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LIST OF ABBREVIATIONS

AFW	Auxiliary Feedwater
CAQ	Condition Adverse to Quality
CAQR	Condition Adverse to Quality Report
CCP	Centrifugal Charging Pump
CCRIS	Calculation Cross Reference Information System
CCS	Component Cooling Water System
CEB	Civil Engineering Branch
DBVP	Design Baseline and Verification Program
DNE	Division of Nuclear Engineering
EA	Engineering Assurance
ECN	Engineering Change Notice
EEB	Electrical Engineering Branch
ERCW	Essential Raw Cooling Water System
FSAR	Final Safety Analysis Report
G/C	Gilbert/Commonwealth
HVAC	Heating, Ventilation, and Air Conditioning
LOCA	Loss of Coolant Accident
MEB	Mechanical Engineering Branch
NEB	Nuclear Engineering Branch
NEP	Nuclear Engineering Procedure
NRC	Nuclear Regulatory Commission
PIR	Problem Identification Report
QIR	Quality Information Report
RIMS	Records Information Management System
RLCA	R. L. Cloud Associates
SCR	Significant Condition Report
SQEP	Sequoyah Engineering Procedure
SQN	Sequoyah Nuclear Plant
TVA	Tennessee Valley Authority
USQD	Unreviewed Safety Question Determination

SEQUOYAH NUCLEAR POWER PLANT

Design Calculation Review Program
Inspection Report 50-327/87-64 & 50-328/87-64
October 26-30, 1987

1. INTRODUCTION AND BACKGROUND

The design calculation review program was developed by the Division of Nuclear Engineering (DNE) because past audit findings and other reviews have shown that the design basis for TVA's nuclear power plants have not been adequately documented by supporting calculations or that such calculations, if performed, may no longer be retrievable. This program augmented the Sequoyah Nuclear Plant (SQN) design baseline and verification program (DBVP) by including a technical adequacy review of supporting calculations, a feature not included in the DBVP.

TVA established an electrical calculation program to correct various problems with electrical calculations identified first by INPO in 1985 and later confirmed through NRC, Gilbert/Commonwealth and DNE audits. This program was later expanded to other engineering branches. The Electric Engineering Branch (EEB) used the services of Sargent and Lundy to help review the existing calculations and to establish a new calculation program. This program was developed to address identified problems such as inadequate documentation, inadequate control, and out-of-date and missing calculations.

Short-term program objectives were to define a minimum set of essential calculations required to support the SQN design bases; then establish procedures and guidelines to generate, control, revise, and maintain the essential calculations to support the restart of SQN Unit 2. Long-term objectives are to generate, verify, control, revise and maintain all nonessential and essential calculations and procedures in the post-restart period and to train TVA personnel regarding the procedures and policies needed to meet the long-term objectives.

The NRC conducted two previous inspections of the design calculation review program and documented the results of these inspections in reports 327, 328/87-06, and 327, 328/87-27 (References 10 and 18)*. TVA has responded to the observations identified in these reports (references 4, 20, and 21).

2. PURPOSE

The purpose of this inspection was to review TVA's corrective actions associated with their in-house calculation review program. Regarding the calculation review program, this inspection principally addressed closeout of previous inspection findings, although some effort was made to assess the status of the program and associated Engineering Assurance (EA) technical review.

The team also reviewed TVA corrective actions associated with NRC observations documented in previous NRC design control inspection reports, including previous inspections of the DBVP.

*References are listed in Section C.2 of Appendix C

3. RESULTS OF NRC INSPECTION

The following paragraphs characterize the team findings and conclusions in each discipline. The inspection results detailing the team's review of licensee action on previous inspection findings for the design calculation review and the DBVP are provided in report Appendices A and B, respectively.

The team found that TVA had completed the calculation review program for the most part in the Electrical, Mechanical, and Nuclear Engineering Branches. The adequacy of the Civil Engineering Branch calculation review program remains an open issue which will be further evaluated by the NRC Office of Special Projects.

The team also noted that the EA technical review of the calculation review program remained an active effort, and appeared to have enhanced the quality of the program efforts.

3.1 MECHANICAL ENGINEERING BRANCH

Reference 19 describes the calculation review effort being conducted by the Mechanical Engineering Branch (MEB). The program includes a review for missing calculations and a review of all calculations for technical adequacy. This effort determined that there were 111 missing calculations. These have been regenerated. MEB conducted a technical adequacy review of 77 calculations and contracted with Stone & Webster Engineering Corporation to conduct a technical adequacy review of the remaining MEB calculations, including the 111 regenerated missing calculations. TVA reported (Reference 19) 13 unacceptable calculations in the sample of 77. Five unacceptable calculations were identified in the remaining MEB calculations reviewed by Stone & Webster (Task Completion Report SQTCR 008-1, Revision 0). These have subsequently been revised. The team was informed that there was no effect on hardware except for possible effects in heating, ventilation, and air conditioning (HVAC), which was still under evaluation during the inspection.

During team discussions with EA regarding the EA technical review, the inspection team was informed that EA inspected 19 MEB calculations and that EA was satisfied with the technical adequacy in this sample. Follow-up EA activity will be through scheduled programmatic audits of MEB.

The inspection team determined that MEB's plan to review for missing calculations and conduct a review of all calculations for technical adequacy was complete; that unacceptable calculations have been corrected and reissued; and that exception sheets have been issued for the 13 remaining unverified assumptions, which have been dispositioned as post-restart and scheduled for confirmation. The team considered that TVA action to address closure of NRC Observations MEB-8 and MEB-10, discussed in Attachment A, was required prior to restart.

3.2 NUCLEAR ENGINEERING BRANCH

Reference 19 describes the Nuclear Engineering Branch (NEB) calculation review effort. It is similar to the MEB effort and includes a review for missing calculations and review of all essential NEB calculations. The inspection team determined that there were four missing calculations. These have been regenerated. The technical adequacy review covered 492 calculations, including 395 essential calculations. There were 30 unacceptable calculations, 21 of which were essential. These were corrected without any effect on hardware.

The inspection team determined that EA inspected 21 NEB calculations and that EA was satisfied with the technical adequacy in this sample. Follow-up EA activity will be through scheduled programmatic audits of NEB.

The team determined that NEB's calculation review program was completed with no remaining pre-restart corrective actions.

3.3 ELECTRIC ENGINEERING BRANCH

Electrical Engineering Branch (EEB) identified 576 essential calculations during the conduct of the calculation review program. All calculations had been regenerated except several that related to cable installations, class 1E timer accuracies, instrument accuracies and justification of contact to contact isolation between 1E and non-1E circuits. Work was in progress to complete the remaining calculations, update existing calculations (which included addressing the impact of DBVP and NRC inspection findings), confirm the validity of unverified assumptions and revise calculations for ongoing design changes.

A portion of TVA instrumentation and control calculations are assigned to the EEB. These safety-related calculations include instrument loop setpoint accuracy determinations for environmental qualification purposes and the recent inclusion of time delay relay setpoints. A number of instrument setpoint accuracy calculations reviewed by the team used an acceptable methodology and were considered satisfactory. No time delay relay calculations were available for review during the inspections; however, there should be no technical difficulty in performing these calculations in an adequate manner. A large portion of these time delay relay setpoint calculations will be completed pre-restart. The team agreed with each of TVA's post-restart decisions for certain time delay setpoint calculations.

A number of safety-related process setpoint calculations for balance of plant instrument loops have been performed by NEB and MEB. The team determined that several such calculations performed by NEB were technically adequate. During this inspection, considerable improvement was noted for setpoint calculations performed by MEB. As a result, TVA's establishment of such process setpoint values was considered technically adequate by the team.

The team also discussed with the EA oversight group those instrumentation and control calculation problems that had been identified by EA during their technical reviews of the calculation review program. In each instance, corrective actions taken by TVA were satisfactory to EA. The team concurred with EA's assessment and individual resolutions.

During this inspection, the team found that the EA technical review findings had been resolved by EEB and that the necessary corrective actions had either been implemented or agreed to between EEB and the auditors. This work will be completed before restart. During the inspection the team found some calculations had been revised and other calculation revisions were in progress.

