TENNESSEE VALLEY AUTHORITY
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August 17, 1990

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of) Docket Nos. 50-327
Tennessee Valley Authority) 50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - CABLE TEST PROGRAM (CTP) RESOLUTION PLAN (TAC NO. 77129/77130)

References:
1. TVA letter to NRC dated July 31, 1987, "Sequoyah Nuclear Plant (SQN) Units 1 and 2 - Revised Cable Test Program"
2. TVA letter to NRC dated July 27, 1990, "Sequoyah Nuclear Plant (SQN) - Condition Adverse to Quality Report (CAQR) SQP900305 - Operability Determination"
3. NRC letter to TVA dated August 8, 1990, "Justification for Continued Operation Regarding the Cable Testing Program (TAC Nos. 77129/77130) - Sequoyah Nuclear Plant, Units 1 and 2"

The purpose of this letter is to provide a CTP resolution plan to resolve the issues relative to pullbys, jamming, vertical supported cable, and TVA-identified cable damage. This resolution plan supersedes portions of the original CTP as submitted in Reference 1.

TVA and NRC met on July 23, 1990, in Rockville, Maryland, to discuss the problems recently identified by TVA with the ranking calculation used to select conduits to be tested for pullby damage and plans to resolve these problems. TVA submitted a revised operability determination, as agreed to in the meeting, by Reference 2. Additionally, TVA agreed to provide a complete plan and schedule to resolve the CTP problems. The resolution plan includes a two-phase (Phase I and Phase II) evaluation of SQN safety-related conduits, a quality assurance (QA) "lookback" plan to investigate for programmatic problems with the original CTP, and a QA "forward look" plan to monitor the activities.

Following the July 23, 1990, meeting, TVA continued evaluations of the data collected by United Engineers and Contractors (UE&C) for the original test conduit selection for pullby damage. These evaluations indicated additional errors in compiling the raw data itself from computerized cable records and pull cards. Errors were found involving incorrect pull dates, cables not identified in conduits, and improperly identifying the number of cables in

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pullbys. These discrepancies were found by looking at a random selection of 59 conduits in the population of 770 conduits with 7 or more cables. A review of the approximately 7,000 safety-related cables indicated additional errors in identifying all conduits with 7 or more cables. These errors necessitated either reverification or justification of much of this data prior to applying the screening equation. Preliminary information on these problems and the potential impact to the schedule described in the July 23, 1990, meeting were provided to NRC by phone on August 6, 1990.

The Phase I and Phase II evaluation plan is included as Enclosure 1 to this letter. Phase I involves the activities to evaluate conduits that are not in ALARA (as low as reasonably achievable) or harsh environment areas, which includes walkdowns to prepare sketches and detailed isometrics. Evaluations for conduits in Units 1 and 2 reactor buildings and other locations that pose personnel safety considerations will be performed as Phase II at the first outage of sufficient duration. For Unit 2, this will be the September 1990 Cycle 4 refueling outage and will overlap the Phase I efforts; both efforts are scheduled to be complete October 5, 1990. For Unit 1, the unit 1 Cycle 5 refueling outage or the first available outage of sufficient duration will be utilized for that corresponding portion of Phase II.

The QA lookback plan and current schedule are included as Enclosure 2 to this letter. This plan describes the objectives and activities to determine the contributing factors leading to the unissued Calculation SQN-CSS-009. This will include evaluations of past and present program controls for calculations, determinations of the extent of unissued calculations, and verification of data adequacy to be used in the new program from Calculation SQN-CSS-009. These objectives are scheduled to be completed by late August 1990, followed by a report scheduled to be issued September 7, 1990, to the Site Director.

The QA forward look plan and current schedule are included as Enclosure 3 to this letter. This part of the resolution plan will monitor activities to ensure proper application and performance of the conduit ranking criteria. These activities include but are not limited to reviewing adequacy of the 1987 ranking calculation data, verifying that sufficient data is obtained to implement new ranking criteria, verifying proper performance of sidewall bearing pressure (SWBP) calculations, and verifying acceptability of vertically supported cables and jamming evaluations. These activities are scheduled to be completed by October 9, 1990.

