- Resolution of human factors engineering practices in the control room that were identified as questionable (SQN, WBN, BFN, and BLN)

- Assessment of 19 human factors engineering concerns identified after the detailed control room design review was suspended (BLN)

The corrective actions implemented to resolve the negative findings are:

- Finish the in-progress detailed control room design review (WBN and BLN)

- Identify and correct human factors engineering discrepancies in the control room (SQN, WBN, BFN, and BLN)

- Place review of the 19 human factors engineering concerns on the computerized tracking and report of open items system list (BLN)

The very limited perspective of this subject precluded inquiry and development of major technical or broader issues. As such, none was revealed in this subcategory evaluation.

Subcategory 26900, Q-List

This subcategory addresses five employee concerns about Q-Lists and CSSC Lists. The five concerns were itemized into 15 original issues and one peripheral issue and assessed in five separate element evaluations. Of the 16 issues, seven were found not to be valid, and three valid issues had corrective actions implemented before the ECTG evaluation. Five valid issues and the one peripheral issue required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluations related to:

- Q-List Differences - Accuracy of the Q-List (or equivalent) questionable for two of the four plants, SQN and WBN

  SQN - Although a review of the SQN CSSC List for accuracy and completeness on a biennial basis had been committed to by TVA, such a review has not yet been performed. Resolution of SQN CSSC review committee meeting open-action items had been repeatedly deferred

  WBN - DNQA and NSRS investigated problems associated with the Q-List documents and found numerous deficiencies. These were reported to the NRC, along with a commitment to corrective action. The corrective action has not yet been completed

- The BFN CSSC List had not been reviewed, as is required on a biennial basis, for accuracy and completeness and to make sure that it incorporates plant modifications

- More than one Q-List (or equivalent) with different contents were in use at the same time at both WBN and BFN. WBN created a CSSC Q-List from the DNE Q-List for use in operations activities; however, the CSSC Q-List was based on incorrect selection criteria. BFN had issued a second (EN DES) CSSC List while the initial (NUC PR) CSSC List was in use

- Lack of evidence that CSSC open-action items reported by DNQA had been closed out (peripheral issue requiring resolution at BLN)

The corrective actions implemented to resolve the negative findings are:

- Q-List Differences

  - Review CSSC List on a biennial basis and review all open-items on SQN CSSC Review Committee agenda (SQN). The SQN corrective action plan provided justification that the scheduled biennial review of the SQN CSSC List for accuracy and completeness is not necessary prior to restart. The NRC approved the use of the SQN CSSC List for the short term (SQN unit 2 restart) and recommended expeditious development and implementation of a Q-List at SQN. SQN committed to provide a Q-list implementation plan by March 1, 1988. This commitment is being tracked to completion on CCTS. The implementation plan will also be tracked to completion on CCTS (SQN)

  - Review Q-List and revise to make it accurate (WBN)

  - Delete CSSC Q-List and NUC PR CSSC List (WBN)

  - Review activities during use of Q-List/CSSC Lists to verify that the QA program controls were adequately implemented (WBN)

  - Complete development and issue new Q-List, then discontinue the DNE and NUC PR CSSC Lists after comparing the new Q-List with the old lists and noting and evaluating the discrepancies (BFN)

  - Close out DNQA memo open-action items (BLN)

- TVA will review the activities that took place at WBN, SQN, and BFN during the use of the questionable CSSC List to verify that the QA program was adequately implemented

At a corporate level, the NQAM (ID-QAP-2.7) commits that DNE will develop and maintain a Q-List for each nuclear plant. It also establishes implementation requirements for each plant.

The full significance of the negative findings is that the impact of any omissions from the Q-Lists/CSSC Lists cannot be determined until the reviews have been completed, and, therefore, the potential exists for future physical plant changes.

No major technical issues were uncovered during the subcategory evaluation.

A broader issue resulting from the subcategory evaluation is that if the reviews find that safety-related structures, systems, or components had been manufactured and installed as nonsafety-related, the consequences could be very significant. It would mean that certain quality assurance program activities during design, construction, and operation intended to ensure that a structure, system, or component will perform satisfactorily in service may not have been performed (SQN, WBN, and BFN). If any such situations are discovered, they will be addressed under the Conditions Adverse to Quality (CAQ) program per NEP-9.1, "Corrective Action."

Subcategory 21000, Environmental Qualification

This subcategory addresses eight employee concerns relating to the overall environmental qualification program at TVA. The eight concerns were consolidated into five issues which were assessed in six separate element evaluations. Of the five issues, one was completely implemented before the ECTG evaluation and required no further corrective action. The remaining four issues were valid, but corrective action had been initiated before the beginning of the ECTG evaluation.

The ECTG evaluation found that TVA management had previously identified significant deficiencies in the environmental qualification program and that these deficiencies were the primary reason for TVA's decision to shut down the Sequoyah plant. These deficiencies were as follows:

- Qualification of equipment not adequately implemented per NRC guidelines that require specialized environmental qualifications of safety equipment subjected to what is termed "harsh environments" (as distinguished from "mild environments," which do not require special environmental qualification)

- Equipment to be qualified not all properly identified

- Programmatic requirements (e.g., record keeping) not met

After the Sequoyah shutdown, TVA initiated a major upgrade of the environmental program directed at improving both the quality of documentation and the organizational coordination necessary for the control of equipment qualification. This upgrade program is

at different stages of implementation at the various TVA nuclear power plants. At Sequoyah, implementation is nearly complete, while at Bellefonte the program is on hold until engineering resumes there. At Browns Ferry and Watts Bar, the program is well established but only partially complete.

The upgrade program for environmental qualification is addressed specifically in Section III, Special Programs, of TVA's Nuclear Performance Plan for each plant.

No major technical or broader issues, other than those already in evidence and being addressed, were discovered during the subcategory evaluation.

Subcategory 21200, Pipe Support Program

This subcategory addresses six employee concerns about the TVA pipe support program, covering pipe support design documentation, installation, and as-built verification activities. The six concerns were developed into 22 original and four peripheral issues and assessed in eight separate element evaluations. Of the 26 issues, 20 were found not to be valid, and two valid issues had corrective actions implemented before the ECTG evaluation. Only the four peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of ECTG.

In summary, the negative findings resulting from the evaluation related to:

- TVA's authorization to EDS Nuclear, Inc. (EDS) to destroy pipe support calculations originated by EDS (WBN)
- TVA's failure to analyze an 8-inch overflow pipe coming from the refueling water storage tank (WBN)
- Potential interference of piping with adjacent plant features (WBN)
- Design of drywell purge system pipe support that cannot accommodate a design basis accident pipe movement (BFN)
- IE Bulletin 79-14 program procedural deficiencies (BLN)
- IE Bulletin 79-14 program for BFN not yet completed

The corrective actions implemented to resolve the negative findings are:

- TVA to review all WBN unit 2 supports as a part of that unit's design process, thus ensuring acceptability of these supports. For WBN unit 1, all pipe support calculations will be reviewed for basic completeness, and it will be verified that all

calculations are in the Records and Information Management System (RIMS). In addition, all missing or otherwise incomplete calculations will be prepared, issued, and documented (WBN)

- Perform an analysis for the affected 8-inch pipe, and design and install supports required as a result of this analysis. Physical piping drawings for other safety-related systems will be reviewed to ensure that all Category I piping has been identified for analysis (WBN)

- Implement a program to correct all potential interferences between piping and adjacent plant features; the procedure has already been written (WBN)

- Remove the affected unit 2 support and a similar unit 3 support (which were added by Construction, but not called for on the original design drawings) (BFN)

- Revise current procedure CEB 80-76; void CEB EP 21.30 and BLEP-08 and replace with new procedures (BLN)

- Use a dedicated work force to complete the 79-14 effort (BFN)

A significant, although nontechnical, issue resulting from the subcategory evaluation relates to document retention problems associated with incomplete, missing, or destroyed pipe support calculations. This overall issue consists of three aspects:

- Calculations that cannot be retrieved because their identifiers were miscoded into the RIMS database

- Calculations that do not fully justify the total support design because support designers did not understand the necessity of formally documenting all calculations required to justify their designs

- The isolated, although costly, incident in which TVA management authorized the destruction of pipe support calculations by the originating contractor (EDS) without verifying beforehand that TVA had copies of these calculations stored in RIMS

The causes cited by the evaluation team related to adequacy of communication, management attention, and TVA's QA program. TVA personnel authorized the disposal of the EDS pipe support calculations on the erroneous assumption that they would have continued access to the EDS microfilmed records. This error was compounded by the misunderstanding that a copy of the calculations existed within TVA. The personal services contract between TVA and EDS was judged to be deficient in not providing for continued access to EDS's microfilmed records or the regularly scheduled turnover of calculations to TVA for lifetime storage. TVA could have exercised greater control over the calculation retention issue by scheduling more frequent audits to ensure that documented calculations

existed as required and were being prepared, retained, and turned over to TVA according to ANSI N45.2.9-1974 requirements. Additional training of personnel, supervisors, branch chiefs, and managers regarding documentation requirements would have helped to prevent such problems.

Subcategory 21300, Electrical Testing and Planning

This subcategory addresses two employee concerns about electrical testing and planning and deviations to preoperational test acceptance criteria. The two concerns were developed into 16 original issues and three peripheral findings and assessed in four separate element evaluations. Eight issues were found not to be valid. The eight valid issues and the three peripheral findings uncovered during the evaluation required corrective actions to be taken as a result of ECTG evaluation.

In summary, the specific findings resulting from the evaluation, with the applicable plant(s) shown in parentheses, related to:

- Previously identified negative findings closed for Sequoyah before the ECTG evaluation

- Engineering procedures and site standard practices relating to the preoperational test program not fully adequate to ensure incorporation of all design requirements, including procedural requirements for the processing of preoperational test documents, and, in some instances, not followed. This has resulted in discrepancies in test results packages (BFN, BLN, WBN)

- No documented acceptance criteria in the initial TVA-prefix test scoping documents and preoperational test instructions. Even Chapter 13.4 of the FSAR Amendment 31 does not clearly define the acceptance criteria of each preoperational test; it merely provides a "Test Summary" (BFN)

- Test results packages found to have minor procedural inconsistencies and/or deficiencies (WBN, BFN, BLN); in addition, engineering review of test results not adequate because some test results packages were approved with open exceptions and no documentation was available to identify the closure of same (BFN)

- Several instances of no documentation for engineering justification of the acceptance of preoperational test deficiencies (WBN, BFN, BLN)

In addition, the following peripheral findings were identified:

- In some instances, FSAR commitments not fully reflected in the acceptance criteria of the test documents (BFN)

- In isolated cases, discrepancies in the acceptance criteria between the FSAR and test documents (BLN)

- Documentation not available for two test and retest results packages (TVA-13B and TVA-13BRT) for the implementation of design changes made by ECNs 2786 and 2799 (WBN)

A summary of the detailed corrective action descriptions to resolve the specific findings, with the applicable plant identified in parentheses, is as follows:

- Develop engineering procedures to prevent: 1) recurrence of procedural deficiencies and/or evaluation inconsistencies in test results packages, and 2) lack of documentation for justifying engineering judgment in the acceptance of test deficiencies, when the test program is reactivated (BLN).