3.4 CIVIL ENGINEERING BRANCH

3.4.1 Rigorous Piping Analysis and Pipe Supports

The Civil Engineering Branch (CEB) calculation review program in the rigorous piping analysis area was originally based on the recommendations for corrective action contained in CEB summary report "Evaluation of Programs Establishing Technical Adequacy of the Civil Calculations," dated January 30, 1987 (RIMS No. B41 870130 013).

In response to the recommendations contained in that report, CEB retained Gilbert/Commonwealth (G/C) to select and reanalyze five rigorous piping analyses to assess the adequacy of CEB's analyses of record for these piping subsystems. G/C summarized the results of their review in Report No. 2689 "Sequoyah Unit 2 Rigorous Analysis Review," dated May 13, 1987 [records information management system (RIMS) No. B41 870519 250]. The report confirmed the technical adequacy of CEB's five rigorous piping analyses with respect to Sequoyah Nuclear Plant's licensing commitments and design criteria, but identified numerous technical issues. CEB then asked R.L. Cloud Associates (RLCA) to review the generic implications of G/C's findings. RLCA provided a first draft of their evaluation in Report No. P154/03/87/001 "Initial Assessment of an Independent Contractor Review of SQN Unit 2 Rigorous Piping Analysis," dated May 19, 1987.

CEB concurrently evaluated G/C's findings and documented that review in CEB Report No. 2689, "Sequoyah Unit 2 Rigorous Analysis Review/ Preliminary TVA - Response to Gilbert/Commonwealth," dated May 28, 1987.

TVA docketed the interim status of CEB's corrective action program in the rigorous piping analysis area in a submittal to the NRC (Reference 19), which contained CEB Report No. CEB-87-07, "Sequoyah Nuclear Plant - Civil Engineering - Technical Adequacy Report," dated June 1, 1987. On September 1, 1987, TVA presented the criteria which CEB is using to regenerate pipe support calculations to the NRC (Meeting Summary dated September 4, 1987). However, during the week of October 26, 1987, the team was unable to confirm the details of CEB's evaluation of the conclusions and recommendations contained in the final issues of the RLCA and TVA reports.

CEB's pipe support calculation regeneration program had regenerated 4,165 of 5,804 pipe support calculations by October 29, 1987, with the remaining 1,639 pipe support calculations to be regenerated before restart of Sequoyah Unit 2. The NRC's Office of Special Projects is overviewing TVA's corrective actions for CEB's calculation review programs, therefore activities during this inspection were limited to assessing the status of completion of CEB's calculation review program.

EA's technical review of the calculation review program in the rigorous piping analysis area are documented in Audit 87-09 (Technical), "DNE Calculation Review Effort Audit Report," dated February 10, 1987, and a followup EA Audit 87-09 (Technical), "DNE Calculation Review Effort Evaluation of Responses for Deficiencies 87-09-01 through 87-09-06 and Response to the Identified Concerns," dated April 24, 1987.

In addition to the reviews which EA documented in audit 87-09(T) and the followup to that audit, EA also reviewed several pipe support calculations which the DBVP identified as missing and which CEB regenerated as part of CEB's pipe support calculation regeneration program. The results of EA's review were documented in the "Supplemental Engineering Assurance Oversight Review Report/SQN Unit 2/DBVP," dated September 29, 1987.

As an additional followup to audit 87-09(T), EA reviewed 26 pipe support calculations during the period September 14 - October 6, 1987 that had recently been regenerated as part of CEB's pipe support calculation regeneration program. During the inspection EA indicated that a draft report summarizing the results of EA's review was in progress.

During discussion with the team, EA stated that they would review the planned CEB report which evaluates the conclusions and recommendations of the RLCA and TVA reports (addressing potential generic deficiencies in the rigorous piping analysis area).

3.4.2 Civil/Structural

In the civil/structural area, the team concentrated its effort on reviewing TVA corrective actions associated with previous NRC inspection findings (See Appendices A and B). The team also held meetings with CEB and EA engineers to obtain information on the status of the calculation efforts for the Sequoyah Nuclear Plant.

During a team meeting on October 26, 1987, CEB stated that there are 1740 essential calculations in the civil/structural area. Of these, 346 calculations were missing. As of the inspection, 146 missing calculations had been regenerated. Twenty-four remain to be generated before restart and 76 to be generated after restart. CEB is also continuing their efforts on technical adequacy reviews performed for miscellaneous structural steel and conduit and HVAC duct supports. At the time of the NRC inspection, TVA had not reached a conclusion on the overall technical adequacy of the civil/structural calculations.

The team also met with TVA EA to determine whether they are performing inspections on the technical adequacy evaluations performed by CEB. EA has advised the NRC team that in the civil/structural area EA was waiting the outcome of the integrated design inspection recently conducted by the NRC to determine a plan of action for their review. At the the time of this NRC inspection, EA was not performing any reviews on the technical adequacy evaluations in the civil/structural area.

The NRC's Office of Special Projects is overviewing TVA's corrective actions for CEB's calculation review programs, therefore activities during this

inspection were limited to assessing the status of completion of CEB's calculation review program.

4. OBSERVATIONS FROM DESIGN CALCULATION REVIEW PROGRAM INSPECTIONS

Specific findings of individual NRC discipline inspectors were categorized as "observations." These observations elaborated on the general comments stated in the inspection reports and in some cases provide additional comments not considered to be of a general nature. TVA actions relating to individual observations were reviewed by the NRC. Individual observations were closed on the basis these reviews and TVA's responses, as appropriate. Selected items, noted as confirmatory items, remain open pending TVA confirmation that the indicated action has been completed.

Results of these reviews by the NRC team are provided in Appendix A of this report.

5. REVIEW OF PREVIOUS DBVP INSPECTION FINDINGS

The team consisted of individuals who had previously participated in a series of design control inspections of TVA's DBVP for SQN. The team reviewed TVA's responses to the deficiencies, unresolved items, and observations documented in the following previous NRC inspections associated with the DBVP:

- 50-327/86-27 and 50-328/86-27
- 50-327/86-38 and 50-328/86-38
- 50-327/86-45 and 50-328/86-45
- 50-327/86-55 and 50-328/86-55
- 50-327/87-14 and 50-328/87-14
- 50-327/87-31 and 50-328/87-31

Details about that review can be found in Appendix B to this inspection report.

6. MEETING SUMMARIES - REFERENCES

A summary of the meetings held during the inspection and a list of references related to the series of design control inspections are provided in Appendix C.

Appendix A

LICENSEE ACTION FOR PREVIOUS CALCULATION REVIEW PROGRAM INSPECTION FINDINGS

Report No. 87-06

(Closed) Observation GEN-1 - Substantiated Condition for a CAQ

This item addressed a team concern with proposed revisions to the DNE corrective action procedure.

The team reviewed Nuclear Engineering Procedure (NEP) 9.1, "Corrective Action," Revision 2, dated June 30, 1987. NEP 9.1 was issued with a revised definition of a condition adverse to quality (CAQ). The new definition states:

> Conditions Adverse to Quality (CAQs)
>
> Adverse conditions within the scope of the Office of Nuclear Power Quality Assurance and limited Quality Assurance programs including nonconforming material, parts or components; failures; malfunctions; deficiencies; deviations; hardware problems involving noncompliance with licensing commitments, specifications, or drawing requirements; abnormal occurrences; and nonhardware problems such as failure to comply with the operating license, technical specifications, licensing commitments, procedures, instructions, or regulations.

A statement that unsubstantiated conditions are not defined as CAQ's, which was in the definition contained in the Nuclear Quality Assurance Manual, was not incorporated in the NEP 9.1 definition.

Revision 2 of NEP 9.1 also provided for implementation of a Problem Identification Report (PIR) system within DNE to document problems and potential problems that are not CAQs. Project engineers, branches, and DNE staff organizations are directed (procedure section 1.1.1) to implement a PIR system to handle non-CAQs that previously would have been handled with an NEP 9.1, Revision 0, PIR. Attachment 10 of procedure NEP 9.1 provides a form for handling PIRs.

The team noted that Sequoyah Engineering Project has implemented a PIR process through Sequoyah Engineering Procedure (SQEP) 61, "Handling of Conditions Adverse to Quality Reports (CAQRs) and Problem Identification Reports (PIRs)," Revision 0, dated February 23, 1987. The team reviewed SQEP 61, noting that the SQN project had in fact implemented a PIR process in advance of DNE direction requiring such a process.

