBN Task Force initially, and finally the WBPT, the identified issues were consolidated into groups of similar issues such as QA/QC Records, design control, and issues affecting the same population of hardware (e.g., cables, piping, conduit and conduit supports, HVAC ducts and their supports). The broad scope, generic, or programmatic issues formed the basis of the CAPs (Refs. 11 through 29). Other significant issues formed the basis of the Special Programs. Specific, isolated issues continue to be resolved through the CAQ process.

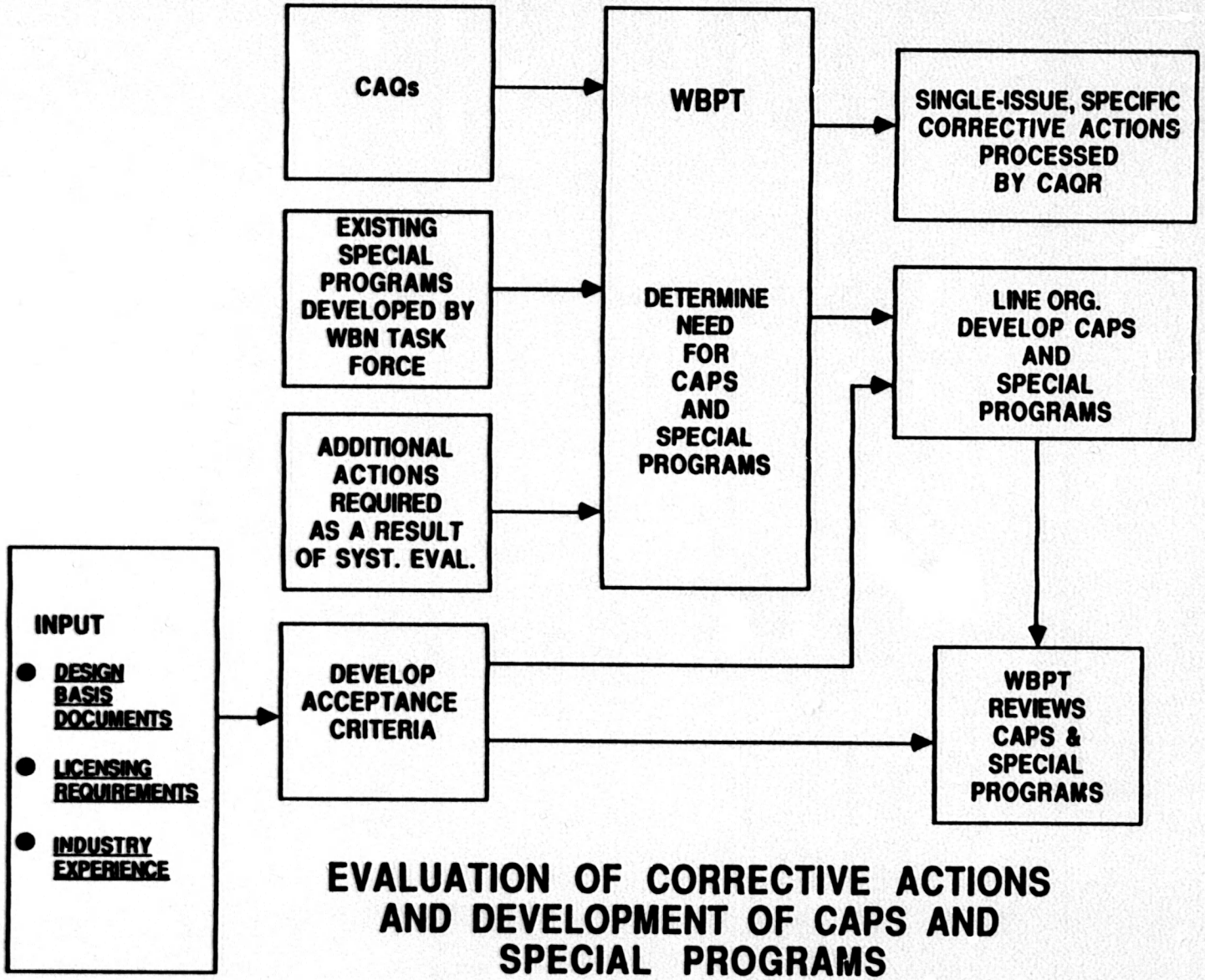
The process of evaluation of corrective actions and the development of CAPs and Special Programs is shown in Figure III-1. The WBPT evaluated the original Special Programs developed by WBN Task Force, CAQRs, and the additional corrective actions identified as a result of the Systematic Evaluation to determine the need for CAPs and any new Special Programs. As a result of this evaluation, five new Special Programs were added to the list (Containment Cooling, Mechanical Equipment Qualification, Microbiologically Induced Corrosion, Radiation Monitoring System, and Use-As-Is CAQ). The listing of 27 original special programs included in the WBPP is included in Table III-1 and a discussion of the disposition of these programs is included in Section 3.12 of this chapter.

The line organizations developed CAPs and Special Programs using the appropriate acceptance criteria which were based on DBDs, licensing requirements, TVA commitments, and industry experience. The WBPT reviewed the CAPs and Special Programs for adequacy of scope and approach, and recommended the CAPs to the Senior Vice President of Nuclear Power for approval.

Section 2 of this chapter provides a summary description and listing of 18 CAPs. The CAPs were submitted to NRC to obtain their concurrence with the approach described in the CAPs. A formal presentation of selected CAPs was also made to the NRC to address the NRC staffs' specific questions as well as questions regarding TVA's overall approach in using CAPs as a tool for resolving nonconforming issues.

Section 3 of this chapter provides summary descriptions and a listing of 11 Special Programs. Since many of these Special Programs are narrow in scope, and for many others substantial progress had already been made and several reports submitted to NRC, Special Programs were not sent to NRC for prior endorsement of approach. However, the WBPT has reviewed and accepted these Special Programs in a manner similar to the CAPs.

Section 4 of this chapter provides the resolution process for specific isolated issues which are not addressed by CAPs or Special Programs.



EVALUATION OF CORRECTIVE ACTIONS AND DEVELOPMENT OF CAPS AND SPECIAL PROGRAMS

FIGURE III-1

TABLE III-1

WBPP - LIST OF SPECIAL PROGRAMS
(Page 1 of 2)

No.	Original Special Program Description	Coverage by Existing CAP & Special Programs
1.	Welding Project	Welding CAP
2.	Concrete Quality Program	Special Program
3.	Environmental Qualification Program	Special Program
4.	Design Basis Document and Licensing Program	DBVP CAP
5.	Hanger and Analysis Update Program	HAAUP CAP
6.	Electrical Issues Program	Electrical Issues CAP
7.	Q-List Development	Q-List CAP
8.	Piece Parts Program	Replacement Items CAP
9.	Calculation Program	DBVP CAP
10.	Prestart Test Program	Prestart CAP
11.	Instrumentation Lines	Instrument Lines CAP
12.	Conduit Supports	Electrical Conduit & Conduit Support CAP
13.	Equipment Seismic Qualification	Equipment Seismic Qualification CAP
14.	Containment Isolation	Addressed in Chapter III, Section 3.12
15.	Unit 1/Unit 2 Interface	Addressed in Chapter III, Section 3.12
16.	Detailed Control Room Design Review	Special Program
17.	Specifications Improvement Program	Addressed in Chapter III, Section 3.12
18.	Heat Code Traceability	Heat Code Traceability CAP
19.	Appendix R Program	Fire Protection CAP

TABLE III-1

WBPP - LIST OF SPECIAL PROGRAMS
(Page 2 of 2)

No.	Original Special Program Description	Coverage by Existing CAP & Special Programs
20.	Protective Coatings	Special Program covered in Containment Cooling
21.	Safety-related Welded Ductwork	HVAC CAP
22.	Design Change Improvements Program	DBVP CAP
23.	Master Fuse List	Special Program
24.	NUREG-0612 Control of Heavy Loads	Addressed in Chapter III, Section 3.12
25.	Soil Liquefaction	Special Program
26.	Moderate Energy Line Break Studies	Special Program
27.	QA/QC Records	QA/QC Records CAP

Completion of the corrective actions in accordance with the plans described in this chapter will provide reasonable assurance that WBN complies with licensing requirements and TVA commitments. In addition, the QA/QC inspection records for the previously accepted nonconforming installations will be supplemented with new documentation that attests to the acceptability of the installation upon completion of the corrective actions. Corrective actions will be taken in parallel with CAP implementation to correct identified damaged, loose, or missing hardware deficiencies. Also, walkdowns of systems identified in the Prestart Test Program CAP will be performed before fuel load to identify and correct additional damaged, loose, or missing hardware. Verification that corrective actions are accomplished in accordance with the established plans and procedures, and that adequate documentation exists to substantiate the acceptability of WBN design and construction will be performed as described in Chapter IV.