During the July 23, 1990, meeting, TVA proposed a 6- to 8-week program duration to complete the new ranking and SWBP calculations by mid-September to late September 1990. This estimate was primarily based on the data collected by UE&C being suitable as a starting point for further calculations. As TVA has discovered, this data, which includes field sketches, was not dependable and will require a more extensive effort to achieve a ranking by SWBP. TVA has allotted additional resources to provide the best possible effort to meet

the original schedule and now projects that Phase I and Unit 2 Phase II should be completed by October 5, 1990. TVA is also sensitive to the need for accuracy and completeness in this effort and realizes the importance of working in a controlled fashion. For this reason as well as supporting the Unit 2 Cycle 4 refueling outage, the schedule could be impacted to some extent. In any case, TVA is working to meet with NRC the end of September 1990 to discuss the program results; we believe sufficient results will be available to allow a substantive meeting with the staff. TVA will continue to communicate closely with NRC during completion of the program to establish the appropriate date for the meeting.

After completion of Phase I and Unit 2 Phase II ranking by SWBP, the results will be compared with and evaluated against the Browns Ferry Nuclear Plant (BFN) CTP data and results. TVA acknowledges the concerns that NRC expressed in Reference 3 regarding bounding of SQN results by the BFN test results; such application of the BFN results will be made only as technically applicable. TVA believes the similarities between SQN and BFN conduit configurations and pulling practices as discussed in the July 23, 1990, meeting clearly afford the technical basis for this application and will yield important information regarding the SQN cables. In further recognition of this overall similarity, SQN's evaluation of associated BFN cable problems provides confidence that the application of BFN CTP results remains valid.

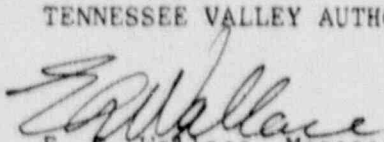
Based on the current schedule to complete the Phase I and Unit 2 Phase II conduits early in the Unit 2 Cycle 4 refueling outage, TVA commits to take the appropriate actions prior to start-up from that outage to verify the integrity of safety-related cables at SQN. These actions could include demonstration of cable acceptability, replacement of cables, or testing as necessary to obtain the required confidence. TVA fully expects the current schedule to support completion of this program and resolution prior to start-up. If it becomes apparent that SQN will not be able to complete these activities prior to start-up from the Cycle 4 outage, you will be promptly notified.

The commitments made in this letter are included as Enclosure 4.

Please direct questions concerning this issue to Marcia A. Cooper at (615) 843-6422.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



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cc: See page 4

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ENCLOSURE 1

Phase I and Phase II Evaluation Plan

I. BACKGROUND

During a June 19, 1990, audit of the documentation to support Sequoyah Nuclear Plant's (SQN's) 1987 Cable Testing Program (CTP), TVA advised NRC that the calculations to support that effort had been prepared and checked but never issued. At that time, TVA was in the process of performing an administrative review to determine what actions would be required to issue these documents in accordance with current procedures. During the course of this review, TVA became aware of allegations that Calculation SQN-CSS-009 contained errors in the way the screening criteria had been applied. As a result of this, TVA initiated an in-depth technical review of that process. Although TVA has not identified any evidence of the systematic misapplication of the selection criteria, several data errors were noted that affected the original ranking of conduits.

Subsequent to the July 23, 1990, meeting at NRC offices in Rockville, Maryland, TVA performed a sample review of the raw data to which the criteria were applied. Data errors (incorrect mark letters, cable count, and pull dates) were identified. The following plan has been developed in response to these findings. Though errors have thus far only been identified in the pullby portion of the document, TVA's plan will include consideration for the other issues addressed by the subject calculation (jamming and lack of cable support in vertical conduits). Implementation of this plan will resolve the concerns regarding the subject calculation and provide additional assurance regarding the integrity of the SQN cable system.