These actions adequately address the concerns noted by the team; therefore, this observation is closed.

(Open) Observation MEB-3 - Water Hammer

Observation MEB-3 noted, in part, that CEB had not formally documented an evaluation of the main feedwater system piping at Sequoyah Nuclear Plant with respect to water hammer forces arising from a postulated line break in the turbine building. TVA had not justified not issuing the feedwater water hammer

analysis when it was identified by engineering as a licensing commitment. During the inspection, CEB was still reviewing the main feedwater system with respect to the water hammer loads, and stated that they would provide the NRC with a revised response to Observation MEB-3 when this review has been completed. Observation MEB-3 will be forwarded to the NRC's Office of Special Projects for review and disposition.

(Open) Observation MEB-6 - Component Cooling Water System Design Pressure

During this inspection period the team re-reviewed the recalculation of the component cooling water system (CCS) design pressure (B44 870320 003) and determined that it did not adequately address design pressure for some of the reasons noted previously in References 10 and 18. After further discussions with TVA, the team determined that a satisfactory resolution should include the following attributes:

1. A design pressure calculation based on:

   (a) a static head produced by the surge tank water level at the high end of the normal level control range,

   (b) the lowest pump flow (highest total dynamic head) that can occur for any normal operating mode of the CCS, and

   (c) the lowest expected operating coolant temperature.

2. TVA should show by calculation that CCS pressure variations meet the requirements of Paragraph 102.2.4 of the Power Piping Code B31.1.0-1967. The team considered that events such as closure of the normal surge tank vent and increase in surge tank pressure to its relief valve setpoint plus accumulation can be considered pressure variations provided the event meets the spirit of the phrase "occasional periods of operation for short periods" contained in B31.1.0-1967 and is not permitted to be a normal mode of operation.

3. TVA should conduct a review to determine if all components meet the calculated design pressure.

The team noted that the final safety analysis report (FSAR) presently states that pump shutoff head is used to calculate design pressure of the CCS. In the event that TVA intends to take credit in its design pressure calculation for a greater flow and less total dynamic head than that associated with pump shutoff, then the FSAR should be revised and the Office of Special Projects notified before restart of TVA's intent to revise this portion of the FSAR.

This observation remains open pending a confirmatory letter from TVA. The team considered that these actions should be completed prior to restart.

(Closed) Observation MEB-8 - Inconsistent Equipment Qualification Temperature

The team reviewed a recent TVA calculation (RIMS No. B44 870716 007) that shows a calculated peak temperature that is in agreement with the plant's

environmental data sheet peak temperature of 110°F for the turbine driven auxiliary feedwater pump location. Therefore, the observation has been closed.

(Closed) Observation MEB-9 - Unverified Heat Load Inputs

This item had been left open during the previous calculation inspection (Reference 18) pending verification of the regenerated calculations by EA. The team reviewed a letter detailing EA followup review (Capozzi to Chandley, RIMS No. B05 871016 004). EA has verified that the calculations were complete, issued and were all included in the Stone & Webster Engineering Corporation technical adequacy review Task Completion Report SQTCR.008-1, Revision 0.

(Closed) Observation NEB-1 - Emergency CCS Pump Net Positive Suction Head

The team reviewed calculations and analysis that address the three parts of this observation:

1. Crane Wall Penetration Seals. The observation noted that operability of the emergency core cooling systems (ECCS) requires maintenance of water inventory in the containment sump. In the sump level calculations, TVA had assumed the crane wall electrical and mechanical penetrations below the 693 feet elevation were sealed and did not allow leakage of sump water. Recent calculations (B45 871026 426) show that, even for a catastrophic failure of foam seals, sump water levels remain above both small and large break loss of coolant accident (LOCA) safety limits.

2. Small break LOCA Sump Water Temperature. The observation noted that the temperature assumed for the small break LOCA calculation, 190°F, may not be conservative since less ice melt would occur. More recent analysis contained in QIR MEB82272 (RIMS No. B45 870826 259) showed that containment spray will always be actuated prior to switchover of the low pressure safety injection pumps to the sump and that temperatures will be approximately 105°F at time of switchover. Factors limiting the sump to less than 190°F include reduced decay heat at switchover and the capacity of the RHR and containment spray heat exchangers to remove decay heat.

3. NUKON Insulation. The observation expressed a concern that NUKON insulation used on pressurizer loop seals and debris from unqualified coatings could cause block of the sump screens and that the 30% blockage factor assumed in the calculations was unverified. Subsequently, excerpts from a proprietary report from Westinghouse Electric Corporation, WCAP-11534, dealing with screen blockage by dislodged NUKON insulation and coatings, were reviewed by the team. The report concluded that adequate net positive suction head will be maintained.

Based on the adequacy of the information made available to the inspection team during this inspection period, the observation has been closed.

(Closed) Observation EEB-1 - Battery and Charger Sizing

The team noted several errors in the battery and the charger sizing calculation, such as failure to address in-rush currents, worst case loading and margins for load changes due to design modifications. The installed capacity of the system was found to be lower than the calculated capacity. TVA tried to

justify a lower capacity for the installed system by changing battery end of life from 80 to 89%. The team found that this limitation was not communicated to the operations department, nor was it included in the appropriate sections of the FSAR and technical specifications. TVA addressed this observation by taking the following steps.

TVA has revised calculation SQN-CPS-004 (Revision 2) using Sargent and Lundy's computerized calculation software program "Electrical Load Monitoring System Direct Current" (No. ECB 77). TVA informed the team that this software is based on IEEE-485 guidelines. However, because the software is proprietary TVA relied upon Sargent and Lundy for software quality assurance and did not perform an in-house (TVA) quality assurance review.

The team reviewed the revised calculation, which used an inverter loading of 17.5 kva (versus nameplate rating of 20 kva), motor in-rush currents, and worst case loading of the dc system. The calculated required size of the batteries was found to be the same as the installed size. This made the team's concerns regarding FSAR and technical specification changes moot. However, the team was concerned that any changes in the values of parameters used in the calculation, such as loading of the inverters beyond 17.5 kva, lowering of the operating temperature of the battery room, increase in other loads due to design changes, human errors, equipment failures or poor maintenance may render the installed capacity inadequate. TVA informed the team that adequate administrative procedures are in place to guard against the possibilities described by the team. In addition, TVA has developed procedures to revise battery and charger sizing calculations for any future design changes. TVA informed the team that since the inverter loading is administratively limited to 15 kva and the inverter loading used for the calculation is 17.5 kva, each battery (having two inverters connected to it) has 5 kva excess capacity. The team agrees that TVA's administrative controls will adequately handle future design changes and therefore considers this observation closed.

(Open) Observation EEB-2 - Breaker Coordination

This observation was related to an error in the corrective action taken by TVA to resolve breaker coordination problems for the 480 V diesel generator and essential raw cooling water (ERCW) system boards. TVA informed the team that the error would have been identified during field implementation of the corrective action. Engineering Change Notice (ECN)-L6883 was issued to correct the coordination problem. The team noted that this ECN describes the proper corrective action and that the ECN is scheduled to be completed post-restart of Unit 2. The team reviewed the impact of post-restart completion and noted that the loss of one board will not impact the plant safe shutdown capacity; therefore, completion of the corrective actions after restart of Unit 2 is acceptable. The team considers this observation open pending a CCTS commitment to complete the corrective action.

(Closed) Observation EEB-3 - 120 V AC and DC Solenoid Voltage

This observation related to inadequacies of voltage drop calculation SQN-CPS-001, which did not address effects of harsh environment temperatures on field cable resistance, added resistance due to extra cable lengths for certain field located junction boxes, and extra lengths of cable associated

with the "pig tails" of electric conduit seal assemblies. The calculation was also inconsistent regarding location and description of unverified assumptions.

TVA has resolved this concern by addressing all the above items in the revised calculation (Revision 9). The team reviewed the revised calculation and found it acceptable. In addition, TVA retrained personnel regarding the requirements of Nuclear Engineering Procedure 3.1, "Calculations," relating to unverified assumptions. The above actions by TVA were considered acceptable by the team, therefore, this item is considered to be closed.