2.0 CORRECTIVE ACTION PROGRAM PLANS

CAPs were developed to bound and resolve all broad scope, programmatic and generic issues. Typically, a CAP plan includes a description of the issues, sources, the scope of corrective actions to resolve the issues, identification of root causes and actions to prevent recurrence.

The WBPT has reviewed each CAP to ensure that:

- The issue addressed is adequately defined.
- Proposed corrective actions are adequate to resolve the issue effectively and thoroughly.
- The root cause analysis of the issue and actions to prevent recurrence are adequate.
- The recommended corrective actions are consistent with licensing requirements.
- There is no unnecessary duplication in the various programs, and interfaces between various programs are adequately described.
- The corrective action approach for WBN has been developed with consideration of corrective actions taken for similar issues at other TVA plants and elsewhere in the industry.

All the CAPs were submitted to the NRC to obtain their concurrence with the CAP approach. A formal presentation of selected CAPs, as proposed by TVA and agreed to by the NRC, was also made subsequent to the CAP submittals to discuss the CAPs and address the NRC staff's specific questions and other concerns regarding overall approach in using CAPs as a tool for resolving nonconforming issues.

The implementation and closure of each CAP will be completed utilizing the approach as outlined in Chapter IV.

NRC's review of the CAPs and their implementation may result in changes to their scope. In such cases, appropriate revisions to the CAPs will be made in accordance with established procedures and with proper approvals.

The subsections that follow briefly describe the CAPs, including identification of issues, actions taken or planned to resolve those issues, root cause identification, and recurrence control:

- Cable Issues
- Cable Tray and Cable Tray Supports
- Design Baseline and Verification Program
- Electrical Conduit and Conduit Support
- Electrical Issues
- Equipment Seismic Qualification
- Fire Protection
- Hanger and Analysis Update Program (HAAUP)
- Heat Code Traceability
- HVAC Duct and Duct Supports
- Instrument Lines
- Prestart Test Program
- QA Records
- Q-List
- Replacement Items Program (Piece Parts)
- Seismic Analysis
- Vendor Information
- Welding

The CAP summaries were developed to provide an executive overview of the CAPs, and are not intended to modify in any manner their scope or content. Actual CAPs must be used for detailed information and for the performance of any technical review.

2.1 Cable Issues

Various concerns related to cable installation and routing have been identified at WBN by TVA through Employee Concerns, CAQs, and NRC

findings. This CAP addresses the adequacy of safety-related cable installations in the following areas:

- Silicone rubber insulated cables
- Cable jamming
- Cable support in vertical conduit
- Cable support in vertical tray
- Cable proximity to hot pipes
- Cable pullbys
- Cable bend radius
- Cable splices
- Cable sidewall bearing pressure
- Pulling cable through 90-degree condulets and mid-route flexible conduit
- Computerized Cable Routing System (CCRS) data base verification and validation
- CCRS software verification and validation

The root causes of these concerns are primarily the absence or incompleteness of specific guidance in the development of design input and output documents, and in some instances, the lack of procedural control for the installation of cables. These concerns identify conditions for safety-related cables that are adverse to quality because of a lack of analysis or documentation that would demonstrate their acceptability.

Corrective action plans for each of the above issues are summarized below:

- Silicone rubber insulated cables - Remove previously installed cables from 10 critical case conduits and subject them to environmental qualification tests. Based on the results of the environmental qualification tests, the silicone rubber insulated cable population will be evaluated and any cables found to be unacceptable will be reworked or replaced.

- Cable jamming, cable pullbys and cable supports in vertical conduits and vertical trays - For cable jamming, cable pullbys, and cable support in vertical conduit, identify critical case conduits and compare them with those conduits identified and successfully tested at SQN. The cable population will be evaluated based on the results of this comparison and any cables found to be unacceptable will be in situ tested or replaced. In

addition, supports will be designed and installed as required to adequately support cables in vertical conduits. Cable supports in vertical tray will be evaluated through analysis or testing. Cable supports will be added where existing supports are found to be inadequate.

- Cable proximity to hot pipes - Develop criteria to establish clearances between cables/raceways and hot pipe/valves. Walkdown Class 1E cables against the criteria to ensure adequate separation. Analyze or rework all deviations from criteria.

- Cable bend radius - Evaluate installed condition by walkdowns, tests, and/or analyses. If analyses show existing conditions to be unacceptable, cables will be reworked or replaced.

- Cable splice - Revise design output documents and site procedures as required to ensure they are acceptable. Splice installation will be evaluated, unacceptable splices will be reworked.

- Cable sidewall bearing pressure (SWBP) - NE has developed selection criteria for critical case conduits, performed a walkdown, and prepared an SWBP calculation. Based on third-party review, only minor revisions to the SWBP calculation will be performed to close this issue.

- Pulling through condulets and mid route flexible conduit - The critical case for pulling cables through condulets is silicone rubber insulated cables. This concern will be addressed using results/conclusions from the environmental qualification tests for the silicone rubber cable issue.

  Cables pulled through mid route flexible conduit will be examined visually at conduit end points and pull points to determine whether there is visible cable damage. All damaged cables will be reworked.

- CCRS data - Evaluate the adequacy of the existing data base using the results of previously completed programs (such as 10 CFR 50.49 Environmental Qualification and Appendix R) where cable design and installation records were reviewed. Expand the data base to include data to support other activities (e.g., cable ampacity calculations and support loading calculations). The evaluation will establish a basis for accepting the CCRS data base for Class 1E cable applications and identify any required corrective actions.

- CCRS software - Generate a new computer software that has been properly verified and validated.

The action required to prevent recurrence is primarily the revision or original issue of design output documents and site procedures to specifically control the installation of cables.

The Cable Issues CAP plan was transmitted to NRC by letter dated December 16, 1988 (Ref. 11).

2.2 Cable Tray and Tray Supports

The Cable Tray and Tray Support CAP plan addresses Employee Concerns, CAQs, and NRC violations. The deficiencies can be categorized as lack of documented design qualification for certain cable tray hardware, installed configurations not complying with design output documents, and lack of documentation to verify previous reinspections.

- Incomplete design criteria for cable tray hardware qualification.
- Incomplete implementation of design criteria for cable tray hardware qualification.
- Lack of emphasis on maintaining and controlling documentation for construction-identified field changes.
- Failure to consider as essential and accordingly, to require adequate installation and inspection documentation for cable tray miscellaneous attributes such as tray covers, fitting bolts, and fitting types.
- Failure to prepare and follow procedures for walkdowns.
- Inadequate interdisciplinary review.

To correct the identified issues, TVA will take the following actions:

- Develop a complete design basis for cable tray, cable tray hardware, and cable tray supports.
- Develop design output consistent with the completed design basis.
- Develop and implement a critical case evaluation of existing cable tray installations and cable tray supports not covered by NCR WBN 5737.
- Evaluate the disposition of NCR 5737, revision 1.

Recurrence control measures will consist of the following actions, some of which are complete:

- Revised procedures requiring documentation to support engineering judgment.
- Revision and maintenance of the DBD per Nuclear Engineering Procedure (NEP) 3.2.
- Training to the revised criteria and strengthened NEPs.
- Revised procedures allowing configuration changes only on the basis of NE-approved drawings.

- Revised implementing procedures addressing inspection requirements that deal with cable tray hardware.

- Procedures governing the performance of walkdowns.

- Strengthen interface review requirements.

The Category I Cable Tray and Cable Tray Supports CAP plan was submitted to NRC on November 18, 1988 (Ref. 12).

2.3 Design Baseline and Verification Program

TVA became aware of inconsistencies in WBN licensing and design basis documentation as well as plant configuration issues as the result of several internal and external reviews that were conducted both at the plant and at the corporate level. The following conditions were identified by these reviews:

- Inconsistencies between the WBN Final Safety Analysis Report (FSAR) (Ref. 37) and WBN design documentation.

- Incomplete and some inconsistent design input information.

- Missing, incomplete, and out-of-date design calculations.

- Disagreements between the actual plant configuration and the as-constructed drawings.

