UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

June 27, 2011

EA-11-143

Mr. R. M. Krich
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: RESPONSE TO DISPUTED NOTICE OF VIOLATION (EA-11-143)

Dear Mr. Krich:

This is in response to your letter dated March 31, 2011, regarding the Non Cited Violation (NCV) 05000327, 328/2010005-03, “Failure to Use Worst Case 6900 Vac Bus Voltage in Design Calculations” dated January 28, 2011. The NCV was identified during an inspection of a previous unresolved item related to degraded voltage protection at the Sequoyah facility.

In your response, TVA disputed the NCV primarily for the following reasons:

1. The NRC’s position associated with the NCV concerning degraded voltage protection was not consistent with Sequoyah licensing basis, and the approach TVA used in addressing degraded voltage protection was, in fact, appropriate.

2. The potential re-analysis of plant loading calculations that would be required in response to the NCV should be processed by the NRC through the backfit process as described in 10 CFR 50.109.

3. The violation of 10 CFR Part 50, Appendix B, Criterion III, “Design Control,” associated with the degraded voltage issue and related calculation was not consistent with the essential purpose of the regulation.

After review and consideration of TVA’s response, the NRC has concluded that for the reasons presented in the enclosure to this letter, a violation of 10 CFR 50 Appendix B, Criterion III, “Design Control” did occur. The NCV has been re-characterized to clearly describe the issue, the performance deficiency, and the applicable regulation. The revised Green NCV is included in the enclosure. Consequently, you are required to initiate corrective actions to address the performance deficiency.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of

NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this letter, please contact Mr. Binoy Desai, at (404) 997-4519.

Sincerely,

/RA/

Joel T. Munday, Director
Division of Reactor Safety

Docket No.: 50-327 & 328
License No.: DPR 77 & 79

Enclosure:
NRC Evaluation and Conclusion

cc w/encl: See page 3

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cc w/encl:
M. D. Skaggs
Site Vice President
Sequoyah Nuclear Plant
Tennessee Valley Authority
Electronic Mail Distribution

K. Langdon
Plant Manager
Sequoyah Nuclear Plant
Tennessee Valley Authority
Electronic Mail Distribution

G. M. Cook
Manager
Licensing
Sequoyah Nuclear Plant
Electronic Mail Distribution

Dan Green
Manager, Corp. Nuclear Licensing - SQN
Tennessee Valley Authority
Electronic Mail Distribution

E. J. Vigluicci
Assistant General Counsel
Tennessee Valley Authority
Electronic Mail Distribution

County Mayor
Hamilton County
Hamilton County Courthouse
208 Courthouse
625 Georgia Avenue
Chattanooga, TN 37402-2801

Tennessee Department of Environment & Conservation
Division of Radiological Health
401 Church Street
Nashville, TN 37243

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, TN 37379-3624

Ann Harris
341 Swing Loop
Rockwood, TN 37854

NRC EVALUATION AND CONCLUSION

INTRODUCTION

The NRC identified Non-Cited Violation (NCV) 0500327, 05000328/2010005-03, "Failure to Use Worst Case 6900 Vac Bus Voltage in Design Calculations" during an inspection conducted between October 1 and December 31, 2010, at the Sequoyah Nuclear Plant Units 1 and 2 near Soddy-Daisy, TN. TVA disagreed with the NCV in a letter dated March 31, 2011.

A. A revised description of the violation is provided below:

Calculation SQNETAPAC was intended, in part, to demonstrate that the design of the Sequoyah Nuclear Plant Auxiliary Power System was in conformance with the description of the degraded voltage protection configuration described in UFSAR Section 8.3. The requirements for degraded voltage protection originate from the requirements of 10 CFR 50, Appendix A, "General Design Criteria (GDC) 17." NRC Branch Technical Position PSB-1, which the licensee is committed to, states, in part, that the selection of undervoltage and time delay setpoints for the degraded voltage relays (DVRs) shall be determined from an analysis of the voltage requirements of the Class 1E loads. The primary purpose of this requirement is to provide assurance that safety-related equipment has adequate voltage when energized from the offsite power supply. The DVR settings at Sequoyah Nuclear Plant are in accordance with TS Table 3.3-14 which states the values to be as follows: Allowable Value ≥ 6403.5 Vac and ≤ 6522.5 Vac, Nominal Trip Setpoint 6456 Vac.