(Open) Observation CEB-2 - Structural Steel Sizing Calculations

(Open) Observation CEB-3 - Structural Steel Details

(Open) Observation CEB-4 - Platform Steel Calculations and Drawings

(Open) Observation CEB-5 - Revisions to Steel Platform Calculations

(Open) Observation CEB-6 - Seismic Loads for Steel Platforms

Observations CEB-2 through CEB-6 raised various concerns about the structural adequacy of the steel platforms at the Sequoyah Nuclear Plant. In order to account for these concerns, TVA has revised significant condition report (SCR) SQN 8711 to require reanalysis for various platforms.

To determine the structural adequacy of platforms, CEB selected six platforms to be reanalyzed. Three of these platforms were located in the auxiliary building. The other three were selected from the reactor building. All platforms were walked down to obtain as-built information, which was later used in the computer reanalysis. The team reviewed TVA calculations (RIMS No. B25 870926 805) which contained the reanalysis of the auxiliary building platform at elevation 724'-3". The team agreed with the TVA approach to determine structural adequacy of the platforms with the following exceptions:

(1) TVA used 0.0 pounds per square foot live load in the reanalysis of the steel platform when combined with seismic loads. The team considers that TVA should issue an administrative control procedure that prohibits live load, other than foot traffic, on such platforms during plant operation.

(2) TVA qualified certain connections by torsional tests performed on connections at TVA's Singleton Materials Engineering Laboratory. These tests were extensive in nature and only partially reviewed by the team (RIMS No. B46 870904 001). Since these tests are not standard tests and are not covered in the AISC code, the team considered that TVA should ensure that the test results are valid, for example, by having an independent review of the testing performed.

(3) TVA concluded that the bending stresses in one beam exceeded the FSAR stress limits. The team stated that TVA should seek approval from the NRC before restart for those cases where the FSAR stress requirements would be exceeded.

These actions are considered confirmatory items.

As a part of the corrective action for SCR SQN CEB8711, TVA also performed walkdowns on five randomly selected miscellaneous steel features and five structural steel elements. These walkdowns were performed to determine whether there were any configuration changes or attachment loads that were not considered in the original design. The walkdown of the five miscellaneous steel features did not identify any significant attachments or any configuration differences. The walkdown of the five structural steel elements showed that two elements, the auxiliary and control building roof framing, had some attachment loads. Reanalysis of these elements by TVA has shown that they are adequate to carry the attachments. The conclusions reached by TVA on miscellaneous steel and structural steel walkdowns were acceptable to the team.

(Closed) Observation CEB-11 - Pipe Rupture Evaluation for Concrete

The team's review of CEB calculation PWP 840920 705 showed that concrete and reinforcing steel allowable stresses were exceeded for pipe rupture loads without any technical justification. In response to this observation CEB issued CAQR SQP870183 and performed a finite element analysis of the slab in question to show that it is structurally adequate to withstand the pipe rupture loads. The TVA calculation (RIMS No. B25 870519 300) that contains this analysis was reviewed by the team and found to be acceptable.

As part of the generic implications of this observation, TVA reviewed the 47E235- series environmental drawings and determined that certain areas had differential pressure loads of up to 1.4 psig. This review is documented in a TVA calculation (RIMS No. B25 870821 490). CAQR SQF870151 was written to evaluate those areas which were found to be affected by these pressures. This evaluation (RIMS No. B25 870831 463) showed that these elements are structurally adequate to carry the pressure loads. The team reviewed this calculation and found the results acceptable. The team considers this observation to be closed.

Report No. 87-27

(Open) Observation MEB-10 - Loss of Station AC Power Calculation

This observation concerned lack of a calculation or other basis which substantiated the adequacy of HVAC during a loss of station ac power. TVA's submitted response (Reference 20) was considered inadequate by the team. During the inspection, TVA acknowledged a commitment to maintain hot shutdown following a loss of station ac power for a two-hour period. The licensee stated that this capability is achieved by adequate vital battery capacity and operation of the turbine driven auxiliary feedwater pumps and associated valves. The team reviewed an analysis and HVAC calculations (RIMS No. B44 870716 007) demonstrating adequate turbine driven auxiliary feedwater pump capability during the two-hour period of loss of ac power. The team considered these actions adequate; however, this item was left open pending submittal of a revised response to the NRC documenting these actions.

(Closed) Observation NEB-2 - Wide Range Containment Pressure Transmitter

TVA calculation SQN NAL4-002, Revision 6, stated that containment wide range pressure transmitters PT-30-310 and PT-30-311 had a range of -5 to +60 psig, an

accuracy of +/- 10.98 psig, and did not have a use specified in plant emergency procedures. The items remaining to be resolved during this inspection were: (1) the required instrument accuracy; (2) use of these transmitters in plant emergency procedures, and (3) their possible replacement with more accurate instruments.

An internal TVA memorandum (RIMS No. B45 870904 255) stated that the required accuracy determination and the use of these instruments in operating procedures would be established post-restart. Since the wide range transmitters were identified in both NUREG-0737 and NRC Regulatory Guide 1.97 Revision 2, and TVA's commitment to implement Regulation Guide 1.97 is after restart, the team agreed with this post-restart categorization. The team was also informed that the search for an improved transmitter would continue. During the inspection on October 29, 1987, the post-restart action items for these transmitters were entered into the TVA Corporate Commitment Tracking System. Hence, this item is closed.

(Closed) Observation EEB-6 - Turbine AFW Time Delay Relay Setpoint

This item identified an automatic auxiliary feedwater (AFW) pump start time delay in excess of design criteria requirements.

CAQR SQF 870086 (RIMS No. B05 870605 306) was initiated in June 1987 to address this issue. The CAQR proposed changing relay R5 to be a 25 second maximum time delay rather than 60 seconds. This relay in the turbine-driven AFW logic controls the steam supply switchover from steam generator 1 to 4. AFW design criteria SQN-DC-V-13.9.8 and FSAR section 15.2.8.1 required that AFW flow be provided to at least two intact steam generators within 60 seconds following a loss of normal feedwater flow. This time delay value was chosen to avoid inadvertent lifting of main steam safety and relief valves during operational transients.

In October 1987, CAQR SQF 870086 was revised to justify continued use of the 60 second R5 time delay relay. However, the team observed that this CAQR revision did not identify that the existing plant relay setpoint was in conflict with requirements stated in both the design criteria document and the FSAR. TVA subsequently revised the CAQR to identify the post-restart changes needed in the design criteria and the FSAR. The overall time interval for valve movement and time delay relay operation is approximately 95 seconds, rather then the 60 seconds stated in the FSAR. Because total loss of AFW for 10 minutes has been accepted, as stated in the FSAR feedwater line break analysis, the team agreed with TVA that the documentation changes could be accomplished post-restart.

(Open) Observation EEB-7 - HVAC Temperature and Flow Process Safety Limits

The team had noted that a TVA calculation (RIMS No. B44 860819 004) did not establish process safety limits for HVAC temperature and flow safety-related measurements. TVA subsequently issued a completely new HVAC setpoint calculation (SQN-30/31-D053-FSG-WVC-080887) that did provide both setpoint values and process safety limits for these measurements. This new calculation established the setpoint value at 90 percent of the process safety limit, rather than the previous calculation setpoint value of 50 percent, and should provide an

earlier indication to the plant operator of HVAC fan failure or performance degradation.

For the fifth vital battery room heater control (0-TC-31-498 and -499), TVA determined a 71°F increasing setpoint with a lower process safety limit of 40°F. This latter value was taken from the environmental qualification document, but the team noted that it is in conflict with another TVA calculation (SQN-CPS-004 revision 4), where a minimum battery room temperature of 60°F was stated for battery operability. Since the lower process safety limit is really 60°F the team considered that the calculation should be revised to show this minimum value.

(Closed) Observation EEB-8 - Setpoint Accuracies for HVAC Temperature and Flow Instruments

The previous MEB calculation for HVAC setpoint accuracies (RIMS No. B44 860819 004) had numerous inconsistencies for instrument ranges relative to 40°F minimum and 104°F maximum temperature limits. This calculation has been superseded by calculation SQN-30/31-D053-FSG-WVC-080887 (RIMS No. B44 871015 006), which corrected each of the observed discrepancies. Hence, this item is closed.