The root cause of these conditions has been determined to be ineffective design and configuration control measures as discussed in the CNPP.

TVA has established the WBN DBVP to address the issues identified above. The WBN DBVP has developed the following five major activities to provide a baseline for the plant licensing and design basis and plant configurations:

- Licensing Verification

- Design Basis

- Calculations

- Configuration Control

- Testing Requirements

The Licensing Verification activity was initiated to ensure that commitments made to the NRC through docketed submittals are captured within controlling upper tier TVA documents. Verification involves unique identification of commitments made to the NRC and subsequent location of each commitment in the appropriate controlling documents. A cross reference between each commitment and the identifier for each controlling document is then provided. Any

mismatch or omission between a commitment and the controlling document is identified and tracked to resolution.

The Design Basis activity was initiated to provide a complete and current set of design criteria and system descriptions to serve as the plant DBD, against which future plant changes may be evaluated. Development of the WBN DBD includes the evaluation of the existing Design Criteria (DC) and System Description (SD) Documents against internal design requirements and licensing commitments to ensure that the appropriate design input statements are identified as a basis for proceeding with or maintaining plant design. In some instances, this mandates the creation of new DC or SDs to provide a complete set of requirements. Any mismatch or omission in the DC/SD Documents is identified and tracked to resolution.

The calculation activity was initiated to ensure that technically adequate design calculations exist for primary and secondary safety-related plant features. The activity involves development of the list of required calculations by each engineering discipline. The existence of each calculation on the list is then determined, and those not found are regenerated. The technical adequacy of existing calculations is then determined through review, which is scoped by one of two means: (1) calculations of a given type are reviewed if problem indicators at WBN or other TVA plants demonstrate the need; or (2) a selected review of calculations is performed of calculation types for which no problem indicators exist with expansion of the review occurring based on a root cause determination of any problems found. Deficient calculations are regenerated as appropriate. The technical adequacy review of existing calculations will include assurance that the calculations are consistent with current plant design.

The configuration control activity has been developed to ensure that plant functional configuration is in agreement with plant design for systems that mitigate design basis events. To provide this confirmation, selected control room drawings for the affected systems are to be verified through plant walkdowns and/or tests to functionally match the installed plant configuration. Once the plant configuration is confirmed, the drawings will then be reviewed against the new WBN DBD, updated calculations, and preoperational test scoping documents to ensure the ability of the system to perform its intended functions.

These evaluations occur on a system basis and are to be documented in System Evaluation Reports. Any discrepancies identified during the drawing confirmation and system evaluation processes are identified and tracked to resolution.

The testing requirement activity has been established to ensure that preoperational test requirements, as specified in test scoping documents, are in agreement with the DBD. The activity includes reviewing the scoping documents against the DBD and revising the scoping documents where appropriate. Any mismatch between the scoping documents and the DBD are identified and tracked to resolution.

Recurrence control efforts for the DBVP are directed toward maintaining the baselines established by each of the program's five major areas. This is accomplished primarily through the development of computer data bases and/or procedures to enhance the design and configuration control processes. Cross-referencing data bases are developed in the Licensing Verification, Design Basis, and calculation activities to assist in locating affected documents when a design change is to be made. Controlling procedures are developed or revised in each of the five major activities to ensure that configuration documentation is properly produced and maintained. The recurrence control efforts include the development of the plant-specific procedures, which institute the improved design change control process described in the CNPP.

The DBVP CAP plan was submitted to NRC by letter dated October 20, 1988 (Ref. 13).

2.4 Electrical Conduit and Conduit Support

The Electrical Conduit and Conduit Support CAP plan addresses Employee Concerns, CAQs, and Weld Project identified deficiencies in the conduit support program at WBN. Concerns can be categorized as involving discrepancies in design basis, design output not enveloping all design parameters, installed configurations not complying with design documents and discrepancies between installed configurations and inspection documentation.

The root causes of these concerns are incomplete design criteria, incomplete implementation of design criteria, fragmented and unclear installation requirements and unclear inspection requirements.

To correct the identified issues, TVA will take the following actions:

- Complete and document the design basis.
- Update design output documents to be consistent with the completed design basis.
- Revise construction, maintenance, and QA procedures to incorporate design output requirements.
- Develop and implement a critical case evaluation of existing installations. Modifications to existing installations will be performed where necessary to ensure compliance with design basis.

Recurrence control measures will consist of the following actions:

- Revision and maintenance of the DBD per NEP 3.2.
- Training to the revised design criteria and strengthened NEPs.

- Issuance of an Engineering Requirements Specification (ER Spec) as a single document for structural requirements pertaining to the installation, maintenance, and inspection of conduit and conduit supports.

- Revision of implementing procedures to incorporate applicable ER Spec requirements, and training to the revised procedure.

The Electrical Conduit and Conduit Support CAP plan was submitted to NRC on November 18, 1988 (Ref. 14).

2.5 Electrical Issues

Various concerns related to electrical installations, materials, and equipment have been identified at WBN by TVA through Employee Concerns, CAQs, and NRC findings. This CAP addresses the adequacy of safety-related electrical installations in the following areas:

- Flexible conduit installations

- Physical cable separation and electrical isolation

- Contact and coil rating of electrical devices

- Torque switch and overload relay bypass capability for active safety-related valves

- Adhesive-backed cable support mounts (ABCSM)

The root causes of the concerns are primarily the absence or incompleteness of specific guidance in the development of design input and output documents, and in some instances, the lack of procedural details for the installation of electrical components.

The corrective actions are to demonstrate that the existing condition is adequate or it will be reworked. The following summarizes each specific corrective action:

- Flexible conduit installation deficiencies - Design output documents will be revised to more specifically define flexible conduit installation requirements. A walkdown will be performed for Class 1E flexible conduits and those found to be damaged or in noncompliance with design output documents will be evaluated or reworked.

- Physical cable separation and electrical isolation - Design input and design output documents will be revised as necessary to include specific requirements. Those which do not comply with the revised output documents will be evaluated or reworked.

- Contact and coil ratings of electrical devices - An evaluation will be performed for the inductive load rating of contacts and specified highest and lowest coil voltage. Any devices that cannot be qualified will be replaced.

- Torque switch and overload relay bypass capability for active safety-related valves - Design input documents, design output documents, and calculations will be revised to indicate which active valves require thermal overload relay and torque switch bypass capability. The necessary changes will be implemented.

- ABCSM - The technical requirements for the use of ABCSM for vendor wiring and field wiring will be ascertained. Design output documents will be issued or revised to control future use. Rework will be performed as required.

The actions required to prevent recurrence are to issue or revise design input and output documents and revise site implementing procedures and inspection procedures to specify requirements.

The Electrical Issues CAP plan was transmitted to NRC on February 15, 1989 (Ref. 15).

2.6 Equipment Seismic Qualification (ESQ)

The ESQ CAP plan addresses CAQ issues regarding activities related to seismic qualification of Category I and I(L) equipment for WBN unit 1 and common. These issues are identified in NRC audit findings, Employee Concerns, CAQs, SQN lessons learned, and the DBVP. The primary issues are discrepancies between design and installation, inspection documents, and installation document retrievability and interface control.

The root causes of the ESQ issues are inconsistent application of installation requirements or unclear requirements; some unclear inspection requirements and inconsistency in specifying the essential inspection attributes; documents not properly entered in the Records Information Management System (RIMS) and indexed for retrieval; and inconsistent application of interface control procedures or unclear procedures.

To resolve the identified issues, documents will be retrieved and reviewed for completeness and for technical adequacy relative to their resolution of the specific seismic issues. These documents include technical specifications, seismic design requirements, acceptance criteria and calculations; procurement and qualification information including vendor seismic reports, TVA review/approval memoranda, calculations, drawings, and qualification procedures; and installation and modification information.

Corrective actions that will be taken include obtaining documents from vendors, assembling equipment review packages, developing an ESQ list to capture equipment document references, and preparing calculations, or performing tests, as required. Walkthroughs will be performed to supplement above documents and to confirm seismic design adequacy of the installed equipment or to define required modifications. Necessary modifications and inspections will be made.

The program will provide documented assurance that Category I and I(L) equipment installations at WBN unit 1 are adequately qualified for design basis seismic events and are in compliance with the WBN criteria, procedures, and licensing requirements.

Recurrence control measures have been and will be taken to address root causes. Interface review requirements have been strengthened through issuance of NEPs. Applicable installation and inspection procedures will be revised as required to clearly define the installation and inspection requirements. Document retrievability will be improved by ensuring that seismic qualification documents are properly entered into RIMS and by ensuring the maintenance of the equipment review packages.