II. RESOLUTION OF PULLBY ISSUES

In response to the aforementioned errors, TVA has decided to regenerate its pullby analysis using methodology similar to that recently employed at Browns Ferry Nuclear Plant (BFN). This analysis will consist of a ranking process based on the forces generated within a conduit during a pullby. Phase I of the analysis will include conduits that are accessible during normal plant operation, while Phase II will include the balance of conduits that are only accessible during unit outages.

The population of conduits at SQN containing safety-related circuits in which the potential exists for cable pullbys to have occurred will be subjected to this process. This will be based on the original 1987 SQN Computerized Cable Routing System data base, because the SQN cable installation program has been upgraded to acceptable standards since that time. The worst-case conduits will be considered as those satisfying the following selection criteria.

1. The conduit will contain a minimum of seven cables.

2. The conduit segment length between pull points will be greater than 20 feet. This will be based on the original 1987 field sketches ("C" condulets will not be considered as pull points). If no field sketch exists, design drawings will be used to ensure the total conduit length will be greater than 20 feet.

3. The remaining conduits will initially be evaluated using an enhanced version of the BFN screening process. The data used for this screening process will be reverified by field walkdowns. The BFN review employed the following ranking factor:

   (L*F)/R = ranking factor

   where:

   L = conduit length
   F = conduit fill
   R = conduit bend radius per TVA standards

   Based on lessons learned during the BFN evaluations and utilizing data available for the SQN conduits, the formula has been modified as follows to more closely reflect the forces generated during a pullby:

   (L*K*Wc*F*p/R)*EXP(K*A*Wc*n) = ranking factor

   where:

   L = conduit segment length (feet)
   K = coefficient of friction
   Wc= weight correction factor
   F = conduit fill percentage
   p = pullby fraction
   R = conduit bend radius (feet)
   A = total bends in a segment (radians)
   n = configuration conversion factor

   This equation reflects the formulas for determining sidewall bearing pressure (SWBP) during pulling, and includes several of the key parameters of consideration during a pullby.

   Pull tension and SWBP increase directly with length. While the BFN program utilized the total conduit length, the SQN effort will derive a greater degree of accuracy by identifying the length of conduit in each segment (i.e., pull point to pull point) from field sketches.

   Since SWBP is inversely proportional to the radius of bend of its conduit, the screening will assume that each segment contains bends formed to the minimum allowed by TVA and industry standards.

The fill percentage (F) of a given conduit and the pullby fraction (p) have been incorporated to account for the influence of the size of a pullby in a given conduit. It can be expected that a pullby in a small (0.75 inch) conduit may easily have involved half of the final fill percentage (i.e., the pulling of one cable over the top of one other). In a five-inch conduit, 60 to 80 small diameter cables may be required to achieve the same degree of fill and a much smaller fraction would likely be involved in any one pullby. Therefore, the unitless multiplier (p) is applied. The multiplier is on a sliding scale according to the size of the conduit and reflects the fact that pullbys in small conduits are likely to have involved a larger portion of the cables than pullbys in large conduits.

In a similar fashion, the weight correction factor (Wc) has been applied to enhance the model. Given that Wc generally varies from 1.0 for single cable pulls to 1.4 for pulls of four or more cables, a sliding scale has been developed that attributes a low value of Wc to small conduits and higher values for the larger raceways.

The BFN model has been enhanced through the inclusion of configuration data taken from field sketches of the conduit. These sketches show the total degrees of bend between adjacent pull points. Consideration for these bends has been incorporated exponentially to best reflect the various formulas for determination of SWBP.

Finally, the unitless factor (n) has been included to account for the fact that bends are being treated as if they were all located at the ends of the run, whereas, in reality, they are distributed along the length of the individual segment.

The combination of these factors will permit quick and efficient determination of a family of conduits that contain the potential for significant pullbys to have occurred. This family will then be further screened as outlined below.

4. A review of this grouping will be performed to identify the top 30 conduits in which a pullby has occurred. This review will be performed using existing pull cards or installation inspection records.

5. As required, walkdowns will be performed of the top 30 conduits identified to obtain isometrics for use in subsequent SWBP calculations.