(Open) Observation EEB-9 - Containment Electrical Penetration Overcurrent Protection

SCR-SQN-EEB-8676 identified a concern regarding continuous overcurrent trip settings that were used to protect the circuits of containment penetration assemblies Nos. 52 and 53. The conductor size used for these electrical penetrations was No. 12 American wire gage. The calculated maximum allowed current through these conductors is 16 amperes, in accordance with IEEE-317-1983.

TVA selected the next larger available trip setting of 20 amperes, which will allow the 16 ampere continuous current to be exceeded without the excess current being detected in the 16 to 20 ampere range. The team felt that the allowed current, in excess of 16 amperes, may result in reduction in the life and/or leak sealing capacity of the penetration assembly. TVA performed calculations using vendor's test data to prove that these penetrations can carry 33.3 amperes safely without raising conductor temperature to 90°C. The team reviewed this calculation and noted that value of the ambient temperature at the penetration assemblies was incorrectly assumed to be 71°F. The team noted that the maximum ambient temperature was 120°F, as shown on environment drawings, Chapter 3 of the FSAR, and the vendor report. Further TVA's calculation did not address the increase in conductor resistance and therefore, heat generation that arises from increases in penetration operating temperature. The team performed alternate calculations using the manufacturer's temperature of 194°F (90°C). The team calculated that the maximum allowable current will be above 25 amperes. On this basis the team does not consider resolution to be required prior to restart.

Although this calculated value for the maximum current was greater than the 20 amperes setting of the breaker, the team still questioned the licensee's approach because it did not correctly address temperature effects. The team considered that TVA should revise the calculation to address the correct

ambient and changes in the resistance of the conductor due to changes in temperature, including an assessment of heat dissipation which considers factors such as the geometry of the penetration assembly and HVAC. The team closed this item for inspection purposes. If TVA's revised calculation indicates that the allowable current is less than 20 amperes, the Office of Special Projects should be informed. This item will be kept open pending a Corporate Commitment Tracking System commitment to revise the calculation. This revision need not be completed prior to restart.

(Open) Observation EEB-10 - Pump Start Time Delay Relay Setpoint Calculations

The team had previously identified that no time delay setpoint calculations had been prepared by TVA for both the 15 to 25 second and 0.5 second time delay relays used in pump start circuits for the ERCW, CCS, and AFW systems. TVA has subsequently revised procedure PM 86-02, "Method For Electrical Calculations," to specifically list a time delay relay category in the set of required calculations. In addition, TVA has identified 38 specific time delay relay applications requiring setpoint calculations, and has designated 12 of these as post-restart. The team reviewed each of these 12 post-restart applications, and independently concluded that TVA's designation was correct. As a result, the technical aspects of this issue have been satisfactorily resolved. This item remains open pending TVA correspondence confirming entry of these post-restart calculations into the TVA Corporate Commitment Tracking System.

(Open) Observation EEB-11 - Component Cooling System Setpoint Coordination

CCS flow alarm accuracy values were discussed between EEB and MEB, but justifications for selecting particular values were not documented in an MEB calculation (RIMS No. B44 870602 001). TVA has subsequently stated that the flow alarm setpoints are not essential for safe shutdown of the plant; consequently, TVA plans to complete demonstrated accuracy calculations for these alarm setpoints post-restart. The team agrees with the technical aspects of this planned action; however, this item remains open pending confirmation by TVA that the commitment to accomplish the accuracy calculations has been entered in the CCTS.

(Open) Observation CEB-13 - Regenerated CEB Pipe Support Calculations

Observation CEB-13 noted that CEB's calculation for pipe support H10-635 demonstrated that the pipe support failed when friction forces were considered, but CEB did not document this deficiency on the calculation cover sheet or in the CAQR which CEB subsequently prepared. In addition, the CEB calculation for pipe support H10-1219 did not include a thermal check of the pipe support, but CEB did not note this as an unverified assumption on the calculation cover sheet or on CEB's pipe support calculation log. During this inspection the team noted that Bechtel had regenerated the calculation for pipe support H10-635, and was regenerating the calculation for pipe support H10-1219. Regeneration of essential pipe support calculations is required before restart of SQN-2. Observation CEB-13 remains open until TVA issues the calculation to qualify pipe support H10-1219 and provides the NRC with a letter confirming completion of corrective actions.

(Closed) Observation CEB-14 - Engineering Assurance Acceptance of CEB's Corrective Action Program for Rigorously Analyzed Pipe Supports

Observation CEB-14 indicated that Engineering Assurance (EA) acceptance of CEB's program to identify and regenerate missing pipe supports was premature. This was because CEB had not addressed the generic implications of the findings from CEB's design verification of 201 of the 791 pipe support calculations which the DBVP identified as missing and which CEB regenerated. TVA's response to Observation CEB-14 noted, in part, that EA would review any significant changes to the pipe support regeneration program, and would overview CEB's implementation of the program. The team confirmed that EA has had responsibility to review and approve the following Civil Engineering Branch instructions, which formed the basis for CEB's pipe support calculation regeneration program:

(1) CEB-CI 21.80, "Program Plan for Calculation Regeneration of Pipe Supports on Rigorously Analyzed Category I Piping - Sequoyah 2," Revision 1, dated August 28, 1987

(2) CEB-DI 21.81, "Generation and Control of Rigorous Analysis Problem Connectivity Diagrams for Category I Piping: Sequoyah 2," Revision 1, dated August 28, 1987

(3) CEB-DI 21.83, "Functional Verification of Supports for Rigorously Analyzed Category I Piping: Sequoyah 2," Revision 2, dated August 28, 1987

(4) CEB-DI 21.85, "Generation of Pipe Support Design Data: Sequoyah 2," Revision 1, dated September 4, 1987

(5) CEB-DI 21.87, "Review and Regeneration of Calculations for Supports on Rigorously Analyzed Category I Piping: Sequoyah 2," Revision 1, dated September 4, 1987

(6) CEB-CI 21.88, "Control of Input and Output from the SQN Hanger Tracking Subprogram of Calculation Cross Reference Information System," Revision 0, dated July 15, 1987

(7) CEB-CI 21.89, "Modification Priorities for Pipe Supports on Rigorously Analyzed Category I Piping - Sequoyah Unit 2," Revision 0, dated August 28, 1987

As indicated by the above, EA has maintained an active oversight role in monitoring the corrective action program for rigorously analyzed pipe supports. Observation CEB-14 is closed.

(Closed) Observation GEN-3 - Unverified Assumptions

This observation addressed the team's concern that no administrative program or procedures were in place that delineated the requirements for verification of unverified assumptions in TVA's calculation program. TVA informed the team verbally during previous inspections that all unverified assumptions contained in "essential restart" calculations for SQN will be verified before the plant would be restarted.

TVA informed the team that a program for verification of unverified assumptions was initiated on June 5, 1987. This program is in accordance with Nuclear Engineering Procedure (NEP) -3.1 and uses a computerized DNE master

log implemented by the Calculation Cross Reference Information System (CCRIS). The team reviewed Revision 1 of NEP-3.1, noting that section 4.1.1 of this procedure directs the lead discipline engineer and assistant branch chief to track calculations containing assumptions (requiring later confirmation) through the CCRIS or a calculation log. For SQN Unit 2 calculations, all disciplines were directed by the Manager of Nuclear Engineering to resolve all unverified assumptions by August 31, 1987. TVA informed the team that NEP-3.1 programmatic controls will be revised to include requirements for timely closure of unverified assumptions. The team noted that each discipline had already developed their own tracking program for tracking unverified assumptions. The team found these measures taken by TVA acceptable. Therefore, this observation was closed.

(Open) Observation CEB-15 - Technical Adequacy of Miscellaneous Structural Steel

Initially, CEB reviewed 54 features to determine the technical adequacy of miscellaneous structural steel at Sequoyah Nuclear Plant. Considering the findings of this review, the team was concerned that this initial sample size was not large enough to represent the total population of miscellaneous structural steel.

In order to resolve this observation, TVA increased their sample size to review 38 more missing calculations which were recently generated. TVA will also select 60 equipment support calculations, which will be reviewed to determine whether the appropriate vendor loads have been utilized in the design. TVA stated that this effort would be completed by November 30, 1987.