The CAP plan for ESQ was submitted to NRC on December 23, 1988 (Ref. 16).

2.7 Fire Protection

The objective of the Fire Protection CAP plan is to complete the remaining fire protection work and provide additional assurance that the WBN Fire Protection Program satisfies WBN licensing requirements.

The scope of the WBN Fire Protection CAP plan includes:

- Completion of remaining fire protection reviews of the Engineering Change Notices (ECNs) issued after completion of the WBN Fire Protection Safe Shutdown Analysis (Ref. 38) and prior to the Appendix R Modification Compliance Review Program.

- Completion of corrective actions for CAQR WBP870978 relating to unprotected HVAC openings. These corrective actions include performing a fire hazards safe shutdown analysis in the area of the HVAC openings.

- Evaluation of SQN fire protection inspection report findings for applicability to WBN, and the completion of any resultant action items.

- Performance of an Appendix R Compliance Review to provide additional assurance that WBN complies with its commitments to Appendix R and associated Generic Letters and Information Notices and to identify any areas of noncompliance.

- Consolidation of WBN Fire Protection documentation into a more organized documentation package to support and substantiate the Appendix R Compliance Review and to facilitate future fire protection design reviews.

Recurrence control action will be identified where appropriate for any specific deficiencies/issues identified during the ECN reviews and evaluation of the SQN Inspection Reports or performance of the Appendix R Compliance Review. For CAQR WBP 870978, the fire compartmentation drawings (47W240 series) provide adequate

information to allow engineers to select appropriate protective devices for future penetrations through fire barriers.

The Fire Protection CAP plan was transmitted to NRC by letter dated December 16, 1988 (Ref. 17).

2.8 Hanger and Analysis Update Program

Throughout the design and construction of WBN, the NRC has issued various IE Bulletins, Notices, and Circulars on the subject of piping analysis and pipe support design. Additional piping and pipe support issues were identified through several avenues including employee concerns, CAQRs, NCRs, PIRs, SCRs, and internal and external reviews. The HAAUP scope includes Category I piping, Category I(L) pressure boundary retention piping, Category I(L) position retention piping, instrument lines, and associated supports.

The identified issues have been grouped into three categories and are listed below with their root causes:

- Interface Control of Design Input/Output

  - Design input was not consistently defined and controlled.

  - Design output was not clearly defined and, thus, was not consistently implemented by Construction.

- Design/Analysis Methodology

  Design Criteria for piping analysis and pipe support design did not specify a consistent and comprehensive set of design/analysis methods. In some cases, relevant industry issues were not considered.

- Level of Design Documentation

  Requirements of closure of unverified assumptions and documentation of engineering judgments were neither fully defined nor procedurally controlled.

The HAAUP for WBN provides assurance that the piping/tubing and associated supports are structurally adequate, and comply with design criteria and the licensing requirements. The objective will be accomplished by completion of the following actions:

- Design criteria and the FSAR (Ref. 37) will be revised to ensure consistency and to comply with licensing requirements.

- Procedures will be revised or established to ensure design input/output are controlled and implemented.

- Safety-related piping systems and the associated piping supports will be reevaluated against the revised piping analysis and support design criteria.

information to allow engineers to select appropriate protective devices for future penetrations through fire barriers.

The Fire Protection CAP plan was transmitted to NRC by letter dated December 16, 1988 (Ref. 17).

2.8 Hanger and Analysis Update Program

Throughout the design and construction of WBN, the NRC has issued various IE Bulletins, Notices, and Circulars on the subject of piping analysis and pipe support design. Additional piping and pipe support issues were identified through several avenues including employee concerns, CAQRs, NCRs, PIRs, SCRs, and internal and external reviews. The HAAUP scope includes Category I piping, Category I(L) pressure boundary retention piping, Category I(L) position retention piping, instrument lines, and associated supports.

The identified issues have been grouped into three categories and are listed below with their root causes:

- Interface Control of Design Input/Output
  - Design input was not consistently defined and controlled.
  - Design output was not clearly defined and, thus, was not consistently implemented by Construction.
- Design/Analysis Methodology

  Design Criteria for piping analysis and pipe support design did not specify a consistent and comprehensive set of design/analysis methods. In some cases, relevant industry issues were not considered.
- Level of Design Documentation

  Requirements of closure of unverified assumptions and documentation of engineering judgments were neither fully defined nor procedurally controlled.

The HAAUP for WBN provides assurance that the piping/tubing and associated supports are structurally adequate, and comply with design criteria and the licensing requirements. The objective will be accomplished by completion of the following actions:

- Design criteria and the FSAR (Ref. 37) will be revised to ensure consistency and to comply with licensing requirements.
- Procedures will be revised or established to ensure design input/output are controlled and implemented.
- Safety-related piping systems and the associated piping supports will be reevaluated against the revised piping analysis and support design criteria.

- Documentation will comply with design criteria and procedures.

The following recurrence control measures have been developed to address the three categories of issues discussed:

- Interface Control of Design Input/Output

  - Watts Bar Engineering Procedures define and establish intra- and interdiscipline responsibilities for piping analysis and pipe support design input/output.

  - The construction specifications were enhanced to clearly define requirements for installing piping and pipe supports.

- Design/Analysis Methodology

  - The piping analysis and pipe support design criteria have been enhanced to clearly define design/analysis methodologies.

  - Other supporting documents, such as analysis handbooks and the pipe support design manual, will be revised to clarify design requirements and to establish a consistent approach.

- Level of Design Documentation

  Engineering procedures for calculations have been revised to require documentation of unverified assumptions and use of engineering judgments.

The CAP plan for HAAUP was submitted to NRC on November 18, 1988 (Ref. 18).

2.9 Heat Code Traceability

The Heat Code Traceability CAP plan addresses employee concerns regarding potential use of lower class piping and fitting materials in unit 1 ASME systems.

The root causes of the issues are inadequate procedures for control of ASME piping materials not supplied by the principal piping contractor, and engineering requirements that were inadequate to address all required attributes for reclassification of materials.

To correct the identified issues, documents will be reviewed to identify piping, fittings, and attachments that do not conform to ASME Code Class requirements. The documents include ASME and ASTM specifications, certified material test reports (CMTRs) for procured material, printouts from the weld monitoring program and the heat code data base, weld operation sheets and weld maps, Nondestructive Examination (NDE) reports, and contracts. Where appropriate, NDE will be performed to upgrade the material to the proper piping classification for compliance with the WBN Code of Record. CMTRs will be prepared to document reclassification of material.

This program will demonstrate compliance with WBN licensing commitments or will technically justify the suitability of installed material. Proposed Code exemptions will be submitted to the NRC for approval. Implementation of this program will provide input for closure of the CAQRs and CATDs that constitute the basis for this program.

Recurrence control measures have been taken to address the root causes. Procedures have been revised to require unique CMTR traceability of material to be installed. Engineering requirements have been established to specify ASME Code Section III requirements for reclassification of materials.

The Heat Code Traceability CAP plan was submitted to NRC on December 23, 1988 (Ref. 19).

2.10 Heating, Ventilating, and Air Conditioning Duct and Duct Supports

The HVAC Duct and Duct Supports CAP plan addresses Employee Concerns, CAQs, and NRC violations. The deficiencies identified can be categorized as discrepancies in design basis, design output not enveloping all design parameters, installed configurations not complying with design documents, and discrepancies between installed configurations and inspection documentation.

The root causes of these deficiencies are incomplete design criteria, incomplete implementation of design criteria, fragmented and unclear installation requirements, and unclear inspection requirements.

To correct the identified issues, TVA will take the following actions:

- Complete and document the design basis.
- Update design output documents to be consistent with the completed design basis.
- Revise construction, maintenance, and QA procedures to incorporate design output documents.
- Develop and implement a critical case evaluation of existing installations. Modifications to existing installations will be performed where necessary to ensure compliance with design basis.

Recurrence control measures will consist of the following actions:

- Revision and maintenance of the DBD per NEP 3.2.
- Training to the revised criteria and strengthened NEPs.
- Issuance of an ER Spec as a single document for structural requirements pertaining to the installation, maintenance, and inspection of HVAC duct and duct supports.

- Revision of implementing procedures to incorporate applicable ER Spec requirements and training to the revised procedures.

The HVAC Duct and Duct Support CAP plan was submitted to NRC on November 18, 1988 (Ref. 20).