6. Detailed calculations will be performed to conservatively estimate the maximum SWBP that would have been encountered during the worst pullby in each conduit. This analysis is based on the configuration and cable data discussed above and will utilize standard industry methodologies and formulas for the determination of expected pull tension and SWBP derived from the fundamental laws of physics.

7. The top 30 conduits discussed above will then be reranked according to SWBP. Since cables of differing construction and SWBP limitations may be involved, the ranking will be based on the percentage of allowable SWBP rather than its magnitude.

   NOTE: The screening process described in Item 3 does not include exact data for conduit configuration and cable pull groupings. Therefore, following completion of the detailed calculation and reranking process, the methodologies will be reviewed to confirm that the screening process has produced viable results. If acceptable correlation does not exist between the screening process and the detailed calculations, TVA will expand the selection of conduits to be walked down and included in the rigorous evaluation.

8. SWBP results obtained as a result of this process will be compared with those of the BFN tested conduits. This comparison will determine whether or not any further testing or additional actions should be taken.

III. REVERIFICATION OF CABLE JAMMING ISSUES

In February of 1987, TVA began development of a calculation (EEB-CSTF-0008) to implement the selection criteria and identify a family of conduits in which the jam ratio criteria were fulfilled. This calculation was prepared and checked, but never issued. TVA will rework this calculation to meet current requirements and issue it. This family of conduits was reviewed in accordance with Calculation SQN-CSS-009, and this review identified the worst-case conduits. As a result of the other errors discovered in Calculation SQN-CSS-009, this portion will be reviewed for accuracy. This will be done concurrently with Phase I of the pullby analysis.

IV. REVERIFICATION OF VERTICAL CABLE SUPPORTED ISSUES

As presented in the July 23, 1990, meeting, TVA has reviewed 10 of the 400 conduits contained in Appendix 6 of the vertical cable support criteria portion of SQN-CSS-009. There were no problems identified at that time with this small sample. However, TVA intends to complete the review of this data to ensure the data contained in Appendix 6 is accurate. This will be done concurrently with Phase I of the pullby analysis.

V. OTHER ISSUES

Two other issues involving cable damage discovered at BFN were also discussed at the July 23, 1990, meeting. The first issue involved missing conduit bushings in junction boxes, which resulted in insulation damage to type "PN" cable. It should be noted that this type of cable has a thin nylon jacket (4 mils), which would be more susceptible to damage by rough conduit edges. There are no PN-type cables used at SQN in 10 CFR 50.49 applications, although they are utilized in some safety-related circuits. SQN original construction procedures, including quality control (QC) inspection, required conduit bushings to be installed. A field inspection for possible moisture damage was performed in 1979-1980 on approximately 1100 junction boxes. This inspection, including QC inspections prior to declaring each box acceptable, reverified proper junction box configuration (all mounting hardware installed, all conduits properly attached, general cleanliness, box covers, and gaskets installed, etc.). Therefore, there is a high degree of confidence that conduit bushings are installed properly at SQN.

The second issue involved cable insulation damage within a penetration. This damage was apparently the result of using sharp objects to dig out the room temperature vulcanizing (RTV) when adding new cables to the penetration. This issue has been previously addressed at SQN as part of the Employee Concern Program (Item 10900-NPS-02). It was determined that the practices utilized at SQN were acceptable and would not result in undetected cable damage. Both of these issues will be further addressed by SQN as necessary as part of the condition adverse to quality (CAQ) process.

VI. CONCLUSION

The program previously described is a major effort to ensure that the worst-case conduits for the issues of pullbys, jamming, and lack of vertical cable support have been identified and properly evaluated, and that the cables therein are capable of performing their intended safety function. For pullbys, the analysis will verify whether the results of SQN's SWBP calculations are bounded by the BFN tested conduits and dictate whether any additional testing or other actions must be taken. Upon completion of this program, the cable installation concerns will be resolved for SQN.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT (SQN)

SQN Site Quality Organization

"Look Back"
Action Plan

For Cable Test Program
Reverification

ENCLOSURE 2

Purpose of Assessment: Determine contributing factors that led to the root cause of the condition.