The team did not perform a technical review of this effort by TVA. However, the conversations held by TVA engineers showed that TVA is preparing an interim acceptance criteria which would be used to qualify miscellaneous structural steel items. The team stated that any interim criteria which deviates from the committed FSAR structural steel stress limits should be submitted to the NRC for review and approval.

Although the team agrees with the sample size which TVA selected to determine the technical adequacy of miscellaneous structural steel, this item will be kept open pending a confirmatory letter documenting completion of this effort. The team considered that work relating to this observation should be completed prior to restart.

(Open) Observation CEB-16 - Conduit and HVAC Duct Support Calculations

CEB's review of recently regenerated calculations (five conduit and four HVAC duct support calculations), identified numerous discrepancies between the calculations and the associated design criteria. TVA performed this review as part of their technical adequacy review of CEB calculations. The team reviewed the CEB findings and concluded that the regenerated calculations lacked complete and adequate analysis. Also, the contract personnel used to regenerate these calculations were apparently not fully aware of the applicable CEB design criteria and TVA standard practices.

In order to resolve the technical issues raised by the TVA findings, TVA has written CAQRs SQT870626 and SQT870843 to perform evaluations of the design of

conduit supports, HVAC ducts and HVAC duct supports. During the NRC inspection, this effort was still ongoing for the HVAC ducts and duct supports. Team meetings with TVA engineers revealed that certain allowable stresses (as stated in Sequoyah design criteria SQN DC-V-13.10), were exceeded for conduits and clamps. The team stated that any interim criteria that deviates from FSAR requirements should be submitted to NRC for review and approval.

Regarding contractor efforts, CEB issued instruction CI-21.53 (RIMS No. B41 870916 007) which clarifies the duties and responsibilities of each TVA or contractor designer in the development of design calculations. CEB also has sent each employee a memorandum emphasizing the need to improve the quality of CEB calculations. This observation remains open pending completion of TVA work on HVAC duct and duct supports, and review by NRC Office of Special Projects.

Appendix B

LICENSEE ACTION FOR PREVIOUS DBVP INSPECTION FINDINGS

The team reviewed the corrective actions taken by TVA to resolve the open deficiencies and observations identified in NRC inspection report Nos. 50-327 and 50-328/86-27, 86-38, 86-45, 86-55, 87-14, and 87-31, which examined the DBVP. Correspondence associated with these findings, including TVA responses, are tabulated in Attachment C. The following are the team's comments on these items.

Report No. 86-27

(Open) Deficiency D4.3-3 - Steam Generator Access Platform Design

The initial NRC inspection identified that the steam generator lower supports were not evaluated for permanently attached platform loads added by an ECN. During the walkdown of these supports to determine platform loads, TVA identified additional pipe supports that were attached to these steam generator supports which were not accounted for in the original design.

Westinghouse has recently completed a reevaluation of these supports using the walkdown information to show that the supports are structurally adequate to carry the additional loads (B45 861219 601). The attachments of these supports to concrete were reanalyzed by TVA using the load information obtained from the Westinghouse evaluation. The calculations by TVA, B25 8711120 452, showed that the attachment stresses are within FSAR requirements. TVA also evaluated the crane wall for the additional loads obtained from the Westinghouse analysis. This calculation, B25 870903 454, showed that the crane wall is adequate to carry these additional loads.

During the NRC inspection, TVA engineers stated that the walkdowns performed on the steam generator supports were not in accordance with the TVA Quality Assurance requirements. They also stated that these walkdowns will be performed again (post-restart) using the TVA Quality Assurance requirements. This observation was kept open pending a Corporate Commitment Tracking System commitment to perform these walkdowns.

Report No. 86-38

(Open) Observation 6.3 - Instrument Sense Line

TVA performed a walkdown of approximately 200 instrument sensing lines for a technical adequacy verification of the instrument process sensing lines relative to Sequoyah drawing requirements. Based on the TVA walkdown results, the team recommended a more complete walkdown of HVAC safety-related instrument connections. TVA subsequently performed an additional walkdown. A large number of HVAC instrumentation discrepancies were documented. The team was satisfied with the technical depth of this TVA re-review. During this process, a number of instrument sense line "as-built" sketches were prepared. TVA indicated that a review of technical adequacy for these sketches was in process, and that when completed, these sketches would be converted into formal TVA drawings. The team stated that this item remains open pending TVA submission of a schedule for completing these HVAC instrumentation drawings.

Report No. 86-45

There are no observations which remain open for inspection purposes for inspection report 327, 328/86-45.

Report No. 86-55

(Closed) Observation 6.12 - CCS Surge Tank Baffle

The CCS surge tank has an internal baffle plate to provide independence of the two redundant water volumes. TVA conducted CCS surge tank leakage tests which demonstrated the integrity of the baffles in the Unit 1 and 2 tanks. In addition, TVA has committed to perform a periodic test of the surge tanks at 10 year intervals (RIMS No. S53 871028 895). These actions were considered satisfactory by the team.

(Closed) Observation 6.14 - Imposed Voltages

During previous NRC inspections, the team had commented that TVA's implementation of checklist question 3C of SQEP-12, "Procedure for Evaluating Engineering Change Notice and Field Change Notice Documents," was not complete. Specifically, the TVA review did not consider imposed voltage failure modes that could result from postulated failures at the electrical terminal board connections within a cabinet. TVA stated that the SQEP-12 procedure used during the DBVP review has been superseded by SQEP-13 for the design control transition period. This new procedure does not require the use of checklist questions for a design change evaluation. Instead, TVA has issued several documents that provide guidance for ECN and field change notice evaluations, as follows:

(1) Nuclear Performance Plan, Volume 2

(2) Procedure 0604.04, Revision 1, dated June 30, 1987, "Evaluation of Changes, Tests, and Experiments" for the unreviewed safety question determination (USQD) evaluation in accordance with 10 CFR 50.59

(3) Training Program Material EGT024.001 Revision 1, dated August 14, 1987, "USQD Evaluator Certification Training" to provide training information for USQD evaluators

The team noted that single failure analysis requirements, including a consideration of internal cabinet failures, were described in these documents. Since the purpose of an imposed voltage analysis is to assure that any single cabinet failure cannot prevent accomplishment of protective functions when required, the documentation provided by TVA appeared adequate to cover the team's concern.

A second aspect of this observation concerned TVA's the acceptability of relay contact-to-contact electrical isolation (RIMS No. B43 870803 905). This calculation did not address the electrical breakdown voltage capability of adjacent relay contacts where one contact is used in a Class 1E circuit and the other contact is used in a non-Class 1E application. TVA subsequently determined that the NEMA breakdown voltage is a minimum of 2200 volts (2 times rated voltage plus 1000 volts) in each instance where contact-to-contact isolation has been used at Sequoyah. TVA stated that calculation SQN-CSS-013

would be revised to reflect that contact-to-contact and coil-to-contact isolation between 1E and non-1E circuits on qualified Class 1E switching devices such as limit switches, relays, and circuit breaker auxiliary switches is analyzed considering the maximum credible voltage and current faults in the non-1E circuit. The team considered these actions adequate, therefore this item is closed.

(Open) Observation 6.15 - Periodic Functional Test and Reset Timers

Half-second reset timers in four safety-related pump motor circuits had not been subjected to periodic calibration or system functional tests. TVA calibrated the reset timers by disconnecting their wiring leads, but did not perform either an in-circuit system functional test or an overlapping test to confirm correct operation of the Class 1E circuits.

TVA has taken a position (RIMS No. B43 860930 901) that only those modifications involving concurrent loss of offsite power and a loss of coolant accident are a pre-restart activity based on an April 20, 1983 NRC Power Systems Branch memorandum. This memorandum stated that a loss of offsite power subsequent to a LOCA was not a design basis event since it did not significantly contribute to the probability of core melt.

However, the team considered that this TVA position is in conflict with their commitment to the periodic test criteria specified in IEEE Std. 338-1971 and NRC Regulatory Guide 1.22 as described in FSAR sections 7.2.3 and 7.3.2.2.5. Since the nonconcurrent loss of offsite power and a loss of coolant accident reset timer circuits are installed in the same Class 1E circuit with other portions of the pump motor actuation controls, the omission of systems functional or overlapping tests for the reset timers could cause an unmonitored degradation of the pump motor Class 1E circuits. Moreover, the team noted that, although TVA may have a valid point regarding whether or not the plant design must address nonconcurrent loss of offsite power and a loss of coolant accident, because these circuits are installed at SQN they will be in effect for a certain fraction of postulated events. In light of this possibility, the team considers that testing should verify the entire circuit on either an integrated or overlapping basis.