Calculation SQNETAPAC evaluated voltage for motors starting at the onset of an accident using minimum expected grid voltage, and included a methodology that allowed crediting the common service station transformer (CSST) load tap changers to improve voltage. The ETAP (electrical engineering software) results in Section 8.4 of the calculation determined that 6.9kV voltage improved to near 100% within approximately 10 seconds by crediting the load tap changers. Since the degraded voltage relays could reset with bus voltage as low as approximately 6432V (93.2%), the inspectors considered a more limiting case where system voltage could be much lower than expected without causing separation of the safety buses. This would result in much less voltage at the terminals of starting motors at the beginning of an accident than is analyzed in SQNETAPAC.

The licensee analyzed starting of individual motors during bus steady state conditions using a bus voltage of 6558.8 Vac, which is higher than the TS allowable value (6403.5 Vac). The team noted that 6558.8 Vac is non-conservative with respect to the lowest voltage that could occur on the safety buses without transfer to the diesel generators based on Technical Specification setpoints. For example, the team estimated that the DVR could reset as low as 6432 (93.2%) Vac when starting large motors, and would not dropout unless voltage dipped below the analytical limit of 6400 Vac during steady state conditions when starting small motors. The licensee's failure to perform the analysis at the lower values resulted in a concern that postulated voltages in the range between <6558.8 Vac and >6400 Vac might not be adequate for the equipment to perform its required safety function under required degraded voltage scenarios.

The team determined that the calculation, which evaluated LOCA block loading and starting of motors, was inadequate because of: (1) the licensee's failure to perform analyses at the

minimum voltage afforded by the DVR and (2) the licensee's crediting of non safety-related equipment to restore voltage during a degraded voltage event.

B. TVA disputed the NCV for the following reasons:

1. The NRC's position associated with the NCV concerning degraded voltage protection was not consistent with Sequoyah Nuclear Plant Units 1 and 2 licensing basis, and the approach TVA used in addressing degraded voltage protection was, in fact, appropriate.

2. The potential re-analysis of plant loading calculations that would be required in response to the NCV should be processed by the NRC through the backfit process as described in 10 CFR 50.109.

3. The violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," associated with the degraded voltage issue and related calculation was not consistent with the essential purpose of the regulation.

NRC's evaluation and conclusion regarding the licensee denial is discussed below.

NRC EVALUATION

The NRC carefully reviewed TVA's response and concluded that a violation 10 CFR 50, Appendix B, Criterion III, "Design Control" occurred. This determination is based on the following:

1. In its letter of March 31, 2011, TVA disagreed with the NRC position and NCV related to TVA's approach to addressing degraded voltage protection. Specifically, TVA disagreed with the NRC statement requiring evaluation by TVA of post LOCA motor starting using the most limiting voltage afforded by the degraded voltage relay rather than the 6558.8 Vac currently used in the design calculation and suggested that it was not in accordance with their licensing basis. TVA stated that the NRC position in the NCV conflicts with the NRR Branch Technical Position PSB-1 and that the approach taken by TVA was in fact appropriate.

   The requirements for degraded voltage protection originate from the requirements of 10 CFR 50, Appendix A, "General Design Criteria (GDC) 17." Following the July 1976, event at Millstone involving degraded voltage conditions in the plant auxiliary systems, the NRC required all licensees to install degraded voltage protection systems as described in NRC Letter dated June 2, 1977, "Statement of Staff Positions Relative to Emergency Power Systems for Operating Reactors." Further, in Generic Letter (GL) 79-36, "Adequacy of Station Electric Distribution Systems Voltages," the NRC required all licensees, including Sequoyah, to review the electric power systems to determine analytically if, assuming all onsite sources of AC power are not available, the offsite power system and the onsite distribution system is of sufficient capacity and capability to automatically start as well as operate all required safety loads.