2.11 Instrument Lines

The Instrument Lines CAP addresses the technical issues related to instrument line functional and structural problems. The functional issue is related to the adequacy of instrument sense line slope. The structural issues are related to:

- Thermal effects on instrument lines
- Pipe and tube bending
- Compression fittings
- Installation discrepancies

The scope of the functional issue (slope) includes sense lines associated with instruments that perform a safety-related function and other selected instruments that are particularly sensitive to the effects of entrapped air in their sense lines. The scope of the structural issues includes Seismic Category I and I(L) instrument lines and their associated supports that are analytically decoupled from the process line. The term instrument line includes the following types: instrument sense, control air, instrument signal, sampling, and radiation monitoring.

The root causes of the issues identified in this CAP are categorized below. These root causes represent a collective assessment of all technical issues.

- NE design requirements were not clearly stated and in certain cases were incomplete.
- NE discipline interface responsibilities in certain cases were not clearly defined.
- NC site implementing procedures did not include certain installation and documentation requirements.
- NQA site implementing procedures did not include certain inspection requirements. Also, QC inspector training was determined to be inadequate.

The corrective actions for the major technical issues addressed in the CAP are as follows:

- Instrument Sense Line Slope

  The instrument sense lines associated with safety related instruments and other selected low differential pressure instruments will be evaluated and reworked to meet the requirements of the ER Spec ER-WBN-EEB-001.

- Thermal Effects on Instrument Lines

  The existing analyses of the instrument lines whose operational mode temperatures exceed the cutoff limit will be reconciled with the updated analysis design criteria.

- Pipe and Tube Bending Devices

  A sampling program was established which considered 200 randomly selected bends from an estimated population of 15,000 bends. These samples were evaluated for the proper engineering attributes and were found to be acceptable.

- Compression Fittings

  Instrument lines designated as Seismic Category I or I(L) will be pressure tested in accordance with appropriate piping code requirements as specified in site implementing procedures. For instrument lines not subjected to pressure test requirements (i.e., instrument drain lines) which could contain radioactive fluids, the compression fitting leak tightness of the drain lines will be confirmed prior to unit criticality. Compression fitting rework, if required, will be performed in accordance with requirements specified in the ER Spec and associated site implementing procedures.

- Installation Discrepancies

  The NE calculations that document the acceptability of the instrument line supports will be reviewed for compliance with updated design input and design criteria requirements. A walkdown, which assures that the clamps are properly installed, will be completed.

Recurrence control measures that address the root causes have been developed. These consist of the following:

- WBEP issued ER Spec ER-WBN-EEB-001, "Instrument and Instrument Line Installation and Inspection," to fully respond to technical issues raised during the Instrument Project. The ER Spec provides a concise, comprehensive source of engineering requirements for the design, installation, inspection, and maintenance of instruments and instrument lines.

- WBEP procedures have been issued to identify and assign NE discipline scope of responsibilities, in order to achieve proper interface.

- Requirements have been established to incorporate the requirements of the ER Spec in the applicable NC and NQA site implementing procedures.

- Programs have been implemented to provide training for appropriate personnel on new/revised NQA site implementing procedures.

The Instrument Lines CAP plan was submitted to NRC by letter dated December 23, 1988 (Ref. 21).

2.12 Prestart Test Program

The Prestart Test Program CAP plan is a test program with an objective of demonstrating, to the extent required for fuel loading, the safe operational capability of WBN unit 1. The program will validate component and system function following the completion of current major construction and modification work. NRC concerns regarding the need for such testing were expressed in a letter to TVA (Ref. 39).

The scope of the program is the prefuel loading part of the system functional test program as identified in Regulatory Guide 1.68, "Preoperational and Initial Startup Test Programs for Water Cooled Power Reactors" (November 1973) with exceptions. These exceptions are primarily tests that must occur after fuel loading or are balance-of-plant systems that were determined not to need retesting because they do not present direct challenges to the safe operation or shutdown capability of the plant. Systems important to normal operation are included within the program scope.

The program is in addition to the WBN Preoperational Test Program defined in FSAR Chapter 14. The program is to be conducted by plant staff members who are experienced test personnel. The program includes approximately 50 of the plant's most important systems that relate to nuclear safety. The system and component level functions of each system included in the program will be principally defined via revised preoperational test scoping documents. These revised preoperational test scoping documents will be prepared and issued by NE as described in the DBVP. Testing will be conducted after each system's construction completion milestone is achieved (but before fuel loading). The program will use to the extent practical the existing WBN test programs (e.g., Maintenance, Preoperational, Surveillance, Technical Instruction, Workplans). For those cases where the existing test programs will not provide the test coverage required by the program, new test procedures will be developed, processed and performed in accordance with existing Site Procedures/Instructions.

The program will produce two documentation packages for each system which, when completed, will be retained as QA records. The first package will be a report that details the scope of testing to be conducted on the system and the procedures to be used for the testing. The second package will include copies of the testing that was conducted and a report that will present an overview of the results of the testing performed on the system. Both packages are subject to an oversight review by the Joint Test Group (JTG). The JTG is an oversight committee and is comprised of senior level engineers or managers. The second report will also be presented to the Plant Operations Review Committee and approved by the Plant Manager.

The Prestart Test Program CAP plan was submitted to NRC by letter dated December 30, 1988 (Ref. 22).

2.13 QA Records

The QA Records CAP plan defines actions to resolve issues associated with WBN construction and operations QA records. Reviews conducted of WBN construction and operations records required for licensing found that some records (1) were not retrievable in a timely manner or were potentially missing, (2) were maintained in improper storage, or (3) had quality problems (e.g., were incomplete, technically deficient or administratively deficient).

A QA Records Team has been established to oversee and manage all activities required by the QA Records CAP. The QA Records Team will be chaired by the QA Records Project Manager and will include a representative from NC, NE, Nuclear Assurance and Services, and Technical Support. Open QA records-related issues will be collected from a review of open CAQs and Employee Concerns CATDs. Identified concerns will be addressed by a three-path corrective action approach. The first path represents the steps to resolve identified records storage issues. The second path represents steps to resolve identified records retrievability issues. The third path represents steps to resolve identified quality issues for deficient records.

After all issues have been identified and resolved, the results will be subjected to a trend analysis to identify common cause factors and to develop appropriate recurrence control actions, based on the program findings. This plan will resolve recognized records issues in a controlled program which (1) ensures adequate storage of construction and operation records, (2) ensures adequate retrievability of construction and operation records, (3) resolves WBN construction and operations record deficiencies, and (4) ensures that programs established to resolve problems are adequate to prevent recurrence.

The QA Records CAP plan was submitted to NRC by letter dated December 21, 1988 (Ref. 23).

2.14 Q-List

The Q-List CAP defines actions for developing a new WBN Q-List to correct several problems with the existing list. These problems were documented in a Site QA Audit, in several employee concerns, and in NCR report W-269-P. The major problems were:

- The Q-List did not differentiate between features with full QA Program requirements and features with augmented (limited) QA Program requirements.
- Motors and other equipment were not uniquely identified on the Q-List.
- The Q-List contained some incorrect QA classifications.

The root causes of the Q-List problems are that TVA's design, construction, and operations organizations used different approaches to identify and list plant features that require QA program application and that the existing Q-List was issued without adequate review or procedural control.

To correct the identified problems, a new Q-List is being developed. The new Q-List will clearly differentiate between features with full and limited QA Program requirements, will list and uniquely identify motors and other equipment as necessary to support operations and maintenance, and will be developed using approved classification procedures to ensure proper classification.

To correct the root causes of these problems, TVA has established the existing Q-List as the single controlled document to be used by all nuclear power organizations and has issued procedures that govern the development of the new Q-List.

The Q-List CAP plan was transmitted to NRC by letter dated October 27, 1988 (Ref. 24).

2.15 Replacement Items Program (Piece Parts)

The Replacement Items Program (RIP) CAP plan defines actions to evaluate commercial-grade items procured without NE review for safety-related applications. The WBN RIP was started in response to BFN employee concerns and NRC audit findings from SQN. The scope of the RIP covers commercial-grade replacement item procurements for safety-related applications and procurements of replacement items for 10 CFR 50.49 components.

The root cause of the concern with replacement item qualification is that previous procedures did not provide for engineering evaluation of replacement item purchases.

The purpose of the RIP is to ensure that the procurement of commercial-grade items for use in safety-related applications has not and will not degrade the ability of the host devices to perform their safety function.