Report No. 87-14

(Closed) Observation 3.13 - West Steam Valve Room Main Steam Line Break Evaluation

Observation 3.13 indicated that CEB did not prepare the pipe rupture calculations for the valve room walls in accordance with the FSAR and design criteria. On June 4, 1987, CEB issued Revision 1 to CAQR SQP870183 to specify the required corrective action post-restart. However, CEB has completed the corrective actions required to verify the structural adequacy of the valve room walls. The team reviewed the following CEB documents:

(1) Two proposed amendments to the FSAR

(2) Sequoyah Nuclear Plant Concrete Evaluation Report, dated February 6, 1987

(3) QIR NEB 87111, dated March 26, 1987, which transmits NEB-generated pipe break design pressures in the west main steam valve room to CEB

(4) CEB calculation "Auxiliary Building West Valve Room Pipe Rupture," Revision 1, dated August 21, 1987 (RIMS No. B25 870821 489)

(5) CEB calculation "Roof Slab El. 729.0 Auxiliary Building," Revision 3, dated August 19, 1987 (RIMS No. B25 870821 488)

(6) CEB calculation "Cumulative Attachment & Rebar Cut Evaluation - Structural Walls " Revision 1, dated August 19, 1987 (RIMS No. B25 870821 487)

CEB also indicated that design criteria SQN-DC-V-1.3.3.1, "Additions After November 14, 1979 - Reinforced Concrete, Structural and Miscellaneous Steel," will be revised consistent with the proposed FSAR amendments. The team considered these actions adequate; therefore, Observation 3.13 is closed.

(Open) Observation 6.16 - HVAC Flow Switch Calibration Data Records and System 30 Surveillance Instruction Procedures

Section 9.4.5.4 of the Sequoyah FSAR states that the electrical components, switchovers, and starting controls of the diesel generator building ventilation and heating systems are tested initially and periodically. The team noted that surveillance procedure SQI-82 does not provide assurance that the HVAC system is operating properly because it does not exercise the starting controls or train-to-train switchover interlocks. The team considered that TVA has not prepared nor performed an appropriate surveillance instruction that would satisfy the FSAR commitment; hence, the team was unable to resolve this concern.

(Open) Observation 6.17 - Diesel Generator Building Ventilation Fans Control Logic and Surveillance Instruction Procedure

This observation identified drawing errors in logic diagrams and noted that the control circuits were not tested in accordance with FSAR commitments. TVA has committed to correct the mechanical and control logic diagram inconsistencies with electrical wiring diagrams prior to restart; however, TVA has not prepared nor performed surveillance instructions to test the HVAC controls and interlocks as committed in the FSAR.

(Closed) Observation 6.18 - Centrifugal Charging Pump Auxiliary Oil Pump Low Flow Bypass Switch

TVA installed a two position bypass switch for fire protection purposes which permitted the centrifugal charging pumps (CCPs) to start without initial oil pressure whenever the switch was placed in its bypass position. Westinghouse letter TVA-87-796, dated September 18, 1987, stated that one or two such starts would be acceptable provided that a minimum oil pressure of 10 psig was maintained. TVA prepared an analysis of vibration measurements taken for each CCP over the past two years which indicated that no bearing degradation or wear was evident even though 21 individual pump starts occurred without auxiliary oil pressure. Consequently, TVA concluded that additional administrative controls

were not required for the CCP's. The team agreed that the vibration data supported TVA's conclusion; hence, this item is closed.

Report No. 87-31

(Closed) Observation 3.16 - Valve Motor Operator Orientation

Observation 3.16 indicated that MEB had prepared problem identification report (PIR) SQN-MEB-86-127 to document differences between the installed orientation and the piping physical orientation of ten component cooling water system (CCS) valve motor operators. However, MEB did not request a potential generic condition evaluation for the PIR. To address this deficiency, MEB revised PIR SQN-MEB-86-127 to request a potential generic condition evaluation and CEB revised the calculation "Summary of Analysis N2-PIR-MEB-86127-MISC," (RIMS No. B25 870821 806) to evaluate the generic implications of the PIR. DNE will revise Nuclear Engineering Procedure 9.1, "Corrective Action," to require that justification for determining that a generic review is not required be documented on the CAQR. Observation 3.16 is closed.

(Open) Observation 3.17 - Solenoid Valve Mounting Support

Observation 3.17 identified two installed variances to a typical solenoid valve mounting support detail which lacked seismic qualification calculations. To address this deficiency, TVA was generating a calculation package that will qualify the instrument line support variances to current (default) or Unit 2 restart criteria. TVA indicated that the calculation package will be generated before restart of Unit 2. Observation 3.17 remains open until TVA confirms that an acceptable calculation to qualify the instrument line support variances has been issued.

(Open) Observation 4.8 - Radiation Monitoring System

TVA provided the team with revised Quality Information Report (QIR) NEB 86 241 RI (B45 871016 251) that concludes the corrective action need not be performed prior to restart since:

1. The sample line isolation valves that serve a containment isolation function will close upon loss of air.

2. The fact that the system has not been specifically designed to remain functional when subjected to a safe shutdown earthquake was determined acceptable in Section 5.2.4 of the Sequoyah Safety Evaluation Report, NUREG-0011, March 1979.

The team considered that TVA had adequately addressed inconsistencies regarding QIR NEB 86 241, and that that system design was consistent with that accepted by NRC during initial plant licensing. Therefore, a post-restart classification was appropriate. This item remains open pending a CCTS commitment to complete the corrective action.

(Closed) Observation 6.20 - Preliminary DBVP Report

The team was concerned that a large number of mechanical walkdown findings were designated as random occurrences in the preliminary DBVP report. The issued

DBVP report (RIMS B25 870529 010) redesignated the mechanical walkdown findings as "of a limited extent", rather than being "random." This redesignation was acceptable to the team; hence, this item is closed.

(Open) Observation 6.21 - Post-Accident Monitoring

TVA's electrical separation design criteria document, SQN-DC-V-12.2 and FSAR Section 7.5 provide specific separation commitments for post-accident monitoring PAM-1 and PAM-2 channels. The existing Sequoyah design does not fulfill these separation commitments for the PAM-1 channel. Full implementation of accident monitoring instrumentation in accordance with NRC Regulatory Guide 1.97 recommendations is scheduled for the end of fuel cycle 4 in the 1989-1990 period.

The team reviewed TVA's preliminary plans for the interim and the final implementation of physical separation and electrical isolation of the PAM-1 and PAM-2 channels. In the interim plan, high impedance resistor termination networks would be added within the R26 and R27 termination cabinets to isolate each PAM channel from the process computer. The final plan would add a qualified Class 1E isolator to each PAM-1 channel to satisfy the FSAR separation criteria commitment. The interim and final implementation solutions appeared technically satisfactory; however, these plans remain to be documented by TVA as a formal commitment incorporated into the Corporate Commitment Tracking System.

(Open) Observation 6.22 - Auxiliary Control Air System

A postulated design basis event could cause the temporary loss of one auxiliary control air system because of a lack of physical separation of safety-related auxiliary control air piping inside containment relative to high energy line break (crack) sources. A postulated single failure during this event could also eliminate the redundant auxiliary control air system. For approximately 7.5 minutes after the design basis accident, safety-related auxiliary control air would be lost to HVAC damper and instrument loads. Air pressure would be gradually restored to the affected auxiliary control air system once its containment isolation valve closed automatically on low pressure.

The team reviewed the licensee's evaluation for this event. TVA has examined the impact of this scenario on the HVAC systems 30 and 31; emergency gas treatment system; auxiliary building gas treatment system; auxiliary feedwater and main stream control valves; containment building vacuum relief isolation valves; transformer room ventilation system; control building air conditioning; 480 volt shutdown board room ventilation; and shutdown board room ventilation. TVA also determined that safety-related ventilation fans either continue to operate or will automatically restart at 7.5 minutes when auxiliary control air would be fully restored to the affected train.