Key Objectives

1. Determine the adequacy of program controls for calculations at the time of restart and present.

2. Determine extent of the condition. Was this a limited occurrence or a generic problem?

3. Determine if additional program controls are necessary to preclude recurrence of the condition.

4. Determine input from old calculation to be used in new calculation and evaluate it for adequacy.

Plan

A. Program Controls at the Time Calculation was Prepared — August 13, 1990

   1. Engineering Procedures

      - TVA
      - Contractor

   2. Licensing Procedures

      - Validation of submittals
      - Identification and tracking of commitments

B. Program Controls Today — August 13, 1990

   1. Engineering Procedures

      - TVA
      - Contractor

   2. Licensing Procedures

      - Validation of submittals
      - Identification and tracking of commitments

C. Complete Interviews (see attachment) — August 20, 1990

D. Extent (Generic or Limited) of Condition (The condition is the review and approval of a calculation to support an engineering decision) — August 27, 1990

1. Review audits/oversights/surveillances for similar conditions

   - Essential calculation audit
   - Design Baseline Verification Program (DBVP) oversight
   - Essential calculation assessment
   - Design change control audit
   - Procured services audits of United Engineers and Contractors (UE&C)
   - Surveillance by Engineering Assurance (EA) Technical Audit Group
   - Surveillance/monitoring by SQN Site EA

2. Review similar calculations to determine if condition exists

   - Determine population

3. Determine inputs from old calculation to be used in new calculation and evaluate adequacy

E. Issue Report — September 7, 1990

Attachment

Interview Sheet

Person Interviewed: _____

Current Position: _____

Position at time of Calculation SQN-CSS-009: _____

1. What were quality assurance (QA) and administrative controls for issuance of calculations at the time of SQN-CSS-009? (If they do not know, ask who was responsible for knowing.)

2A. Did those QA and administrative controls apply to SQN-CSS-009? Why?
_____ Yes _____ No

2B. If 2A answered yes, were QA and administrative controls followed?
_____ Yes _____ No

2C. If 2B answered no, should a condition adverse to quality report (CAQR) have been initiated?
_____ Yes _____ No

Why?

2D. If answer to 2C is no because no problems were known to exist with the calculation, what was individual's understanding of who in TVA had reviewed the calculation for technical adequacy, and what were the results of this review?

3. Who for TVA owned the technical aspects of Calculation SQN-CSS-009?

4. Was calculation to be issued under UE&C's QA program or TVA's QA program? _____ UE&C _____ TVA

5. Did UE&C QA or TVA QA/EA overview UE&C's work on this calculation?
_____ Yes _____ No About when _____?

6. What was your personal knowledge concerning the circumstances surrounding the nonissuance of the calculation?

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT (SQN)

SQN Site Quality Organization "Forward Look" Action Plan

For Cable Testing Program Reverification

ENCLOSURE 3

SUBJECT: Sequoyah Nuclear Plant - Site Quality Organization (SQO) Action Plan for Cable Test Program Reverification

PURPOSE: To provide an additional level of assurance that SQN's (1) Sidewall Bearing Pressure Calculation (SWBP) for accessible conduit is bounded by Browns Ferry Nuclear Plant's (BFN's) tested conduits; (2) cables in vertical raceways comply with National Electric Code (NEC) requirements; and (3) jamming calculations are appropriately evaluated and documented.

OBJECTIVES:

A. To determine if regulatory commitments and applicable program controls are implemented for the preparation of calculations.

B. To determine if reverification of the sample data associated with the 1987 ranking calculation is adequate.

C. To determine if conduits are ranked in accordance with established criteria.

D. To determine if needed information is collected for top ranked conduits.

E. To determine if the SWBP calculations are acceptable.

F. To determine if vertical cables supported by a 90-degree condulet or "T" meet the requirements of the National Electrical Code, Article 300-19.