Four distinct work activities comprise the RIP. These activities address procurement requirements in the following four areas:

- Current and future procurements
- Current warehouse inventory
- Plant-installed items in accordance with previous maintenance activities
- Plant-installed items in accordance with previous construction replacements

The RIP activities in these areas consist of engineering evaluations, review of maintenance and construction activities, and programmatic corrective actions to ensure NE review of current and future procurements. The WBN RIP is modeled after the SQN RIP with adjustments made for lessons learned from that program.

Recurrence control measures have been taken to address the identified root cause. Procedures have been established or revised to require and define NE activities to assure that appropriate technical and quality requirements are specified for current and future safety-related replacement part procurements. These activities are performed by a group of engineering procurement personnel assigned to the WBN site.

The RIP CAP plan was submitted to NRC by letter dated December 14, 1988 (Ref. 25).

2.16 Seismic Analysis

The seismic design basis for WBN is the Modified Newmark design spectrum anchored at 0.18 g horizontal and 0.12 g vertical for the Safe Shutdown Earthquake (SSE). The Operating Basis Earthquake (OBE) is equal to one-half the SSE. The design basis spectra was confirmed to be an acceptable design basis by comparison with the Site Specific Response Spectra developed in 1979. The seismic design basis was documented in the WBN FSAR and the NRC review and acceptance was documented in the WBN SER (Ref. 3). An independent review of the seismic analysis calculations for Seismic Category I structures was initiated in September 1987 as part of the DBVP calculation activity. The seismic analysis calculations were selected for an early review to ensure that the analysis and the resulting amplified response spectra used for seismic design of structures, systems, and components are technically adequate and satisfy licensing requirements. Based on this review, certain aspects of the structural seismic analysis were identified as requiring further evaluation and justifications. In addition, an

area of seismic analysis methodology was also identified from the WBN ECP, which required additional evaluation. The concern is related to the time interval of integration used for performing seismic analyses. Also, three CAQRs identified issues related to soil properties used in seismic analyses and consideration of soil and pile interaction effects.

The root cause of the issues identified in this CAP is attributed to the use of engineering judgments in the original seismic analysis without supporting documentation.

To correct the identified issues, the following will be completed:

- Review of seismic analysis criteria and licensing requirements for Category I structures.
- Review of seismic analysis calculations for Category I structures and revisions as required, or preparation of new calculations when necessary.
- Disposition of identified issues.

The disposition of the identified issues will be accomplished by using the site specific response spectra and updated structural models for evaluation purposes. For new design and modifications, an envelop of the results obtained using site specific response spectra and the original ground motion with the updated structural models will be used.

The root cause identified in this CAP has been addressed through procedural improvement. A procedure is now in place (NEP 3.1) to ensure that engineering judgments used in the design process will be adequately documented.

The Seismic Analysis CAP plan was originally submitted to NRC on November 18, 1988 (Ref. 26).

2.17 Vendor Information

Vendor information for safety-related components has not been maintained in a complete, current, and configuration controlled manner. Specific problems include:

- Vendor requirements that have not been implemented.
- Vendor information that does not match the plant configuration.
- Vendor information that is inconsistent with related TVA-developed design input/output documents.
- Inadequate vendor document control program.

- Manuals lost or uncontrolled.

- Installations not approved by NE.

These problems have been identified through TVA's CAQ process, the ECSP, QA Audits, and NRC inspections.

The root cause of the identified problems is inadequate procedural requirements to govern receipt, review, distribution, filing, control, maintenance, and use of vendor information which contains requirements for safety-related components.

To correct the problems identified, safety-related equipment will be identified along with the set of vendor documentation containing engineering requirements necessary to support installation, operation, maintenance, and testing of the equipment. These requirements will be reviewed and approved by NE and confirmed to be located in the proper design input or output documents.

Complete and up-to-date vendor manuals for safety-related components will also be prepared. A master set of vendor manuals will be established, and will be maintained under configuration control. These actions will assure that:

- Specific components to which each manual applies are identified.

- Manuals are complete and up-to-date with respect to current vendor requirements.

- Manuals match the plant configuration and are consistent with related TVA-developed design input/output.

- Engineering requirements in the manual are identified.

- TVA design documents are revised as necessary to reference or incorporate engineering requirements in the vendor manual.

Recurrence control will consist of the development of standards and procedures to improve the control and maintenance of vendor information. Corporate procedures addressing the processing and control of vendor information are being revised and strengthened as necessary. Project and site procedures are also being developed to implement the corporate guidance and requirements relative to vendor manuals and other vendor information. As a long-term enhancement, a cross-reference index is being prepared to be used in the development of design changes. This index will be used to assist in the location of affected vendor documents during design change development.

The Vendor Information CAP plan was submitted to NRC on December 14, 1988 (Ref. 27).

2.18 Welding

During the course of TVA work at its nuclear plants, conditions related to welding were identified that did not meet TVA licensing requirements. After assessing these conditions, TVA concluded that reviews were needed to determine the adequacy of the TVA welding program, including that at WBN. The TVA Welding Project (WP) was established as an independent group in 1985 to conduct these reviews.

The responsibility of the WP was to provide TVA, the NRC, and the public with a high degree of confidence in the adequacy of the overall TVA welding program and in the reliability of the welded structures, systems, and components, including those at WBN. As part of this effort at WBN, an independent review of welding activities was performed by the Department of Energy Weld Evaluation Project (DOE/WEP). DOE selected EG&G to perform this independent evaluation.

The scope of the reviews by the WP includes WBN unit 1 TVA-performed safety-related welding. These reviews cover the WBN written welding program and the TVA welds associated with safety-related structures, systems, and components: piping welds, welds in building and miscellaneous steel, and welds in component supports; e.g., pipe, instrument and control, electrical, and HVAC. At the request of the NRC, vendor-supplied welds for WBN were added to the scope of the TVA weld evaluation. Specific employee concerns related to vendor welding were evaluated by the WP, and TVA developed and implemented a program for evaluation of vendor welds.

During the initial part of the review (evaluation of the written welding program at WBN) of the TVA-performed safety-related welds, several general and programmatic recommendations for improving the welding program, including recommendations for training and revisions to engineering specifications, were made. In addition, two potential deficiencies related to program implementation were identified for resolution during the remaining portion of the review. One of these issues was dispositioned as acceptable by reinspection and engineering calculations. The second issue was evaluated and resulted in a corrective action.

During the remainder of the review at WBN (evaluation of program implementation), 12 areas requiring corrective action were identified. Other conditions were identified that were not within the scope of the WP but required further evaluation and/or resolution. These evaluations are being conducted and corrective actions being implemented.

The evaluation of vendor welds was assigned to WBN NQA to complete. Vendors were selected by using quality indicators compiled by the WP. There were 16 vendors selected for evaluation. Further review indicated that previous corrective actions adequately addressed the scope of vendor deficiencies for 11 of the 16 vendors and that further evaluation was not required. Corrective actions for the remaining five vendors are being implemented.

An in-depth root cause analysis is currently being performed to determine the fundamental causes of the problems encountered in the TVA welding program, including those at WBN.

The recommendations and conclusions of the WP and NQA efforts will be integrated with the results of all WBN-specific corrective action programs to ensure that the overall WBN welding program is modified to preclude a recurrence of similar problems in the future with welding activities at WBN.

In addition to the aforementioned activities, each TVA nuclear organization associated with welding is making applicable revisions to its individual program to establish a single, unified program that can be implemented for initial construction, modification, and maintenance activities within the particular organization's area of responsibility. The changes made to the program, new procedures, and specifications provide sufficient controls to assure compliance with TVA licensing requirements.

The Welding CAP plan was submitted to NRC on January 13, 1989 (Ref. 28).

3.0 SPECIAL PROGRAMS

As stated in Section 1 of this chapter, many significant issues, which were not as broad-scoped as CAPs, or where substantial progress had already been made toward their resolution with several reports submitted to the NRC, were bounded in a number of Special Programs. These Special Programs were reviewed by the WBPT in a similar manner as the CAPs. However, because they were not as broad-scoped, or because significant progress had already been made in their implementation, these programs were not submitted to NRC for prior endorsement of approach. For each Special Program, a background information file (BIF) was prepared by the line organization in accordance with WBPT procedures. Each BIF includes the historical background of the issue, identification of nonconforming issue, description of the condition (commitments and code compliance), objective and scope of the program, corrective action, root cause identification, and recurrence control measures. WBPT has reviewed Special Programs using the information in the BIF and information derived from discussions with the line organization.