The team questioned two aspects of this analysis; namely, a determination of the time required for operator action based on higher heat loads in the 480 volt shutdown board rooms than those assumed by TVA, and a review operating procedures used by the control room operator for the ventilation system process-auto control switches. The team stated that TVA should verify that the operator will adequately respond during the postulated event and that the time allowed for operator action is not too prompt (less than 30 minutes).

(Closed) Observation 7.5 - Punchlist Accuracy

The DBVP punchlist was generated to track and resolve concerns resulting from ECN reviews, system evaluation reviews, NRC inspections and internal EA oversight reviews. Each of these concerns was identified by a unique punchlist number. The forms which control the list (SQEP 45-Attachment 2 Forms) provide a description of the concern, proposed corrective action, schedule for corrective action such as post-restart or pre-restart, status of implementation of the corrective action and a short explanation if the item was categorized as a post-restart item. NRC team review of punchlist items revealed that the punchlist had many errors. These errors were related to one or more factors such as incorrect schedule category, incorrect status of corrective action, incorrect definition of corrective action to resolve the punchlist item, errors relating to problem description, incorrect data on SQEP-45 attachment 2 forms, absence of such forms, and editorial errors. To resolve this concern TVA initiated the following actions.

Regarding the timeliness and accuracy of the control and processing of changes, the DBVP project issued DBVP Directive DBVP-D-87-008, dated August 5, 1987. This directive requires the punchlist changes to be classified as administrative changes, implementation status changes, or technical changes. Technical and implementation status changes require review and approval by the responsible system engineer and discipline evaluation supervisor. The punchlist coordinator now reviews all SQEP-45 Attachment 2 forms to ensure that all the requirements of SQEP 45 and Directive D-87-008 have been met.

TVA stated that these actions, together with those required by previously issued DBVP Directives 87-12, 06, and 07, greatly improved the consistency and correctness of the punchlist data base.

The team considered that the above steps taken by TVA to resolve concerns regarding punchlist errors acceptable; however, the team was concerned with their implementation. EA informed the team that they had reviewed approximately 333 valid punchlist items and verified that the directions of the above directives were followed properly. Considering the extent of implementation reviews performed by the oversight effort the team concurs with the review results and considers this item closed.

APPENDIX C MEETINGS AND REFERENCES

C.1 MEETINGS

Table C.1 provides a matrix of meeting attendance and lists principal persons contacted for the meetings conducted during the inspection. Other licensee personnel were also contacted. The following paragraphs summarize the general purpose of these meetings.

Meeting 1: On October 26, 1987, the NRC held an entrance meeting. The NRC reviewed the team's plans to inspect the calculation review program and to assess the adequacy of TVA's corrective actions for previous inspection findings.

Meeting 2: On October 28, 1987, a meeting was held to discuss the interim status and the results of the inspection as of this date.

Meeting 3: On October 30, 1987, the NRC held an exit meeting at the plant site to summarize the results of the inspection team's efforts.

Table C.1 - MEETINGS

Name	Organization	Title	Meeting Attended		
			1	2	3
REArchitzel	NRC-NRR	Team Leader	X	X	X
SVAthavale	NRC-NRR	NRC-Electric Power	X	X	X
AduBouchet	NRC-Consultant	NRC-Mech.Components	X	X	X
FJMollerus	NRC-Consultant	NRC-Mech. Systems	X	X	X
AIUnsal	NRC-Consultant	NRC-Civil/Structural	X	X	X
LStanley	NRC-Consultant	NRC-Instr./Controls	X	X	X
EFGoodwin	NRC-OSP	Tech. Assistant		X	X
APCapozzi	TVA-DNE	Manager - EA-EA	X		X
MPBerardi	TVA-EA	EA Oversight Adv.	X		X
BHall	TVA-ONP-DNLRA	Licensing-Sequoyah	X	X	X
RJames	TVA-DNE	Civil DES			X
PBNesbitt	TVA-DNE	Electrical DES			X
DLKitchel	TVA-DNE	DBVP Eng. Mgr.	X	X	
RTHolliday	ONSL-KLS	Nuclear Eng.	X	X	X
TCPrice	TVA-DNE	Design Basis Mgr.	X	X	X
PKGuha	TVA-DNE	Asst. Br. Ch. - EEB			X
WPennell	TVA-DNE	Mgr., E&TS	X	X	X
LJones	TVA-ECB	Acting Mgr., ECB	X	X	
ALenyard	TVA-ECB	Section Supervisor	X		X
DGRenfro	TVA-NEB	Principal Nuc. Eng.	X	X	
JCKey	TVA-SQEP	Asst. Proj. Eng.	X	X	
GLNicely	TVA-EEB	Sr. Elec. Eng.	X	X	
KDKeith	TVA-NEB	Sr. Nuc. Eng.	X	X	X
RDHernandez	TVA-CEB	Asst. Chief Civil Eng.	X		X
SDStone	TVA-CEB	Sr. Geotech. Eng.	X	X	X
FEDenny	TVA-EA	Sr. Lead Auditor	X	X	X
DLWilliams	TVA-DNLRA	Acting Manager	X		X
JPLittle	TVA-MEB	Sr. Mech. Eng.	X	X	
FAKoontz, Jr.	TVA-NEB	Asst. Branch Chief	X	X	X
PRWasher	TVA-SQEP	Asst. Lead Eng.	X		X
JARoop	TVA-EEB	Sr. Elec. Eng.			X
LWBoyd	TVA-MEB	Sr. Eng. Specialist			X

C.2 REFERENCES

(1) Inspection Report 50-327/86-27 and 50-328/86-27, forwarded by J. Taylor letter dated April 22, 1986.

(2) Inspection Report 50-327/86-38 and 50-328/86-38, forwarded by J. Taylor letter dated September 15, 1986.

(3) Inspection Report 50-327/86-45 and 50-328/86-45, forwarded by J. Taylor letter dated October 31, 1986.

(4) TVA response to Inspection Report 50-327/87-06 and 50-328/87-06 (Domer to NRC) dated July 2, 1987.

(5) TVA Response to Inspection Report 86-27 (Gridley to Grace), dated July 28, 1986.

(6) TVA revised response to Inspection Report 86-27 (Domer to Grace), dated December 31, 1986.

(7) TVA response to Inspection Reports 86-38 and 86-45 (Domer to Taylor), dated February 3, 1987.

(8) TVA response to Inspection Report 86-55 and other Inspection Items remaining open (Gridley to Ebneter), dated April 22, 1987.

(9) Inspection Report 50-327, 328/86-55, forwarded by J. Taylor letter dated February 3, 1987.

(10) Inspection Report 50-327, 328/87-06, forwarded by S. Ebneter letter dated April 8, 1987.

(11) TVA Additional Information in Response to Inspection Report 86-27, (Domer to Taylor), dated January 30, 1987.

(12) Engineering Assurance Oversight Review Report, "Sequoyah Nuclear Plant-Unit 2 Design Baseline and Verification Program," EA-OR-001, issued April 29, 1987.

(13) Sequoyah Nuclear Plant - Design Baseline and Verification Program Unit 2 Phase 1 Report, dated May 29, 1987.

(14) Inspection Report 50-327, 328/87-14, forwarded by S. Ebneter letter dated June 4, 1987.

(15) TVA response to Inspection Report 50-327, 328/87-14 (Gridley to NRC), dated July 16, 1987.

(16) TVA revised response (Observation 5.7) to Inspection Report 50-327, 328/87-14 (Gridley to NRC), dated September 1, 1987.

(17) TVA letter relating to control and processing of changes to the punch list (Gridley to NRC), dated August 20, 1987.

(18) Inspection Report 50-327, 328/87-27, forwarded by S. Ebneter letter dated August 24, 1987.

(19) TVA letter addressing SQN-DNE Design Calculation Efforts (Gridley to NRC), dated July 31, 1987.

(20) TVA response to Inspection Reports 87-27 (Gridley to NRC), dated October 21, 1987.

(21) TVA letter addressing revised commitment date for interface guidelines (Gridley to NRC), dated November 20, 1987.

(22) TVA letter is response to findings identified during the final NRC inspection of the DBVP (Gridley to NRC), dated October 27, 1987.