- Review test packages for procedural deficiencies and/or inconsistencies and revise test results packages as required. Also, develop new engineering project procedures to prevent recurrence of the above shortcomings (WBN).

- Document technical justification to support engineering judgment in the acceptance of preoperational test deficiencies (WBN).

- Train personnel in new and revised engineering procedures to prevent recurrence of procedural and documentation deficiencies (WBN, BLN).

- Develop a restart test program and resolve the shortcomings of the preoperational test and retest programs (BFN).

- Review and revise existing site director standard practices to include procedural control of engineering activities and to require engineering approval for corrections of design-related test deficiencies (BFN).

In addition, the following corrective actions were identified for the peripheral findings:

- Review the FSAR commitments. Correct FSAR and/or input to the restart test program as necessary (BFN).

- Revise Chapter 14 of the FSAR and resolve other discrepancies with test documents on reactivation of the preoperational test program (BLN).

- Review and document previously completed test and retest results packages (TVA-13B and TVA-13BRT) for the implementation of design changes made by ECNs (WBN).

The major technical issues resulting from the subcategory evaluation relate to the lack of documentation and lack of fully adequate engineering procedures and site practices in establishing design requirements.

FSAR commitments were not, in some instances, fully reflected in the acceptance criteria of the test documents. In several instances, engineering judgments in the acceptance of test deficiencies were not documented. Also, there was a lack of documentation in the test and retest results packages for the implementation of design changes made by ECNs. The Browns Ferry initial preoperational test program was not well developed, and it did not include documented acceptance criteria. Browns Ferry has now developed a restart test program.

On the basis of the observations made and in spite of the negative findings identified and of corrective actions mainly in the areas of procedural inconsistencies and deficiencies, overall engineering participation in the preoperational test program appears to be adequate for all plants except Browns Ferry. However, a restart test program has been developed for Browns Ferry to resolve the shortcomings of the preoperational test and retest programs. Implementation of the corrective actions should resolve all the findings identified during the evaluation for WBN, BFN, and BLN. A potential for hardware modifications exists as a result of implementation of corrective actions for Watts Bar and Browns Ferry.

No broader issues were revealed as a result of the subcategory evaluation.

Subcategory 21800, Pipe Stress Calculations

This subcategory addresses 22 employee concerns about pipe stress calculations. The 22 concerns were translated into 44 issues and assessed in 21 separate element evaluations. Of the 44 issues, 13 were found not to be valid, and two valid issues had corrective actions implemented before the ECTG evaluation. Twenty-six valid issues required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative significant findings resulting from the evaluation related to:

- Procedures that permitted arbitrary acceptance of increases in operating temperatures of up to the larger of 20F or 10 percent without reanalysis and without regard to code qualification (WBN). Failure to consider the full stress range in thermal stress evaluations (SQN, WBN, BFN, and BLN)

- A checklist in use for verification of time-history analyses that did not verify the analysis parameters specifically applicable to such analyses; in some analyses, the values of such parameters actually used were incorrect (WBN)

- Water hammer loads being neglected for a small branch pipe on the basis of improper technical justification (WBN)

- Some calculations not being retained; one calculation contained a calculated overstress that was accepted on the basis of improper technical justification; one calculation revision improperly deleted a thermal operating mode from evaluation (BFN); amplified response of free-ended branch piping was not properly considered (SQN, WBN, BFN, and BLN)

- Seismic anchor motion analyses being performed with unconservative phasing of structurally imposed motions and incorrectly omitting such motions at pipe supports (WBN)

- Rigorous analyses being terminated at locations of three-way restraints although the piping beyond the three-way restraints was flexible (SQN, WBN, BFN, and BLN)

- Potential interferences to growth of a steel containment vessel (WBN)

- A pipe support being attached to a building other than that considered in the piping analysis (WBN). A pipe support being attached, in common, to two buildings but analyzed as attached only to one (BFN)

- At one time, no programmatic requirements for the installation and removal of temporary supports; no requirements for maintaining seismic qualification of piping while sesimic supports were temporarily removed (BFN)

- An interference between a pipe and a pipe support caused by growth of the steel containment (BFN)

The corrective actions implemented to resolve the negative findings are:

- Revise design criteria and conform calculations (WBN, BFN, SQN, and BLN)

- Rescind requirement for use of verification checklist and reperform time-history dynamic analyses to adequate frequency limits (WBN)

- Revise design criteria (SQN, WBN, BFN, and BLN). Review all calculations to ensure that verifications do not predate origination of latest analyses and reperform water hammer analyses to adequate frequency limits (WBN). Perform a walkdown and evaluation of a sample of piping and supports (BFN). Revise calculations, as necessary, to eliminate snubbers in-line with rigid restraints; evaluate LOCA movements for piping attached to containment; revise calculations, as necessary, to include lug stress evaluations; review all "alternate" calculations for proper interfacing (BLN)

- Prepare calculations for safety-related piping less than 2-1/2 inches in diameter; revise one calculation with a 25.8-percent overstress and an improperly deleted thermal mode; revise design criteria (BFN); revise criteria and issue a CAQR to address existing calculations (SQN, WBN, BFN, and BLN)

- Evaluate all affected response spectra analyses; revise pipe support designs as necessary; revise design criteria; use correct seismic anchor motion (SAM) methodology for planned total reanalysis of all "rigorous analysis" piping (WBN)

- Revise design criteria (SQN, WBN, BFN, and BLN); evaluate a sample of "worst case" calculations (SQN); reanalyze piping systems where boundary conditions were not selected by acceptable methods, such as at an anchor (WBN); and conform calculations (BLN)

- Resolve potential interferences to growth of steel containment vessel (WBN)

- [illegible] pipe support design manual, review all pipe supports in close proximity to two or more seismic zones, modify supports as necessary (WBN); evaluate existing designs, reanalyze, and, if necessary, modify supports; add seismic zone information to drawings (BLN)

- Corrective action is to be defined in TVA's ECTG report number 307.04 (BFN)

- Remove two pipe supports and requalify the piping (WBN)

No major technical or broader issues were revealed as a result of the subcategory level evaluation.

Subcategory 22000, Support Design General

The concerns of this subcategory report deal mainly with the design adequacy of pipe supports. Other related issues in this report include design change control, technical decisions made by Construction, and technical review by Engineering. The 18 concerns were itemized into 42 original and peripheral issues and assessed in 15 separate element evaluations. The majority of issues were found not to be valid, and approximately half of the 15 valid issues had corrective actions initiated by TVA before the ECTG evaluation. The remaining valid issues and the peripheral issues found during the evaluation required corrective actions to be taken as a result of the ECTG work.

The findings confirm that the only issue of major significance is the adequacy of pipe support design. The rest of the related issues were found to be either technically insignificant or invalid. The evaluation team examined both the design criteria and individual pipe support calculations. The pipe support design criteria for all four plants were found to adequately address the necessary seismic design requirements, with the exception of one Browns Ferry criterion. Furthermore, the pipe supports reviewed by the

evaluation team for all four nuclear plants (SQN, WBN, BFN, and BLN) were found to be adequately designed according to the applicable design criteria, with the exception of four Watts Bar pipe supports.

In summary, the negative findings resulting from the evaluation related to:

- Four (of 28 reviewed) WBN pipe supports not meeting code stress allowables
- No deflection/rigidity requirement in the BFN pipe support design criteria for the Long-Term Torus Integrity Program (LTTIP)
- Some calculation documentation incomplete or irretrievable, or containing minor discrepancies and inadequate documentation of engineering judgment

The corrective actions implemented to resolve the negative findings are:

- Reevaluate the four Watts Bar pipe supports and modify if necessary. In addition, all WBN engineered pipe supports will be reevaluated under the Hanger and Analysis Update Program
- Revise the Browns Ferry LTTIP criteria to include the deflection/rigidity requirement. The existing Browns Ferry pipe support calculations will be evaluated for this requirement under the Calculation Verification Review Program
- TVA is aware of the need to properly document calculations. Each plant has programs in place to improve the quality of documentation; e.g., WBN Hanger and Analysis Program, SQN Calculation Regeneration Program, BFN Calculation Verification Review Program, and NRC IEB 79-14 Program

No other major technical or broader issues resulted from the subcategory level evaluation.

Subcategory 22100, Pipe Support Design

This subcategory addresses 13 employee concerns about the design adequacy of pipe supports, supports with perceived inadequacies and their impact on pipe stress, use of supports that are incompatible with stress analysis, and the retention of permanent records for pipe support design calculations. Thirteen concerns were developed into 22 original and two peripheral issues and assessed in 14 separate element evaluations. Of the 24 issues, 16 were found not to be valid, and one valid issue did not require any corrective action. Five valid issues and two peripheral issues uncovered during the evaluation required corrective actions. Of the 5 valid issues, one valid issue had the corrective action implemented before the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Retention of permanent records for design check and verification (WBN)
- Adequacy of pipe support design without considering the load due to zero period acceleration (ZPA) (SQN)
- Installation of pipe support base plate grout over an expansion joint (WBN)
- Design adequacy of clamps affected by excessive torque on the clamp bolts (SQN and WBN)
- Qualification of clamps modified by welding gusset plates (WBN)
- Use of a snubber instead of a rigid support as analyzed (SQN)

The corrective actions implemented to resolve the negative findings are:

- Regenerate the destroyed and missing pipe support design calculations (WBN)
- Finalize all preliminary reviews and studies performed for ZPA (SQN)
- Incorporate notes on the pipe support I-035-569 detail drawing and issue memo to avoid recurrence of this problem (WBN)
- Revise drawing 47B001 to provide the appropriate torque value (SQN and WBN)
- Perform a plant walkdown to identify and evaluate deficient B001 type supports (SQN and WBN)
- Qualify the clamps modified by welding gusset plates (WBN)
- Remove a snubber and install a rigid support on the vertical riser of the upper head injection system (SQN)

No major technical or broader issues resulted from the subcategory level evaluation. However, regeneration of destroyed and missing pipe support design calculations is significant to documentation and cost. Although the above finding was identified for Watts Bar, preparation of pipe support design calculations currently in progress for Sequoyah confirms the existence of a condition at Sequoyah similar to that at Watts Bar. It is not known whether a similar condition exists at Browns Ferry or Bellefonte since this issue was not evaluated at these plants. However, the essential calculation program initiated by TVA is designed to address the retrievability of the essential calculations at all plants (see Subcategory 24600). Because of the significance for plant safety, TVA is required to perform a plant walkdown to evaluate deficient B001 supports at Sequoyah and Watts Bar.