The following subsections briefly describe the Special Programs listed below, including the identification of issues, actions taken or planned to resolve the issues, root cause identification, and recurrence control.

- Concrete Quality Program
- Containment Cooling
- Detailed Control Room Design Review
- Environmental Qualification Program

- Master Fuse List
- Mechanical Equipment Qualification
- Microbiologically Induced Corrosion
- Moderate Energy Line Break Flooding
- Radiation Monitoring System
- Soil Liquefaction
- Use-As-Is CAQs
- Other Programs

3.1 Concrete Quality Program

In 1985, employee concern IN-85-995-002 was filed stating that plant/construction procedures did not meet or address FSAR commitments regarding concrete compressive strength and frequency of sampling. The concern was investigated with the results concluding that the concern was substantiated. Specifically, the investigation concluded that: (1) the percentage of strength test results below specified strength was greater than allowed by the FSAR and TVA General Construction Specification G-2; (2) the quantity of concrete represented by most samples was generally within specification limits, however, there were a substantial number of samples found to be outside the limits; and (3) TVA commitments, specifications, and procedures did not conform to any nationally recognized code, standard, or specification.

The root causes of the above issues are identified by two categories (1) licensing and engineering basis, and (2) implementation basis. The root cause for the licensing and engineering category was a lack of industry procedures at the time TVA was developing General Construction Specification G-2. TVA General Construction Specification G-2 predated the nuclear industry standards for concrete. The root cause for implementation category was oversight of personnel to make the necessary adjustments to mix designs and sampling in a timely manner. Low compressive strength test results were originally evaluated on an individual basis and concrete mix adjustements were made in the field to control the average 3-day strength of the concrete. These efforts were not always effective in achieving the required strength test results.

NE, in conjunction with NC, performed a detailed review of Employee Concern IN-85-995-002 and provided a detailed response in Civil Engineering Branch (CEB) Report 86-19-C (R1). In addition, TVA formed a consulting panel to review the engineering basis with respect to industry standards and to review the proposed methods for estimating in-place concrete strength. The panel's report is included in CEB report 86-19-C (R1). Corrective actions for these

specific items with respect to implementation, were covered under WBN SCR 6719, 6720, and 6721. These are summarized as follows:

- A procedure was developed to conservatively estimate in-place strength considering strength test results, use of bedding mortar, sampling frequencies, and strength gains with age. A consulting panel reviewed and agreed with the procedure. Because of the high fly ash content of TVA concrete, significant strength gains with age are realized. This, coupled with the original adequacy of most of the strength test results, limited the need for detailed engineering review to localized areas and building features. Where necessary, design calculations were reviewed, and it has been determined that the concrete is structurally adequate. TVA also performed in-place testing of the concrete by Winsor probe and coring. CEB Report 87-03 documents the results of this testing. The testing verified that the estimated in-place strengths are acceptable.

- Implementation of the program resulted in deviations from the program requirements. Approximately nine percent of the concrete has an estimated in-place strength less than the specified or design strength. Concrete design drawings for Category I structures were revised, where appropriate, to include a reference that ensures the use of proper concrete strengths in future design evaluations. An engineering evaluation has determined that the in-place concrete is of adequate strength to satisfy structural requirements. The results of this analysis are documented in CEB Report 86-19C.

Since nearly 99 percent of all structural concrete in category 1 structures has already been placed, recurrence controls are limited to procedural changes associated with the documentation of the engineering evaluations. Construction Specification G-2 has been revised to clarify provisions for bedding mortar and project procedures have been revised to use the same type mix with one size smaller nominal maximum size aggregate for congested areas.

The results of the concrete quality program were submitted to the NRC on April 16, 1987 (Ref. 40).

3.2 Containment Cooling

10 CFR 50.49(e)(1) requires that, "The time-dependent temperature and pressure at the location of electrical equipment important to safety must be established for the most severe design basis accident during or following which this equipment is required to remain functional." Contrary to this requirement, during the development of the Watts Bar time-dependent environmental qualification accident temperature profile for the lower compartment, there was a failure to consider the long-term effects of a main steam line break (MSLB) inside containment for a plant going to hot standby conditions as opposed to cold shutdown. The present profile shown on drawing 47E235-42 (R2) reflects the peak temperature from an MSLB at the initiation of an accident and decreases over time until the loss of

coolant accident (LOCA) curve becomes limiting. The Reactor Coolant System (RCS) was not considered as a major heat source after an MSLB because it was assumed that the post-LOCA environment represented the limiting condition for long-term temperature effects. However, when the primary system heat loads, because of decay heat at hot standby conditions, is considered as a long-term heat source, the post-MSLB environment may be the most limiting in the long term. The long-term lower compartment temperature will not exceed the peak temperature experienced immediately following an MSLB, but the temperature may exceed the long-term qualification limits that have currently been established for safety-related equipment. This condition has been documented in a CAQR WBF870061, which was determined to be reportable (WBRD 50-390/87-22).

The root cause of this deficiency is a combination of two factors: (1) premature termination of the MSLB temperature profile analysis by Westinghouse, and (2) design oversight on the part of TVA when extrapolating beyond the time covered by the Westinghouse analysis. The Westinghouse analysis for an MSLB was terminated after the termination of the steam blowdown. It was believed that after steam release, the post-MSLB containment temperature profile temperature was declining due to containment spray and air return fan actuation (containment spray was not assumed to work after switchover to the containment sump). As a result, TVA reflected this in the post-MSLB profile. However, after ice bed melt-out, the decay heat emitted by the RCS pipes and pumps during hot standby results in gradually increasing temperatures in subcompartments of lower containment for ice condenser plants. The gradually increasing temperatures do not occur during long-term post-LOCA cold shutdown.

To correct this identified deficiency and to ensure the operability of equipment important to safety, TVA will take the following actions:

- The long-term temperature profile for lower containment will be determined for the duration of the design basis MSLB event using the Ice Condenser and Containment Spray Systems as the safety-grade systems for removing containment ambient heat post-MSLB.

- The Lower Compartment Cooler (LCC) units and associated ducting will be upgraded to safety grade, with the exception of the LCC coils. This upgrade will provide a fully qualified means of providing air circulation via the LCC fans and ductwork to subcompartments of lower containment to prevent hot spots from forming in these compartments.

- In order to ensure the availability of the WBN containment sump for recirculation and spray operation, a containment coatings transport evaluation will be performed to confirm that the protective coatings inside containment will not affect sump screen performance. These protective coatings have not previously been qualified to the MSLB temperatures because long-term, post-MSLB containment spray operation was not assumed.

The corrective actions are in two phases. The first was accomplished by the performance of the DCRDR and the transmittal of the DCRDR Summary Report to the NRC by a TVA letter (Ref. 43) dated October 1987. The NRC staff safety evaluation of DCRDR was received with their letter dated April 28, 1989 (Ref. 45). The second phase is the implementation of the corrective actions identified in the DCRDR Summary Report.

Recurrence control includes: NE issued Human Factor Design Guides, and WBEP issued Human Factors Design Criteria. Also, the NE design change process now requires human factors to be addressed.

3.4 Environmental Qualification Program

10 CFR 50.49 requires the environmental qualification (EQ) of safety-related electrical equipment to ensure reactor coolant pressure boundary integrity, to shut down the reactor and maintain it in a safe shutdown condition, and to prevent or mitigate the consequences of accidents that could result in offsite exposures comparable to the 10 CFR Part 100 guidelines. It is further required that the evaluation of EQ be documented and maintained in auditable files.

TVA conducted a management review of the EQ programs at SQN, BFN, and WBN in July and August 1985. This review indicated that much of the qualification documentation was not fully auditable and, in some cases, the documentation available did not demonstrate full qualification.

The root 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. Responsibility and authority were not clearly defined and thus the level of documentation and attention to detail required for compliance was not recognized. These factors were further compounded by an organizational structure that made communication and cooperation between design and operational personnel difficult.

Subsequent to the voluntary shutdown of SQN, the WBN Environmental Qualification Project was formed with the responsibility for developing and implementing an EQ program. The WBN EQ program has issued two design output documents to satisfy 10 CFR 50.49 requirements: (1) the list of safety-related electrical equipment representing the installed configuration of the plant required to meet 10 CFR 50.49, and (2) the qualification file (EQ binders) that provides the auditable record demonstrating qualification for each item on the 10 CFR 50.49 List.