G. To determine if jamming calculations are acceptable.

OBJECTIVE A: To determine if regulatory commitments and applicable program controls are implemented for the preparation of calculations.

Action	Completion Due Date
1. Identify regulatory commitments for cable testing calculations	
2. Review NE programs and procedures for preparation of calculations	08/01/90

OBJECTIVE B: To determine if reverification of the sample data associated with the 1987 ranking calculation is adequate.

Action	Completion Due Date
1. Review qualification of personnel performing verification of cable pull data.	
2. Ensure controlled cable pull data is utilized for verification activity of 59 randomly selected conduits.	
3. Ensure the resolution of differences in United Engineers and Contractors's (UE&C's) data from controlled cable pull data.	
4. Verify that discrepancies with the applicable sketches are identified during walkdown and those missing are second-party verified. (Phase I)	
5. Verify that discrepancies with the applicable sketches are identified during walkdown and those missing are second-party verified. (Phase II)	
6. Issue Summary Report for Objective B	10/07/90

OBJECTIVE C: To determine if conduits are ranked in accordance with established criteria.

	Action	Completion Due Date
1.	Review screening criteria used for conduit ranking.	
2.	Review actual ranking of conduits against established criteria.	
3.	Issue monitoring report documenting results.	09/10/90

OBJECTIVE D: To determine if needed information is collected for top ranked conduits.

	Action	Completion Due Date
1.	Overview walkdowns for collection of data.	
2.	Review isometrics.	
3.	Verify proper collection of data pull dates for pull groups.	
4.	Issue monitoring report documenting results.	09/14/90

OBJECTIVE E: To determine if the SWBP calculations are acceptable.

	Action	Completion Due Date
1.	Sample SWBP calculations for adequacy.	
2.	Overview the comparison of SQN results to BFN's tested conduits to determine if they are bounded.	
3.	Verify that calculations are properly checked, reviewed, approved, and issued.	
4.	Issue final monitoring report.	10/09/90

OBJECTIVE F: To determine if vertical cables supported by a 90-degree condulet or "T" meet the requirements of the NEC, Article 300-19.

	Action	Completion Due Date
1.	Verify selection criteria are properly utilized for screening conduits.	
2.	Verify QA documentation is complete including source documents referenced, assumptions are documented, and missing data is collected or evaluated.	
3.	Issue monitoring report.	09/17/90

OBJECTIVE G: To determine if jamming calculations are acceptable.

	Action	Completion Due Date
1.	Verify general requirements with jamming data are acceptable.	
2.	Ensure cable data for conduits is field verified as appropriate.	
3.	Verify issuance as a jamming calculation or other appropriate QA documentation per NRC commitment.	
4.	Issue monitoring report.	10/07/90

ENCLOSURE 4

List of Commitments

1. TVA will perform a new preliminary ranking process similar to the Browns Ferry Nuclear Plant (BFN) program and execute a new sidewall bearing pressure (SWBP) conduit ranking. TVA expects to complete Phase I and Unit 2 Phase II by October 5, 1990.

2. In implementing the quality assurance (QA) lookback plan, TVA's QA organization will determine the contributing factors that led to Calculation SQN-CSS-009 not being issued. A report to the Site Director is expected by September 7, 1990.

3. In implementing the QA forward look plan, TVA's QA organization will monitor the activities associated with the new SWBP ranking process. A report to the Site Director is expected by October 9, 1990.

4. Based on the current schedule to complete the Phase I and Unit 2 Phase II conduits early in the Unit 2 Cycle 4 refueling outage, TVA commits to take the appropriate actions prior to start-up from that outage to verify the integrity of safety-related cables at SQN. These actions could include demonstration of cable acceptability, replacement of cables, or testing as necessary to obtain the required confidence. TVA fully expects the current schedule to support completion of this program and resolution prior to start-up. If it becomes apparent that SQN will not be able to complete these activities prior to start-up from the Cycle 4 outage, you will be promptly notified.

5. TVA will perform the Unit 1 Phase II portion of this plan at the first outage of sufficient duration but no later than the Unit 1 Cycle 5 refueling outage.