Subcategory 22300. Instrument Supports Design

This subcategory addresses five employee concerns about the design and installation of instruments and instrument line support connections. The five concerns were itemized into 31 original and four peripheral issues and assessed in seven separate element evaluations. Of the 35 issues, 13 were found not to be valid, and ten valid issues had corrective actions implemented before the ECTG evaluation. Eight valid issues and the four peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Improper materials and installation methods used for instrument line supports (SQN, WBN, BFN, and BLN)
- Adequacy of instrument brackets to withstand abusive treatment (SQN and WBN)
- Lack of seismic qualification of locally mounted instruments (SQN)

The corresponding corrective actions approved to resolve the negative findings are:

- Update drawings and other related documents to more properly specify materials and installation requirements (WBN, BFN, and BLN); perform walkdowns and inspections to identify and correct discrepancies in installed items (SQN, WBN, and BLN); and replace unqualified or damaged instrument line support clamps (SQN, WBN, and BFN)
- Identify and inspect existing installations, and install stronger instrument mounting brackets where appropriate (SQN and WBN)
- Determine the seismic qualification basis for all safety-related instruments, inspect installations to verify proper details, modify supports or replace instruments to satisfy qualification requirements, update calculations to reflect as-built conditions, and document past engineering judgment (SQN)

No major technical issues emerged from the subcategory evaluation.

The broader issue of Engineering's lack of attention to the details of nuclear plant design was identified in this subcategory and raised to the category level.

Subcategory 22400. Raceway Support Design

This subcategory addresses eleven employee concerns about the design and installation of electrical raceway support. The eleven concerns were itemized into nine original and one peripheral issue and assessed in six separate element evaluations. Of the ten issues, six were found to not be valid, one issue was valid but consequences were acceptable with no

corrective action required, and two valid issues had corrective actions implemented before the ECTG evaluation. One peripheral issue uncovered during the evaluation required further corrective action to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Design of conduit support - the damping values of the design criteria are inconsistent with the FSAR. The design criteria do not require conduit support evaluation for an operating basis earthquake (OBE) load condition (WBN)

- Seismic safety of the unsupported and Flamastic-covered vertical cables in the cable spreading room (SQN)

- Lack of seismic qualification of the essential raw cooling water (ERCW) pump electrical motor boxes and installation (BLN)

The corrective actions implemented to resolve the negative findings are:

- Update the FSAR and conduit support design criteria as required to show correct conduit damping values used for both OBE and SSE load conditions. Evaluate the OBE load condition or justify its exclusion from conduit support design criteria (WBN)

- A shake table test by TVA, together with several walkdowns and subsequent evaluations performed by the evaluation team on cable anchorage at the cable spreading room ceiling, confirmed the seismic qualification of the laterally unsupported vertical cables in the cable spreading room (SQN)

- TVA's Division of Nuclear Engineering (DNE) qualified the ERCW pump electrical motor boxes and installation as seismic Category I(L) and determined that no additional supports are required for the boxes. A walkdown of the pump motor boxes and subsequent evaluation performed by the evaluation team confirmed the seismic qualification of the ERCW pump electrical motor box installation (BLN)

No major technical issues or broader issues emerged from the subcategory evaluation.

Subcategory 22500, Battery Support Design

This subcategory addresses four employee concerns about the design adequacy of battery supports. The four concerns were itemized into eight original and one peripheral issue and assessed in four separate element evaluations. Of the eight issues, six were found not to be valid, and one valid issue had corrective actions identified before the ECTG evaluation. One valid issue and the one peripheral issue uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Adequacy of battery supports to resist a seismic event (BFN) without vertical tiedowns for the batteries and with the use of Unistrut members for the battery racks

- Discrepancies between the project "critical structures, systems, and components" (CSSC) list and the FSAR. As a result of these discrepancies, it was not possible to determine directly from the available documentation which batteries are class 1E (BFN)

The corrective actions implemented to resolve the negative findings are:

- Assess the need for providing vertical tiedowns for class 1E batteries in the Reactor and Diesel Generator Buildings (BFN)

- Assess the adequacy of battery racks that support class 1E batteries to resist seismic loads (BFN)

- Revise documents to remove inconsistencies between and within the FSAR and CSSC List (BFN)

No major technical issues or broader issues were revealed as result of the subcategory evaluation.

Subcategory 22600, Seismic Interaction Design

This subcategory addresses two employee concerns about design and installation of lighting fixtures to withstand a seismic event. The two concerns were itemized into eight original and 14 peripheral issues and assessed in four separate element evaluations. Of the 20 issues, three valid issues had corrective actions implemented before the ECTG evaluation. Three valid issues and the 14 peripheral issues uncovered during the process required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Possibility of lighting fixtures becoming free missiles during a seismic event (BFN)

- Possibility of lighting fixtures becoming swinging missiles during a seismic event (SQN, WBN, BFN, and BLN)

- Resolution of plant-specific significant condition reports (SCRs) (SQN and BFN)

- Generic review of Sequoyah SCR (WBN and BLN)

- Completion of a program to describe and control seismic interaction evaluations (SQN, WBN, BFN, and BLN)

- Adequacy of existing seismic interaction evaluations (SQN)

- Resolution of inconsistencies among design documents and any impact on existing hardware (SQN, WBN, BFN, and BLN).

The corrective actions implemented to resolve the negative findings are:

- Complete the resolution of plant-specific SCRs (SQN and BFN)

- Perform a generic review of SCR SQN MEB 8610 (WBN and BLN)

- Develop a complete program to describe and control the seismic interaction evaluations for current and future design activities (SQN, WBN, and BLN)

- Finish development of a complete program to describe and control the seismic interaction evaluations for current and future design activities (BFN)

- Furnish technical basis for inspection criteria (SQN)

- Perform walkdowns, evaluations, and calculations for plant areas previously excluded (SQN)

- Review calculation CEB CAS 214 to ensure that it contains adequate written technical justification (SQN)

- Review design documents to eliminate inconsistencies and evaluate any potential hardware impact (SQN, WBN, BFN, and BLN)

No major technical issues resulted from the subcategory evaluation.

The broader issue of Engineering's lack of attention to the details of nuclear power plant design was identified in the subcategory report and raised to the category level for further evaluation.

Subcategory 22800, Unistrut Support Design

This subcategory addresses ten employee concerns about Unistrut support design. The ten concerns were itemized into 14 original and 17 peripheral issues and assessed in four separate element evaluations. Of the 31 issues, thirteen were found not to be valid. No corrective actions had been implemented for the valid issue before the ECTG evaluation. One valid original issue and the 17 peripheral issues uncovered during the evaluation required corrective actions.

In summary, the negative findings resulting from the evaluation related to:

- Errors, omissions, and discrepancies found in both test results and design calculations for Unistrut support design (SQN, WBN, BFN, and BLN)

The corrective actions implemented to resolve the negative findings are:

- Reevaluate Unistrut pipe/conduit clamp allowable loads. If necessary, retest the clamps and evaluate the effect of the revised allowable loads on conduit support designs (SQN, WBN, and BFN)

- Evaluate the adequacy of the double cantilever conduit supports. If required, perform plant walkdowns to identify as-built locations where the supports were used. Revise the drawings to restrict further use of this detail (SQN and WBN)

- Revise design calculations to include correct allowable clamp loads, correct bolt ultimate shear strengths, correct conduit spans, and address all allowed Unistrut member sizes (WBN and BLN)

- Add to design criteria an interaction equation for Unistrut pipe clamps and evaluate the effect on conduit support designs (BFN)

- Reevaluate the criteria and calculations used to qualify safety-related small bore supports, CRD insert and withdrawal piping supports, instrument tubing supports, and conduit supports (BFN)

- Determine appropriate seismic damping values for instrument tubing and conduit supports. If current values are revised, evaluate effect on support designs (BLN)

- Determine appropriate spans between supports for instrument tubing and conduit. If current span allowables are revised, evaluate effect on support designs (BLN)

No major technical issues resulted from the subcategory evaluation.

The broader issue of Engineering's lack of attention to the details of nuclear plant design was identified in this subcategory report and has been raised to the category level.

Subcategory 22900, Instrumentation and Control Design

This subcategory addresses 20 employee concerns about presumed deficiencies or inadequacies in the design of instrumentation and control systems. The 20 concerns were itemized into 50 original and five peripheral issues and assessed in 29 separate element evaluations. Of the 55 issues in this subcategory, 33 were found not to be valid, eight were found to be valid but to require no corrective action, and three valid issues had corrective

actions implemented before the ECTG evaluation. Five valid issues and six peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluations related to:

- Accuracy associated with the calculations of flow element orifice sizes (SQN, WBN, BFN, and BLN)
- Routing of potentially radioactive inventory by some panel drain piping to nonradioactive drainage systems (BFN)
- Adequacy of instrumentation for monitoring flow to the river through the cooling water diffuser (WBN)
- Availability of the control air system under postulated accident conditions (SQN)
- Discrepancies in the documentation of the acoustics monitoring system (WBN)
- Use of mercury switches in the Diesel Generator Building (BFN)
- Quantity of installed radiation detection equipment (SQN, WBN, BFN, and BLN)

The corrective actions implemented to resolve the negative findings are as follows:

- Perform loop accuracy calculations and compare results to defined safety limits (SQN, WBN, BFN, and BLN)
- Review as-built panel drawings and modify potentially radioactive panel drains as appropriate (BFN)
- Complete wiring change associated with replacement of flow transmitter (WBN)
- Modify the auxiliary control air (ACA) system to prevent loss of control of essential safety functions in the event of a high energy pipe break and a single failure (SQN)
- Revise FSAR to incorporate additional information concerning the acoustics monitoring system (WBN)
- Document justification for "use as is" or replace mercury switches in diesel generator support systems with switches containing no free mercury (BFN)

- Revise FSAR to reflect addition to postaccident monitoring (PAM) equipment to plant (SQN); revise radioactive monitoring system design documents and FSAR to eliminate inconsistencies (WBN, BLN); complete installation and checkout of PAM equipment (BFN); track open licensing issue on RG 1.97 until resolved with the NRC (BFN)

No singularly identifiable major technical issues emerged from the subcategory evaluation. The wide-spread and detailed nature of the concerns expressed precluded development of information necessary to make judgment on the synergistic effect of these minor issues.