The WBN 10 CFR 50.49 EQ program documents that the ability of safety-related electrical equipment hardware installed in harsh areas has been qualified to perform its designated function in the environment to which it will be subjected during accidents. Programs and procedures have been established to ensure that qualification is maintained as future plant modifications are made.

Close coordination of the WBN EQ and the SQN EQ programs has been maintained. The SQN EQ program has been reviewed by NRC on several occasions starting in January 1986, and concluding before restart of SQN unit 2. Feedback from these reviews has been incorporated into the WBN program.

The work on EQ binders for WBN unit 1 has been substantially completed as described in the WBN EQ Summary Status Report provided to the NRC on September 30, 1986 (Ref. 46). The binders have some open items (Sections 10.1 and 10.2 of Summary Status Report) which remain to be closed. These open items include technical issues such as the need for additional vendor information, additional calculations, additional testing, etc. and open items which require additional field work such as the need for additional field verification of equipment, piece parts or whole device replacement, rerouting of cables, etc.

For the long term EQ program, procedures have been developed to provide the controls necessary to maintain compliance with 10 CFR 50.49. These controls are to ensure that the impact of design changes on EQ documents are evaluated and input into the design output documents, and to ensure maintenance or modification work on equipment within the scope of 10 CFR 50.49 is identified and feedback provided to NE to update the associated EQ documents. These actions will ensure that the auditable files are maintained to reflect the as-constructed plant.

The actions to close the open items are being implemented in accordance with existing design change processes and procedures. Corrective actions will be completed and open items will be closed before fuel load with allowance for documenting specific exceptions for tasks which are dependent upon a particular plant mode for completion.

3.5 Master Fuse List

The objectives of the Master Fuse List (MFL) program are to formulate a Master Fuse List of Class 1E fuses, resolve the misapplication of Bussman KAZ actuator devices as fuses, and resolve deficiencies involving electrical penetration assembly (EPA) overcurrent protection fuses. The MFL development will include the corrective actions taken to resolve both the use of the Bussman KAZ fuses and deficiencies with EPA fuses.

The root causes for the misapplication of the KAZ actuator devices as fuses and failure to provide proper EPA redundant overcurrent protection fuses are as follows:

- NE did not provide adequate design input at the time of the fused circuit design to require that device coordination studies be performed to ensure selectivity under fault conditions.

- NE did not provide adequate design input and output documents to detail and clarify the design process to ensure proper EPA protection fuses.

- NE did not properly coordinate and review the fuse design.

The objective of the MFL Program will be achieved by the following corrective actions:

- NE will develop and issue an MFL for the Class 1E fuses. This list will be maintained as a design output document.

- NE will issue design output to replace the existing Bussman KAZ actuator devices.

- NE will evaluate the EPA protection fuses and perform calculations or rework as necessary to ensure adequacy of the installation.

The recurrence control for the misapplication of the KAZ actuator device and for ensuring adequate EPA fuses is given below:

- Design Criteria WB-DC-30-27 has been issued and requires device coordination studies to be performed to ensure selectivity.

- NEP 3.2 has been issued to require that design input for components be identified, documented, reviewed and approved.

- NEP 5.2 has been issued and requires design verification procedures including checklists and questions to be addressed during design verification and reviews.

These corrective actions are being implemented in accordance with existing design change processes and procedures. All corrective actions will be completed before fuel load.

3.6 Mechanical Equipment Qualification

The mechanical equipment qualification program (MEQ) defines WBN actions to ensure that active mechanical equipment located in a harsh environment can perform its intended function during both normal and accident conditions. The WBN MEQ program was established in response to the NRC's letter from E.G. Adensam to H. G. Parris dated April 1, 1983 (Ref. 47). The MEQ program will ensure that active safety-related equipment conforms to the applicable requirements of 10 CFR 50 Appendix A GDC 4 and will adequately perform its safety functions when subjected to both normal and postulated conditions. The MEQ Program complements the 10 CFR 50.49 EQ Program and includes the analysis of the nonmetallic subcomponents of mechanical equipment for the effect of maximum thermal and radiation conditions. This analysis will be done on active safety related mechanical components located in harsh environments before fuel load.

This issue developed from the NRC concern (Ref. 47) that accelerated degradations of non-metallics may occur because of postulated temperature and radiation exposure or that non-metallics of unknown type or pedigree exist in active safety-related equipment which must be evaluated for degradation.

To address this issue the mechanical equipment qualification program has been developed to identify and analyze affected equipment. The program provides for the review of the initial design and incorporates material and equipment modifications, maintenance review and field verification. Analysis of components is accomplished in a recognized and established manner and closely follows the programmatic logic of the 10 CFR 50.49 environmental equipment qualification program for electrical equipment. A controlled binder will be issued which will document and maintain records of qualified equipment and establish qualification maintenance requirements. Maintenance procedures will be established to provide for material changeout to ensure that materials in use are within their qualified life.

The following describes the major emphasis of the MEQ program:

- The mechanical equipment list will establish the population of mechanical equipment within the MEQ Program to be baselined for as-designed and as-installed configurations.

- The documents produced by the MEQ Program will be in controlled binder or manual form and will contain documents necessary to establish and maintain the prescribed equipment in a qualified status for life-of-plant.

Recurrence control is assured through the implementation of the MEQ Program at WBN. When the MEQ binders are in place, evaluation for subcomponent suitability and qualified life will be in accordance with the data contained therein.

This program will demonstrate compliance with 10 CFR 50 Appendix A GDC 4 and will technically justify the suitability of installed equipment and materials for it's environmental area. The program will provide a basis for closure of existing conditions adverse to quality as well as discrepancies identified in the Vertical Slice Review.

TVA letter to the NRC dated 05/19/83 (Ref. 48) summarized the MEQ program activities that were necessary to establish the degree of environmental qualification referred to in Ref. 47. This program is substantially complete in the evaluation of the as-designed equipment status. The remaining program activities include completion of the as-designed equipment evaluation, verification of the as-installed equipment status, and implementation of the programs to maintain the prescribed equipment in a qualified status for life-of-plant.

- The components in lower containment important to safety will be qualified to the revised calculated MSLB temperature profile.

Recurrence control measures will be completed by the incorporation of decay heat into the containment temperature profile analysis. No additional recurrence control is required because TVA considers this deficiency to be an isolated incidence of design oversight during the development of the time-dependent environmental qualification accident temperature profile.

3.3 Detailed Control Room Design Review (DCRDR)

The DCRDR program was developed in response to the NRC requirements following the TMI-2 accident. The NRC required all licensees and applicants for an operating license to conduct a DCRDR to identify and correct human factor deficiencies in their control rooms. The guidance for conducting a DCRDR was provided in NUREG-0700 and draft NUREG-0801; additional guidance was provided in NUREG-0737 and the minimum requirements were specified in NUREG-0737, Supplement 1.

Applicants who were unable to complete the DCRDR before issuance of their operating license were required to conduct a preliminary design assessment (PDA) of the control room to identify human engineering discrepancies, and to establish a correction schedule, approved by the NRC staff. These applicants were also required to complete a full DCRDR later. The NRC conducted an onsite review of the WBN control room from October 6 through October 10, 1980. TVA performed a PDA of the WBN control room and submitted its findings to the NRC in a report dated January 13, 1981 (Ref. 41). Discrepancies identified in both the NRC staff's onsite review and TVA's PDA were documented in the NRC staff's control room design review report received by TVA on June 1, 1981 (Ref. 42). License commitments resulting from NRC's control room design review and the PDA were made confirmatory items in Appendix D of NUREG-0847 (Ref. 3). During the DCRDR process, some original corrective actions were modified as part of the integrated, more comprehensive DCRDR corrective action plans, described in TVA's "WBN DCRDR Summary Report" (Ref. 43) dated October 2, 1987. During the week of November 14, 1988, NRC performed an in-process audit of the WBN DCRDR program. Following the NRC audit, in a letter to NRC dated March 7, 1989 (Ref. 44), TVA requested NRC to consider commitments of SER Appendix D to be superseded by the WBN DCRDR summary report and to address this request in the audit results. The WBN DCRDR addressed the man-machine interfaces of the main control room, the auxiliary control room, and the adjacent switch transfer rooms. In terms of review tasks, the scope of the WBN DCRDR was required to include identification of human engineering deficiencies and implementation of resulting corrective actions.

The DCRDR program was primarily instituted to address the lack of incorporation of human factor principles in the main and auxiliary control rooms for nuclear power plants.