A broader issue associated with the findings in this subcategory is the apparent failure of the TVA engineering organization to perform a design review during the design process. A well-executed design review program with follow-up action to resolve review comments should lead to fewer inconsistencies and improved design documentation, and, therefore, could be expected to eliminate many of the types of negative findings noted in this subcategory. Special emphasis of such a design review should be placed on design integration wherein the electromechanical interface is more unified and consistent with licensing/technical specification requirements.

Subcategory 23000, HVAC Design

This subcategory addresses five employee concerns about the design and testing of building environmental control systems and components, including fire dampers and ALARA considerations. The five concerns were itemized into 28 original and two peripheral issues and assessed in nine separate element evaluations. Of the 30 issues, 21 were found either to be invalid or their consequences acceptable. One valid issue had corrective actions initiated before the ECTG evaluation. Six valid issues and two peripheral issues uncovered during the evaluation required corrective actions.

In summary, the negative findings resulting from the evaluation related to:

- Detailed operating instructions for ventilation flow shutdown to ensure fire damper closure during a fire (SQN)

- Replacement of one oversized fire damper (SQN)

- Response to fire damper manufacturer's 10 CFR 21 notice regarding closure against airflow (BFN)

- Superseded fire damper locations shown in surveillance instructions, which do not agree with 10 CFR 50, Appendix R evaluation (BFN)

- Completion of the TVA recommended air handling unit (AHU) cooling coil cleaning and hardware changes to reduce maintenance and improve performance of the computer and battery room HVAC system (WBN)

- Potential habitability problems because of leakage from ducts passing through control room. (No element report investigating this concern was prepared for BFN, but a corrective action plan has been developed by TVA in response to a CATD)

- Airborne radioactivity in the Condensate Demineralizer Waste Evaporator (CDWE) Building due to changed process of radwaste treatment which was not reflected in operating instructions and may violate ALARA guidelines (SQN, WBN)

The corrective actions planned to resolve the negative findings are:

- Update operating instructions to include more specific action in case of fire (SQN)

- Install a new fire damper (SQN)

- Evaluate the installed fire dampers against latest manufacturer test with air flow to identify which dampers require administrative instructions to ensure closure. Develop appropriate operating instructions (BFN)

- Update surveillance instructions to include the fire damper locations per 10 CFR 50, Appendix R requirements (BFN)

- Clean AHU cooling coils and modify HVAC system components per TVA design study request recommendations (WBN)

- Review all HVAC ductwork that passes through the control room pressurization envelope to identify duct leakage; evaluate potential consequences of control room habitability to demonstrate compliance with the post-TMI NUREG 737.II-D.3.4 requirements (BFN)

- Revise system operating instructions to minimize airborne radioactivity and evaluate the modified piping configuration and changed process parameters for compliance with ALARA guidelines (SQN, WBN)

No major technical issues resulted from the subcategory evaluation.

The broader issues of timely resolution and communication of important problems were identified in this subcategory report. A need to improve and centralize the tracking and closure of open items was also established.

Subcategory 23100. Fire Protection Design

This subcategory addresses 11 employee concerns about fire protection system design and related compliance considerations. The 11 concerns were itemized into 36 original and five peripheral issues and assessed in 16 separate element evaluations. Of the 41 issues, three were found to be invalid. Seven of the valid issues had corrective actions implemented before the ECTG evaluation. The remaining fifteen valid issues and the five peripheral issues uncovered during the evaluation required corrective actions to be taken.

In summary, the negative findings resulting from the evaluation related to:

- Differing requirements and methods used in the fire protection sprinkler system design and modifications as regulations evolved over time (SQN, BFN; corrective action completed at WBN)

- The presence of obstructions to water spray patterns (WBN)

- Inconsistency in the engineering design criteria documents for the Main and Additional Diesel Generator Buildings (SQN and WBN)

- HVAC ducting not designed to preclude hydrogen accumulation (SQN, BLN), or testing being required to demonstrate that damper leakage precludes hydrogen accumulation (corrective action completed at WBN)

- Ambiguities in Specification G-73 with respect to fire protection quality assurance (QA) jurisdiction (SQN, WBN, BFN, BLN); incorrectly invalidating a nonconformance report (NCR) because of a lack of the identification of limited QA for the fire protection labels (BLN); and a lack of consistency in the engineering design standards which impose QA requirements on the fire protection systems (BFN)

The corrective actions implemented to resolve the negative findings are:

- Complete the program to upgrade the fire protection sprinkler system to NFPA standards and NRC guidelines (SQN, BFN: corrective action completed at WBN)

- Complete the sprinkler obstruction review program (WBN)

- Revise engineering design criteria documents to eliminate conflicting requirements for fire dampers in the Additional Diesel Generator Building (SQN and WBN)

- Revise and test HVAC ducting to preclude hydrogen accumulation (SQN, BLN; corrective action completed at WBN)

- Edit the G-73 specification to preclude misinterpretation of QA jurisdiction for fire protection (SQN, WBN, BFN, BLN); investigate possible incorrect NCRs based on incorrect identification of QA requirements (BLN), and devise cable listing procedures to identify limited QA for the fire protection system cables (BLN); resolve contradictions in the backfitting of generic limited QA requirements (BFN); and issue general design standards for limited QA for fire protection systems (BFN).

While these reviews generally found deficiencies in the TVA design process area, this is somewhat balanced by the fact that fire protection as applied to nuclear power plant design has had an awkward evolution and is not looked upon as a genuine safety system. It does not, in and of itself, constitute an unambiguous example of design process deficiencies in the TVA system. However, when coupled with related subject matter (e.g., Subcategory 23000, HVAC Design), the need for an improved interdisciplinary design integration process, as also outlined in 22900, becomes more evident.

Beyond this, no major technical or broader issues were made evident by the limited review made possible during this subcategory evaluation.

Subcategory 23300, Essential Raw Cooling Water Piping

This subcategory addresses 23 employee concerns about quality of the cement mortar lining in the essential raw cooling water (ERCW) systems piping. The 23 concerns were itemized into 11 original issues and assessed in two separate element evaluations. Of the 11 issues, seven were found not to be valid. Two of the valid issues had corrective actions implemented before the ECTG evaluation and the remaining required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Failure of the cement mortar lining installation contractor to document required inspections

- TVA quality assurance (QA) failing to identify this situation in a timely manner (WBN)

The corrective action implemented to resolve the negative findings is:

- Provide a better means for controlling contractor quality assurance activities (WBN)

No major technical or broader issues resulted from the subcategory evaluation.

The Nuclear Performance Plan (NPP) was reviewed at the subcategory level to determine if this issue was addressed by TVA. The results of the review indicate that, although no specific mention is made of the issue, significant improvements in TVA QA organization and procedures are in process.

Subcategory 24200, Electrical Separation

This subcategory addresses seven employee concerns about electrical separation deficiencies or inadequacies in the design and installation of electrical equipment, cables/wires, and components. The seven concerns were developed into 16 original issues and assessed in four separate element evaluations. Of the 16 issues, ten were found not to be valid. The six valid issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

The negative findings resulting from the evaluation related to inadequate electrical separation in installation and inadequate design basis for electrical separation.

Regarding the general issue of electrical separation adequacy, specific cases of installation nonconformances with licensing commitments or design criteria requirements were identified for all four nuclear plants (SQN, WBN, BFN, and BLN). Such nonconformances include:

- Redundant raceways not meeting minimum separation requirements, such as spatial, missing tray covers, or improper installation of tray covers (WBN, SQN, and BFN)

- Internal separation of wiring or components not meeting minimum separation requirements (spatial and missing barriers) (WBN and BFN)

- Class 1E cables incorrectly routed in non-class 1E conduits or not meeting separation requirements (BFN)

- Redundant control instrument air tubing not meeting minimum separation requirements (BLN)

- Other nonconformances either internally identified by TVA (WBN and BFN), or identified as violations by the NRC (BFN)

All four plants are committed to comply with IEEE Standards 279-1971 and 308-1971, but only BLN is committed to comply with IEEE Standard 384-1974 and Regulatory Guide 1.75-1979.

In general, physical separation and electrical isolation commitments and requirements are not fully reflected in the FSAR and design criteria. Adequate applicable criteria were not found for the following specific areas:

- Separation of cables in free air (SQN, WBN, and BFN)

- Separation of wiring and components inside boards/panels (SQN, WBN, and BLN)

- Spatial separation of vertical trays from redundant horizontal trays or, in general, spatial separation of redundant trays under angular orientations other than horizontal tray separation, vertical tray stacking, and tray crossings. (SQN, WBN, BFN, and BLN)

- Electrical isolation (SQN and WBN)

The corrective actions implemented to resolve the negative findings are combined into two groups: one group deals with the resolution of identified installation nonconformances; the other group addresses the inadequacy of design basis documents. These are further described below:

- As the first group of corrective actions, where the actual installation identified by the evaluation team does not conform with licensing requirements or design criteria, the condition will be corrected by modification or justification/analysis to satisfy the requirements. In other cases, evaluation will be performed and corrective action will be taken as needed to ensure that raceway installations and internal wiring meet the established separation criteria. A similar approach is applicable for corrective action required for conditions either identified before the evaluation team's involvement (e.g., NRC-identified conditions and routing of class 1E cables in non-Q conduits at BFN, and separation of redundant instrument air tubing not meeting the separation criteria at BLN) or where existing corrective action will cover specific items identified by the evaluation team (internal separation not meeting the separation criteria at BFN).

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

The major technical issue resulting from the subcategory evaluation relates to the incompleteness of design bases and the lack of complete documentation of commitments/requirements regarding physical separation of cables/wires and equipment.

The identified installation nonconformances, if not corrected, could result in a potentially unsafe condition from a common event, such as fire, that may affect redundant safety components. Although the identified nonconformances could have an effect on safety-related cable systems, their limited number cannot be considered uncommon for nuclear projects. Furthermore, the identified nonconformances were random in nature, and no systematic pattern could be detected that would indicate a more generalized problem in the separation program. Incomplete design basis documents or inconsistencies between these documents and licensing commitments could result in error in the separation design; however, no specific design basis nonconformances with licensing commitments were identified.

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

No broader issues were revealed as a result of the subcategory evaluation.

Subcategory 24500 - Incorporation of Requirements, Commitments, and Experience in Design

This subcategory addresses 45 employee concerns about perceived deficiencies or inadequacies in the design procedures, design criteria, and engineering documentation, as well as in the feedback of industry and TVA nuclear experience, and as-built documentation of the plant facilities configuration. The 45 concerns were itemized into 111 original and six peripheral issues and assessed in 37 separate element evaluations. Of the 117 issues, 38 were found not to be valid, and 15 valid issues had corrective actions implemented before the ECTG evaluation. Thirty-four valid issues and the six peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Some regulatory guides not addressed or not incorporated in a timely manner (SQN)

- Incomplete, inadequate, and untimely compliance with licensing commitments and some regulatory requirements (WBN)

- Inadequate evaluations and late or partially complete responses to NRC Bulletins and Notices (SQN, WBN, and BFN)

- Design Baseline and Verification Program (DBVP), which tracks licensing commitments and requirements, not yet fully implemented (SQN, WBN, and BFN)

- C/R database not yet fully complete (SQN, WBN, and BFN)

- Nonexistence of procedural requirements for updating and maintaining the commitments/requirements (C/R) database for the life of the plant (BFN)

- C/R database not yet generated (BLN)

- Some electrical and other engineering design criteria being inadequate and sometimes nonexistent (SQN, WBN, BFN and BLN)

- Applicable standards and regulatory guides not adequately referenced in design criteria (WBN)

- Some discrepancies in the existing design criteria, and some criteria listed in the Design Criteria Manual Index not issued (BLN)

- Applicable procedures not followed (SQN, WBN, BFN, and BLN)

- Inadequate TVA design standards and guides (SQN, BFN and BLN)

- Incomplete implementation of an Electrical Engineering Branch (EEB) design control process program to review all electrical design guides and design standards, and to recommend deletions, additions, and revisions (SQN, WBN, BFN, and BLN)

- Inadequate tracking of commitments and updating of licensing documents (SQN, WBN, BFN, and BLN)

- Some deficiencies in tracking TVA commitments to NRC (SQN, WBN and BFN)

- Licensing documents (FSAR) not current (SQN, WBN and BFN)

- Inadequate control of design calculations, which adversely affects traceability of design requirements (SQN, WBN, BFN, and BLN)

- Design requirements, and the basis of determining design requirements, not readily available (SQN, WBN, BFN, and BLN)

- No formal system to track and assign commitments for problems identified by NRC, INPO, or other utilities (SQN, WBN, BFN, and BLN)

- Design changes being made to one unit without timely incorporation into the other unit (WBN)

- Possible incorrect installation of unit 1 condensate pots (WBN)

The corrective actions implemented to resolve the negative findings are:

- Complete the C/R Database Program, Design Basis Program, and DBVP as applicable to the restart and post-restart phases for these programs (SQN)

- Identify and locate the source documents(s) for each C/R or designate as an open item in the WBN DBVP until fully resolved (WBN)

- Completely identify licensing commitments and develop Design Criteria/Design Bases, as well as the balance of General Design Criteria, before unit 2 restart. Complete the Design Basis Document (DBD), which is an integral part of the DBVP, before restart of the applicable units. Complete the portion of the C/R database related to each unit before each respective unit restart; maintain over the life of the plant (BFN)

- Revise engineering procedures "Identification of Licensing Commitments" and "Design Criteria/Design Bases" to require the C/R database to be maintained current and to determine if the DBD requires revision when the C/R database is revised (SQN, WBN, BFN, and BLN)

- Fully develop and issue a DBD before fuel loading of each unit. Maintain the C/R database generated for the DBD for the life of the plant (BLN)

- Develop and fully implement the DBVP, the DBD Program, and the C/R database program (WBN)

- Prepare DBD before unit 1 fuel loading; correct design criteria documents; develop and fully implement a DBVP (WBN)

- Review, revise, or generate design criteria that are identified in Sequoyah Engineering Procedure 29 as requirements for restart before restart (SQN)

- Adequately reference applicable standards and regulatory guides in the specified design criteria documents as part of the DBVP (WBN)

- Delete design criteria not required; resolve design criteria discrepancies in CATD (SQN, WBN, BFN, and BLN)

- Revise FSAR to agree with the revised design criteria; issue all revised criteria before unit 1 fuel load (BLN)

- Perform a comprehensive review of all electrical design standards and design guides; implement a program for maintaining the integrity of the standards and guides on an ongoing basis (SQN, WBN, BFN, and BLN)

- Develop and issue two ONP procedures covering the Corporate Commitment Tracking System (CCTS) before restart (SQN)

- Review and identify open and completed commitments to the NRC; verify that they are being tracked by CCTS (SQN, WBN, and BFN)

- Issue Site Director Procedure "Site Commitment Management and Tracking" onsite by October 1, 1987 (BLN)

- Revise procedures for reviewing the ECNs for the FSAR update program; verify the accuracy of the UFSAR (SQN)

- Division of Nuclear Engineering to complete as-constructed configuration control drawings (CCDs), and to incorporate changes resulting from the DBVP; update the UFSAR accordingly during the next annual update (BFN)

- ONP Policy 6.1 was issued and an ONP directive for an NER program will be issued at a later date (SQN, WBN, BFN, and BLN). Also, site procedures for an NER program were revised (SQN, WBN, BFN, and BLN). Division-level (DNSL and DNE) procedures for an NER program for all plants were issued. An NER program has been implemented as a restart item at SQN and will be implemented later at all plants.

- Complete the development of the prerestart phase of the DBVP for each unit before restart; complete the postrestart phase for each unit before the next refuel outage. Complete all DBDs by the end of August 1987 (BFN)

- Revise engineering specification to include the requirements for condensate pot installation (WBN)

- Revise engineering procedure to require a review of future ECNs to determine their possible effect on the other WBN unit (WBN)

- Issue site director and nuclear project manager procedure to implement program management procedure 0600.03 and clarify reporting requirements (WBN)

No major technical issues resulted from the subcategory evaluation. However, the evaluation team observed that the ineffective and often lacking transfer of experience data between various TVA units/plants, and reciprocal transfer of industrywide experience information with NRC, INPO, and other nuclear-based utilities, undoubtedly resulted in the repetition of design mistakes and the prolongation of numerous technical problems. In the future, more emphasis should be placed on taking full advantage of (and contributing to) the available body of industry experience in order to avoid, or detect early-on and resolve, numerous problems that are common to the entire industry.

Subcategory 24600, Design Calculations

This subcategory addresses 13 employee concerns about the adequacy and control of design calculations; inadequate management, control, and status listing of ac and dc electrical loads; and diesel generator design margin. The 13 concerns were itemized into 65 original and five peripheral issues and assessed in 15 separate element evaluations. Of the 70 issues, 18 were found not to be valid, two were found to be valid but required no corrective action, and 37 valid issues had corrective actions implemented before the ECTG evaluation. Eight valid issues and the five peripheral issues uncovered during the process required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Inadequate calculation preparation, scope, and quality (SQN, WBN, BFN, and BLN)
- Some calculations not treated as permanent plant documents; lack of adequate coordination between branches and projects (SQN, WBN, BFN, and BLN)
- A large number of calculations that TVA may have produced being informal or not retrievable or available for review (SQN, WBN, BFN, and BLN)
- Past inadequate verification/documentation of quality-related design computer codes (SQN, WBN, BFN, and BLN)
- Indeterminacy of actual electrical load margins because of inadequate preparation and control of electrical load calculations (SQN, WBN, BFN, and BLN)
- Inadequate maintenance of diesel generator loading and margin records; indeterminate adequacy of diesel generator margins (SQN, WBN, and BFN)

The corrective actions implemented to resolve the negative findings for all four plants (SQN, WBN, BFN, and BLN) are:

- Implement the essential calculation program

- Write lower-tier procedures to supplement NEPs that control calculation records; provide training in procedures

- Perform evaluation, verification, and documentation for computer programs

- Implement a long-term electrical calculation program

- Finalize and document diesel generator loading

- Complete minimum required electrical calculations to support design prior to restart (SQN and BFN)

A major technical issue resulting from the subcategory evaluation relates to the adequacy of design calculations. As an example, TVA discovered that, under certain conditions, there could be a potential overloading of the diesel generators for a design basis event. The consequence of this condition is that the margins available for the diesel generators were indeterminate for SQN and BFN while those plants were in operation. Whether they were capable of performing their design function is, therefore, also indeterminate. The corrective action to finalize and document diesel generator loading, when completed, in conjunction with the other corrective actions is expected to resolve this issue.

A second major technical issue regards inadequate verification/documentation of quality-related design computer codes where incorrect results may be generated by use of an improperly verified computer code. In addition, the computer code may be used for an application it was not intended for if proper documentation is not available (e.g., required input, basis of code, assumptions used, range of applicability, etc.). The corrective action to perform evaluation, verification, and documentation for computer programs, when completed, should resolve this issue.

No broader issues were revealed as a result of the subcategory evaluation.

Subcategory 25000, Civil/Structural Design and Pipe Whip Restraint Design

This subcategory addresses 13 employee concerns about civil/structural design subjects such as seismic criteria, cut rebar, seismic analysis of radiation shielding, roofing design, hanger loads on structures, crane service, monorail design, floor sleeve covers, and pipe whip restraint design. The 13 concerns were itemized in 34 original and eight peripheral issues and were assessed in 17 separate element evaluations. Of the 42 issues, 16 were found either to be not valid or not to require corrective action. Eighteen valid issues and the eight peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Engineering control and evaluation of cut rebar in Category I concrete structures (SQN, BFN, and BLN)
- Engineering review of loads imposed on Category I concrete structures by various component (piping, raceways, etc.) hangers (SQN, WBN, BFN, and BLN)
- Compliance of abandoned protruding floor sleeves to OSHA standards, and the adequacy of sleeve foam seals to support anticipated loads (WBN)
- Consistency among design documents relative to piping/tank interfaces (BLN)

The corrective actions implemented to resolve the negative findings are:

- Review, evaluate, and document cut rebar condition (SQN, BFN, and BLN)
- Develop/revise procedures to control rebar cuts (SQN, BFN, and BLN)
- Address NRC 1982 open items (BLN)
- Review, evaluate, and document cumulative hanger load assessments (SQN, WBN, BFN, and BLN)
- Develop/revise procedures to control hanger attachments (SQN, WBN, BFN, and BLN)
- Revise FSAR to reflect design methods used (SQN, WBN, BFN, and BLN)
- Perform worker safety evaluation of the protruding floor sleeves for compliance with OSHA standards, and do a design evaluation of the adequacy of sleeve foam seals (WBN)
- Revise a drawing and FSAR to reflect correct nozzle size (BLN)

The major technical issues resulting from the subcategory evaluation relate to the subjects of cut rebar and hanger supports. The evaluation substantiated that the cumulative effects of cut rebar on the capacity of concrete elements and the increase in load because of continuous addition of hanger supports were not adequately documented. The prime causes for these findings were judged to be a combination of inadequate communication and lack of supervisory attention to technical matters.

The corrective actions required to address these findings will result in an extensive engineering evaluation exercise based on walkdowns and/or compilation of relevant data. In addition, there is a potential for results of the evaluation to lead to hardware modifications.

The broader issue of Engineering's lack of attention to the details of nuclear plant design was identified in this subcategory report and has been raised to the category level for further evaluation.

Subcategory 25500, Support Weld Design

This subcategory addresses 22 employee concerns about pipe support weld and structural steel connection designs. These concerns were itemized into 14 issues which were assessed in 22 separate element evaluations and resulted in 35 findings (including four peripheral findings). Of the 35 findings, seven were found not to be valid and 14 valid findings had corrective actions implemented before the ECTG evaluation. Ten valid findings and the four peripheral findings uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

In summary, the negative findings resulting from the evaluation related to:

- Box anchor drawings not showing gap requirements between the rear plate and the process pipe, resulting in a possibility of the weld being fused to the process pipe and overstressing the rear plate and the process pipe (WBN, BFN, and BLN)

- Proper analysis assumptions not used to design surface-mounted plates with mixed bolted/welded connections (SQN, WBN, BFN, and BLN)

- Weld symbols not detailed properly on BLN support drawings and open to misinterpretation by Construction (BLN)

- Modified pipe clamps at WBN not qualified by proof tests or analysis (WBN)

- Weld sizes for top and bottom sides of structural tubing calculated on the basis of entire lengths (i.e., including the curved surfaces); however, Construction provided a weld for the flat lengths only (WBN)

The corrective actions implemented to resolve the negative findings are:

- Select a random sample of box anchor drawings and reinspect gaps between the rear plate and the process pipe. Qualify the weld fused to the process pipe by analytical methods or rework as required. Provide [illegible] requirements on box anchor drawings to prevent recurrence (WBN, BFN, and BLN)

- Evaluate surface-mounted base plates with mixed bolted/welded connections using the proper assumption (designing weld for entire shear load). Rework deficient base plates. Retrain personnel to prevent recurrence (SQN, WBN, BFN, and BLN)

- At BLN, verify the as-constructed welds detailed with 2-sides/3-sides symbols and review/evaluate with the weld configuration used in the design. Detail future welds as defined in AWS code (BLN)

- At WBN, review all pipe support drawings to identify the modified vendor components, including pipe clamps. Qualify or replace the modified vendor components as required. Add requirements in design criteria to qualify future modification of vendor components (WBN)

- At WBN, select a random sample of pipe support welds for structural tubing, and evaluate the adequacy of the welds by considering a flat length. Expand the sample if one or more deficient weld is discovered. Rework the deficient weld. Revise the pipe support design manual to consider only the flat length in the design for welding a tube on two opposite sides

The major technical issues resulting from the subcategory evaluation relate to the surface-mounted plates with mixed bolted/welded connection (WBN, BFN, and BLN) and modified vendor components (WBN). The main cause of these discrepancies was inadequate calculations. Evaluation of surface-mounted plates with mixed connections may result in modification/hardware changes. However, SQN has completed the corrective action for surface-mounted plates with mixed connections and observed no deficient plates. The modified pipe clamps at WBN may result in overstressing the clamp and that may require hardware changes.

The broader issues of design process effectiveness and management effectiveness were identified in the subcategory report.

Subcategory 26000, Flushing and Piping Valve Design

This subcategory addresses 18 employee concerns about a presumed deficiency or inadequacy in the design and construction of the plant fluid systems. The 18 concerns were itemized into 39 original and three peripheral issues and assessed in 16 separate element evaluations. Of the 42 issues, 25 were found not to be valid, and three valid issues had corrective actions implemented before the ECTG evaluation. One valid issue and the three peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation. Ten issues were characterized as valid; however, the consequences were deemed acceptable.

In summary, the negative findings resulting from this evaluation related to:

- Some drainage piping attachments installed at Watts Bar and at Sequoyah not conforming to design documents (SQN and WBN)

- Piping calculations at Browns Ferry using a less conservative formula than that required by the applicable code to determine pipe wall thickness (BFN)

- Judgment bases not documented for relocating a personnel security station in the vicinity of high energy piping (WBN)

- Air handling unit drainage piping ice plugging – operational problems normally expected to be encountered and solved during commissioning (SQN)

The corrective actions implemented to resolve the negative findings are:

- Replace noncomplying floor drainage system components (SQN and WBN)

- Review piping calculations to ascertain code compliance regarding minimum pipe wall (BFN)

- Conduct risk assessment analysis regarding steam operator blowdown piping movements (WBN)

- Provide adequate insulation of air handling unit condensate drainage piping (SQN)

No major technical issues were identified. Issues of a broader nature could not be developed because of the wide spread of the concerns expressed and their individually specific context.

Subcategory 26500, Electrical Safety and Systems Design

This subcategory addresses 27 employee concerns about equipment access, electrical safety, electrical protection design, and cable terminations and splices. The 27 concerns were developed into 111 original and eight peripheral issues and assessed in 55 separate element evaluations. Of the 119 issues, 35 were found not to be valid, and ten valid issues had corrective actions implemented before the ECTG evaluation. Sixty-six valid issues and the eight peripheral findings uncovered during the evaluation required corrective actions to be taken as a result.

The negative findings resulting from the evaluation are summarized below; they apply to the plants as noted:

- Mating plugs of receptacles not documented in the Master Bill of Material (SQN)

- Cable entries to motor control centers (MCCs) not properly sealed (WBN and BFN)

- PVC jacketed flexible conduits not environmentally qualified used in harsh environments (SQN, WBN, and BFN)

- TVA follow-up action (NRC IEB 80-20) regarding Westinghouse type W-2 switch malfunction and misleading indication not complete (SQN and WBN)

- Compliance with Regulatory Guide 1.106 for motor-operated valve (MOV) circuits not addressed in design basis documents. Discrepancies exist in the associated design input and output documents (SQN, WBN, BFN, and BLN)

- Torque switch bypass for MOV circuits not addressed in design basis and design output documents (SQN, WBN, BFN, and BLN)

- MCC circuit breakers for motor branch circuits unacceptably selected or set for circuit protection. Design basis documents do not cover the design of protection and the level of compliance with the National Electrical Code for motors less than 1/2 horsepower (SQN, WBN, BFN, and BLN)

- MCC motor circuit power fuses not properly selected and documented (SQN, WBN, and BFN)

- Possibility of current transformer (CT) failure and resulting explosion because of gassing of high voltage, oil-filled, free-standing CTs. This would affect the availability of preferred offsite power (SQN, WBN, BFN, and BLN)

- Incomplete documentation to determine adequacy of cable splices installed in manholes and preventive maintenance of manholes (SQN, WBN, BFN, and BLN)

- Improper crimp-type lugs on solid conductors (SQN, WBN, and BFN)

- Improper installation of Amphenol connectors in stand-by diesel generator circuits (WBN and BFN)

- Potential deficiencies identified regarding qualification and EQ-documentation of containment electrical penetrations (WBN and BFN)

The corrective actions identified to resolve the negative findings are:

- Master Bill of Materials was revised to specify acceptable mating plugs (SQN)

- WBN has completed and BFN will complete cable entry sealing (WBN and BFN)

- SQN has completed an analysis to justify the use of PVC jacketed flexible conduit. WBN has verified that PVC jacketed flexible conduit is not required to be qualified because it is not taken into account in beta radiation reduction. BFN will complete qualification documentation (SQN, WBN, and BFN)

- Before restart, SQN will: (1) identify all safety related W-2 switches; (2) review each application; (3) advise operators; and (4) revise drawings. After restart, SQN will: (1) update the response to NRC Bulletin 80-20; (2) ensure that all W-2 switch circuits are identified and modified; and (3) prevent recurrence of the problem. WBN's action will be similar to SQN's (SQN and WBN)

- Update the FSAR and indicate in design basis documents the method of compliance with Regulatory Guide 1.106. Make the valve list consistent with the Technical Specification (SQN, WBN, BFN, and BLN)

- Revise standard drawings and issue design basis documents (SQN, WBN, BFN, and BLN)

- Prepare calculations and revise the applicable design standard and design guide to provide criteria; clarify conformance with the National Electrical Code (SQN, WBN, BFN, and BLN)

- Document the adequacy of fuses used in power circuits for valves (SQN, WBN, and BFN)

- Complete the CT monitoring program and evaluate replacement of the subject CTs (SQN, WBN, BFN, and BLN)

- Verify the adequacy of cable splices, provide records of splices, document materials, and identify all splices and their locations (SQN, WBN, BFN, and BLN)

- Rework the terminal lugs on solid conductors and perform walkdown inspections (SQN, WBN, and BFN)

- Investigate reasons for the looseness of connections, possible deficiencies in design or procurement requirements; document any deficiencies found in a Condition Adverse to Quality Report (WBN and BFN)

- Complete the inspection of unit 2 penetrations at WBN. At BFN, replace the Physical Science Corp. penetrations in safety-related service and include unit 1 and 3 penetrations in the EQ program (WBN and BFN)

The major technical issues resulting from the subcategory evaluation relate to weaknesses of various design bases and the lack of proper documentation of commitments/requirements and design outputs. The findings and their corrective actions require improvements in design basis, design process, and licensing.

The lack of clear documentation that the PVC jacketed conduits are qualified for the harsh environment raises questions as to whether the safety-related components served can perform to mitigate potential accidents. The lack of clear demonstration that

motor-operated valves have the proper thermal overload protection and torque switch bypass design indicates that there is a potential for more than one valve of different safety-related systems to fail to operate properly for accident mitigation. Improperly selected circuit breakers and fuses create the potential for losing more than one safety-related power system and its loads. The problem of the Westinghouse type W-2 switch malfunctions was created by improper design changes made to address NRC IE Bulletin 80-20. Plant modifications were not well documented to confirm that commitments to the NRC have been met, indicating weakness in the organization of tracking NRC commitments. Problems in the cable termination and splicing areas could affect more than one safety-related system's performance during normal and abnormal plant operations.

A number of broader issues emerged from a collective review of this subcategory. TVA's fragmented organization, which did not have clear lines of responsibility, authority, and accountability, led to lack of effective control and monitoring of the electrical discipline design process, inability to identify problems and to implement timely and effective corrective action, and ineffective response to licensing issues. However, the TVA CNPP addresses all of these broader issues through the restructuring of TVA's organization and the implementation of a number of specific programs (such as Design Basis and Verification, Engineering Assurance, Corporate Commitment Tracking System, Management Information System) that should correct the performance deficiencies. The implementation of the Calculation Cross Reference Information System (CCRIS) by DNE will improve the design coordination between the four DNE technical branches.

Subcategory 26600, Raceway and Cable System Design

This subcategory addresses 48 employee concerns about raceway and cable system design. The 48 concerns were developed into 55 original and six peripheral issues and assessed in 14 separate element evaluations. Of the 61 issues, 16 were found not to be valid, three were valid but the consequences were acceptable without need for corrective action, and three valid issues had corrective actions implemented before the ECTG evaluation. Thirty-three valid issues and the six peripheral issues uncovered during the evaluation required corrective actions to be taken as a result of the ECTG evaluation.

The negative findings resulting from the evaluation are summarized below; they apply to all four nuclear plants (SQN, WBN, BFN, and BLN) except where noted:

- Uncertain raceway fill status because unverified cable data were used

- Inadequate justification of ampacities for instrumentation and control (I&C) cables in 60-percent filled trays; inconsistencies between the FSAR and design standards for conduit fill

- Calculation of cable pulling tensions for most cable installations without consideration for sidewall pressure, thereby increasing the possibility of undetected cable damage. Early procedures written to avoid excessive cable sidewall pressure during cable installation were not followed

- Wall and floor cable tray penetrations not tested or analyzed to establish their effectiveness as firestops and pressure seals under overfilled conditions

- Computerized cable routing programs not adequately verified to ensure performance of their intended function of divisional and voltage separation, calculation of raceway fill, rejection of erroneous input, and rejection of cable routes in overfilled raceways

- Lack of adequate feedback from Construction, resulting in inaccurate cable lengths being used in electrical calculations

- No procedures to track deleted or abandoned cables

- Present records incomplete for status verification of manually routed cables at BFN units 1 and 2

- Deficiency in both the cable routing programs and the Engineering-Construction Monitoring and Documentation (ECM&D) programs in the areas of security, controlling documentation for system maintenance, documenting revisions, and program usage procedures

- ECM&D programs used at WBN and BFN not properly verified; therefore, the adequacy of the cables as installed cannot be determined through the use of the ECM&D program

- Cable deratings for cable tray covers, coating compounds, and Appendix R to 10 CFR 50 firewrap not addressed; effects of abandoned cables and cable bundling on ampacity not covered in the design documents

- No specific requirements for evaluation of ampacity in overfilled raceways (WBN, SQN, and BFN)

- At some plants, primarily BFN where IEEE Standard-383 qualified cables were not used for installation, many cables were coated with fireproofing material thicker than the 1/4 inch stated in design documents. Excessive coating can lead to cable overheating and insulation failure before the end of the design life is reached

The corrective actions identified to resolve the negative findings are:

- Analyze computerized cable routing system program (SQN). Revise FSAR regarding maximum allowable conduit fill (SQN, BFN). Obtain NRC concurrence on sidewall pressure questions and cable failure trend program (SQN, WBN). Resolution of the cable damage problem at SQN will provide the basis for resolving the problem at the other plants.

- Correct and verify computer-generated fill data (WBN). Verify installed cable weights (WBN). Provide raceway fill status and QA-level cable data (BFN). Revise procedure WBEP-EP43.13 to include control for raceway fill (WBN, BFN). Address cable tray penetration pressure seals/firestops as part of existing corrective action for cable trays (WBN).

- Enter cable survey data into the computer tray fill tracking system for future use. Determine effectiveness of firestops for overfilled trays. Justify limited review of tray supports (SQN).

- Implement software QA plan, create test file to verify the output of the computer program, and reload computer data after program verification (SQN, WBN, BFN). Prohibit increase of raceway fill limits in computer program without approval (SQN, BFN, WBN). Modify and verify the ECM&D program (WBN, BLN).

- Evaluate cable derating in overfilled trays and analyze effect of cable bundling (SQN). Review ampacity standards against thermolag tests and establish ampacities for trays in firestops (SQN, WBN, BFN, BLN). Perform sampling program to verify cable ampacities (WBN, SQN).

The major technical issue resulting from the subcategory evaluation relates to uncertainties about the adequacy of the raceway and cable system design. TVA's corrective actions include several evaluations, inspections, and analyses that could result in hardware changes. When these corrective actions have been completed, they will resolve questions of potential raceway overfills, cable routing, undetected cable damage, and/or ampacity problems. The safety significance of the potential changes can then be determined. Raceway overfill could lead to cable tray support failure and, possibly, a common mode failure during a seismic event. Undetected cable damage could lead to a common mode failure if the damage causes redundant cables to fail during exposure to harsh environments such as might occur during an accident. Finally, improper cable ampacity could invalidate cable qualification and lead to premature and unexpected cable failure.

The broader issue of the lack of an integrated TVA program for the design and design control of raceway and cable systems is being addressed by TVA's Corrective Action Plan, which states that a program will be initiated to establish engineering and design controls for management of all cable design implementation at SQN, WBN, BFN, and BLN.

Furthermore, implementation of a Branch Chiefs' design review process and the establishment of the Engineering Assurance organization are expected to support TVA's effort to monitor effectively the technical aspects of Engineering's performance.

Proper implementation of TVA's Corrective Action Plans and closeout of any follow-up actions that may be identified by the defined corrective actions are expected to eliminate the potential for common mode failure.

APPENDIX D
SUMMARY OF MAJOR TVA NUCLEAR PROGRAMS TO CORRECT PAST WEAKNESSES AND DEFICIENCIES

This appendix summarizes seven of the most significant programs to correct the majority of the weaknesses and deficiencies in the nuclear engineering design process. These programs referenced in the Engineering Category Report are:

1. Design Baseline and Verification Program (DBVP)
2. Design Basis Document Program (DBD)
3. Essential Calculation Program (ECP)
4. Commitment/Requirements Data Base (C/RDB)
5. Corporate Commitment Tracking System (CCTS)
6. Nuclear Experience Review Program (NER)
7. Engineering-Construction Monitoring and Documentation Program (ECM&D)

At Watts Bar the Design Basis Document Program and the Commitment/Requirements Data Base are part of the Design Baseline and Verification Program.

1. Design Baseline and Verification Program (DBVP)

TVA's Office of Nuclear Power (ONP) has committed in the Nuclear Performance Plans (NPPs) to replace its two-drawing system ("as-designed" and "as-constructed") with a single drawing system under the control of the Division of Nuclear Engineering (DNE) at each of its nuclear plant sites. This change is intended to prevent the recurrence of problems experienced in the past with discrepanices between drawings and actual plant configuration.

The Division of Nuclear Engineering (DNE) has developed and is implementing Design Baseline and Verification Programs (DBVP) at SQN, WBN, and BFN to ensure that drawings for safety systems within the scope of the respective programs reflect the actual plant configuration and reconcile the actual system configurations with the design basis and licensing commitments. The plant construction has not been completed at BLN, thus the implementation of a single drawing system is intended to maintain control of plant configuration and compliance with the design basis and licensing commitments.

The DBVPs at SQN and BFN are being implemented to revise a defined scope of drawings to match the actual plant configuration and to reconcile these drawings to related engineering documentation in a two-phase program, i.e., prerestart and postrestart for each unit. In this program, the flow diagrams, electrical single line diagrams, schematics, and control diagrams used in the control room (control room drawings) depicting the systems, or portions of systems, required to mitigate design basis events and to provide for safe shutdown of the plant will be updated in the PRERESTART phase. The POSTRESTART phase will include implementation of the modifications not required for restart, completion and revision of the design criteria documentation, completion of other safety systems evaluations not required for restart, and implementation of corrective actions to the other safety systems, as required, and formal revision of control room drawings (i.e., configuration control drawings).

The DBVP at WBN is being implemented to verify that the WBN unit 1 construction satisfies licensing commitments and that unit 1 is ready for power operation. The former "as-designed" and "as-constructed" drawings will be merged into baseline drawings for nuclear safety-related systems.

2. Design Basis Document (DBD) Program

A Design Basis Document (DBD) program has also been established and is now being implemented at Sequoyah. The DBD development concept is a top-down approach in which commitments made in generic upper tier design input documents, commitments made in licensing documents, design requirements, TVA policies, and existing design criteria must be captured in either plant-specific design criteria or other design input documents. These design criteria must include, as a minimum, those general design criteria for site, plant, structures, and systems which constitute the DBD. Note that the design criteria required to be prepared prior to Sequoyah restart will be limited to those systems or portions of systems identified by SQN-0SG7-048.

The DBD constitutes a design input document that is commitment-driven. The development requires a combination of senior engineers and managers, who are familiar with the design evolution, to research the documents and identify the plant design requirements and commitments; and experienced working level engineers to prepare or revise the design criteria documents while ensuring that these design requirements and commitments are captured. The Project Engineer (PE) will accept and adopt this collection of design criteria documents along with the mechanical flow diagrams, functional control and logic diagrams, single line diagrams, the site plan and plot plan, and the general arrangement drawings as the DBD for the plant. The drawings will be the latest revision of the Configuration Control Drawing (CCD), if available, or the latest revision of the As-Constructed (AC) drawing if the CCD is not available.

The DBD provides, over the life of the plant, the basis against which possible future plant modifications are evaluated.

3. Essential Calculation Program

Each discipline branch's essential calculation program is slightly different, depending on the time it was begun, the unique nature of the calculations, the total number of calculations, schedules and resources, and other factors. However, the basic requirements of the TVA Essential Calculation Program are the same for each engineering discipline branch (NEB, MEB, EEB, and CEB):

- List all calculations and identify each as essential, desirable, or superseded
- Essential calculations are those required to support safety systems used for safe shutdown of the plant
- Desirable calculations are those appropriate for plant reliability, availability, and economic operation.
- The review of desirable calculations is not within the scope of the Essential Calculation Program
- The list of essential calculations is to be evaluated, independently reviewed, and refined into a final list
- The final list is then to be approved by TVA management (each discipline Branch Chief)
- Essential calculations are then to be retrieved and reviewed for technical adequacy, revised as needed, and reissued
- Reviews for technical adequacy and revisions to calculations may be delegated to outside contractors; however, the responsibility for adequacy rests with the engineering discipline branches
- Any essential calculations that cannot be retrieved must be regenerated
- Regeneration of calculations may be delegated to outside contractors; however, the responsibility for adequacy rests with the engineering discipline branches
- Essential calculations must be maintained current over the life of each plant
- Implementation of this program is to be monitored and audited as required by Engineering Assurance (EA)

4. **Commitment/Requirements Data Base Program (C/RDB)**

This program identifies commitments and requirements as source information for each plant's design criteria development. The following excerpts from the Sequoyah procedure describe its key points:

"This procedure establishes a systematic approach to identify the licensing commitments and other design requirements which should be captured and reflected in design documents. The scope includes both safety-related and nonsafety-related systems, structures, and components."

"A Licensing Commitment is an action related to the design, construction, operation or testing of a TVA nuclear plant that has been communicated to an organization authorized to regulate TVA activities."

"A Design Requirement is any technical requirement or internal TVA commitment which is essential for the safe or reliable operation of a nuclear plant."

"The concept used is a top-down approach in which commitments made in generic upper tier design input documents, commitments made in licensing documents, design requirements, TVA policies, and existing design criteria must be captured in either plant-specific design criteria or other design input documents."

"The program requires senior engineers and managers who are familiar with the design evaluation to research the applicable source documents and identify the plant design requirements and commitments. [These reviewers] . . . complete a commitment/requirements (C/R) data sheet for each licensing commitment or design requirement identified in accordance. . . [with the procedure. This information is then entered into the database.]"

"The program establishes a database containing the commitments/ requirements to be initially incorporated into the design criteria. The database will then be turned over to the project and maintained throughout the life of the plant."

"A continuous review of new source documents (e.g., Change Documents, Vendor letters, Correspondences, System Design files, Job Books, etc.) for commitments/requirements will be done by the Responsible Engineer/personnel who deal with the various source documents."

5. **Corporate Commitment Tracking System (CCTS)**

When a commitment that has a significant effect on DNE's scope of work, responsibilities, licensing, and safety is made to NRC or another regulatory body, the commitment will be tracked to closure by the Corporate Commitment Tracking System (CCTS).

The commitment is controlled and monitored by the Project Engineer/Lead Nuclear Engineer. Procedures outline how licensing commitments made to the NRC are identified, controlled, and tracked to completion.

The following excerpt is from the TVA Corporate NPP (CNPP):

> "TVA has had a nuclear licensing group at its corporate headquarters for a number of years, and it also has licensing groups at each of its nuclear plant locations which were essentially independent of the headquarters group. . . ."

Because this has contributed to weaknesses in TVA's licensing activities, TVA has committed in the CNPP to centralize these activities under a single director who reports directly to the Manager of Nuclear Power.

6. Nuclear Experience Review Program (NER)

In October 1980, the NRC issued NUREG-0737, "Clarification of TMI Action Plan Requirements." In Task Action Plan I.C.5, which only addresses feedback of operating experience to operators, the NRC requires that:

> "Each applicant for an operating license shall prepare procedures to assure that operating information pertinent to plant safety originating both within and outside the utility organization is continually supplied to operators and other personnel and is incorporated into training and retraining programs."

In the Corporate Nuclear Performance Plan (CNPP), TVA describes a Nuclear Experience Review (NER) program where:

> "Licensing personnel, under the direction of the Director of Nuclear Safety and Licensing, will be responsible for managing the TVA Nuclear Operating Experience Review program system for internally and externally identified problems or events. Under this system, significant problems or events identified at other nuclear plants by the NRC, INPO, NSSS vendors, and others, and significant problems (events) identified at TVA's nuclear plants will be made the subject of experience review reports."

At Sequoyah, the site responsibilities for the NER program are further described in the Nuclear Performance Plan, Volume II, Sequoyah, as follows:

> "The Site Nuclear Operating Experience Review Program (NOERP) has been established as part of the TVA Corporate Program managed by Nuclear Safety and Licensing. The site licensing organization will establish procedures to implement and interface with the corporate NOERP to:

- Receive information into the site NOERP and disseminate that information to the appropriate departments responsible for operations, training, engineering, and other plant activities.

- Ensure that recommendations from external site organizations are factored into the appropriate department programs.

- Ensure Inspection and Enforcement (IE) Bulletins and Generic Letters are reviewed from both a regulatory and an experience review point because of their dual role.

- Implement an in-house experience review program to communicate significant site operational events, maintenance and design problems to other TVA plants and the industry through corporate NOERP."

In Revision 1 of the CNPP, this Program is listed as commitment item No. 21 with completion required before restart of the Sequoyah plant. This commitment is also shown in the Corporate Commitment Tracking System (CCTS) as commitment No. NCO 860156109 and as a restart item.

In conjunction with this NER program, the CNPP also commits to establishing a corporate nuclear operation experience database that will provide a management tool and TVA-wide access to all experience review items. This commitment is listed as commitment item No. 22 but the due date is shown as long term. The CCTS control number for this commitment is NCO 860156 063.

7. **Engineering-Construction Monitoring and Documentation Program (ECM&D)**

The Engineering-Construction Monitoring and Documentation (ECM&D) computer program used by the Office of Construction was developed to permit accurate monitoring and documenting of defined engineering and construction activities. This program accesses the engineering design data files to establish the design portion of the ECM&D master file. All construction- related information is entered by construction into the ECM&D file. Information relating to the printing of pull slips and the completion of cable terminations is transferred into the engineering computer file. All other construction inputted data are maintained in the ECM&D computer file.

APPENDIX E

CATD LIST

The following CATD forms are included as part of this report:

20000-NPS-01 (see Subsection 3.3.1)
20000-NPS-02 (see Subsection 3.3.2)
20000-NPS-03 (see Subsection 3.3.3)

ECTG Corrective Action Tracking Document (CATD)

INITIATION Applicable ECTG Report No.: 20000 - Engineering Category

1. Immediate Corrective Action Required: ☐ Yes ☐ No
2. Stop Work Recommended: ☐ Yes ☐ No
3. CATD No. 20000-MPS-01 4. INITIATION DATE 11/20/87
5. RESPONSIBLE ORGANIZATION:
6. PROBLEM DESCRIPTION: ☐ QR ☐ NQR See Page E-3

☐ ATTACHMENTS

7. PREPARED BY: NAME DATE: 11/20/87
8. CONCURRENCE: CEG-N DATE:
9. APPROVAL: ECTG PROGRAM MGR. DATE:

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN:

☐ ATTACHMENTS

11. PROPOSED BY: DIRECTOR/MGR: DATE:
12. CONCURRENCE: CEG-N: DATE:
ECTG PROGRAM MANAGER DATE:

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

0686T

Attachment to
ECTG Report 20000
CATD 20000-NPS-01 of 11/20/87

Implementation of NEP-5.2, "Review," is not complete nor fully effective at this time. The following items need to be addressed (CATD 20000 NPS 01):

- Design verification is not yet fully effective as demonstrated by continued difficulties in completing technically sound corrective actions.
- Means for line management to measure improvements in the quality of design output are not in place.
- Systematic interfaces or system reviews are not yet scoped, scheduled, or proceduralized.
- Scope and methodology of operation and maintenance data reviews are not available.
- Technical review branch instructions are not yet issued in EEB, CEB, and NEB. Planning and scheduling of technical reviews have not been completed in any of the branches.

ECTS Corrective Action Tracking Document (CATD)

INITIATION Applicable ECTS Report No.: 20000 - Engineering Category

1. Immediate Corrective Action Required: ☐ Yes ☐ No
2. Stop Work Recommended: ☐ Yes ☐ No
3. CATD No. 20000-NPS-02
4. INITIATION DATE 11/20/87
5. RESPONSIBLE ORGANIZATION:
6. PROBLEM DESCRIPTION: ☐ QR ☐ NQR See Page E-5

☐ ATTACHMENTS

7. PREPARED BY: NAME DATE: 11/20/87
8. CONCURRENCE: CEG-H DATE:
9. APPROVAL: ECTS PROGRAM MGR. DATE:

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN:

☐ ATTACHMENTS

11. PROPOSED BY: DIRECTOR/MGR: DATE:
12. CONCURRENCE: CEG-H: DATE:
ECTS PROGRAM MANAGER DATE:

VERIFICATION AND CLOSEOUT

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

0686T

Attachment to
ECTG Report 20000
CATD 20000-NPS-02 of 11/20/87

Difficulties experienced by TVA working-level engineers in adequately performing their design activities within schedule constraints indicate that TVA corporate guidelines and goals regarding planning have not been fully implemented. Resource constraints and conflicting priorities have not been balanced against commitment dates.

ECTG Corrective Action Tracking Document (CATD)

INITIATION Applicable ECTG Report No.: 20000 - Engineering Category

1. Immediate Corrective Action Required: ☐ Yes ☐ No
2. Stop Work Recommended: ☐ Yes ☐ No
3. CATD No. 20000-NPS-03 4. INITIATION DATE 11/20/87
5. RESPONSIBLE ORGANIZATION:
6. PROBLEM DESCRIPTION: ☐ QR ☐ NQR See Page E-7

☐ ATTACHMENTS

7. PREPARED BY: NAME DATE: 11/20/87
8. CONCURRENCE: CEG-H DATE:
9. APPROVAL: ECTG PROGRAM MGR. DATE:

CORRECTIVE ACTION

10. PROPOSED CORRECTIVE ACTION PLAN:

☐ ATTACHMENTS

11. PROPOSED BY: DIRECTOR/MGR: DATE:
12. CONCURRENCE: CEG-H: DATE:
ECTG PROGRAM MANAGER DATE:

VERIFICATION AND CLOSURE

13. Approved corrective actions have been verified as satisfactorily implemented.

SIGNATURE TITLE DATE

0686T

Attachment to
ECTG Report 20000
CATD 20000-NPS-03 of 11/20/87

No method currently exists by which TVA ONP management can measure shifts in employees' attitudes toward quality and management effectiveness.