   For plants under construction, the requirements of the June 2, 1977, letter and staff guidance described in GL 79-36 were incorporated in NUREG-0800, "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants," Appendix 8-A, "Branch Technical Position (BTP) PSB-1: Adequacy of Station Electric Distribution System

Voltages," Rev. 2 (07/1981) which is part of the licensing basis for the Sequoyah Nuclear Plant. SRP BTP PSB-1 Position 1.a states that the selection of undervoltage and time delay setpoints for the degraded voltage relays shall be determined from an analysis of the voltage requirements of the Class 1E loads.

At Sequoyah Nuclear Plant Units 1 and 2, calculation SQNETAPAC is one of the design calculations of record for degraded voltage protection. This calculation was intended, in part, to demonstrate that the design of the Sequoyah Nuclear Plant Auxiliary Power System was in conformance with the description of the degraded voltage protection configuration described in UFSAR Section 8.3.

The NRC reviewed calculation SQNETAPAC and determined that for certain instances, TVA utilized a non-conservative approach. For motor starting voltage calculations, TVA analyzed motors at a higher voltage than was afforded by the degraded voltage relays, which have a Technical Specification Allowable value of ≥ 6403.5 volts and ≤ 6522.5 Vac. The higher voltage used by TVA was derived from the analysis used to optimize system voltage considering the minimum anticipated range of offsite voltage, and adjusted by operation of load tap changers of the transformers. This analysis was done in accordance with BTP PSB-1, Position 3 and is intended to ensure adequate voltage to system auxiliaries during all modes of operation, and to minimize the probability of losing offsite power following a unit trip, as required by GDC 17. The TVA methodology of assuming minimum expected grid voltage (established by administrative controls) and proper operation of transformer automatic load tap changers is acceptable for the purpose of optimizing system voltages for normal operation. However, these assumptions are not appropriate for evaluating the adequacy of the degraded voltage relay setpoints with respect to (1) the starting and running voltage requirements of Class 1E motors, and (2) the minimum voltage requirements for the most limiting safety related component as delineated in by BTP PSB-1 Position 1.a. The setpoint of the degraded voltage relays is lower than the voltage used in the Sequoyah system voltage optimization calculation and does not satisfy the BTP staff position 1.a (i.e., selection of undervoltage and time delay setpoints for the degraded voltage relays shall be determined from an analysis of the voltage requirements of the Class 1E loads).

The voltage requirements of Class 1E loads for various accident and non-accident operating conditions including motor starting transients should be established. These requirements should be used to determine the setpoint of the degraded voltage relays. Load-flow and voltage drop studies for steady state operation and motor starting transients should validate the minimum acceptable grid voltage and the adequacy of the degraded voltage relay setpoints including time delays. The technical specification (TS) values should validate the design parameters established by the above analyses. Thus, the analyses should determine the worst case voltage afforded by the safety-related undervoltage protection configuration as required by BTP PSB-1. Sequoyah Nuclear Plant Units 1 and 2 should not rely on administrative controls or non-safety voltage regulation equipment to mitigate voltage deficits. As a result, TVA's methodology was not in agreement with the BTP PSB-1.

2. In its letter dated March 31, 2011, TVA states that there are no specific requirements in NRC regulations regarding the method for evaluating the degraded voltage protection system and that NRC has accepted TVA's approach in the calculation and its conformance to BTP, PSB-1 in numerous safety evaluation reports. TVA also suggested that the potential re-analysis of the plant loading calculations that would be required in response to the NCV should be processed by the NRC through the backfit process as described in 10 CFR 50.109.

It should be noted that the staff's review of the conclusions of analyses used to support license amendment requests should not be construed as the staff's acceptance or approval of specific methodologies or detailed calculations to support license amendments. Specifically, the positions taken in the March 31, 2011, letter detail methodologies whereby voltage requirements of Class 1E equipment may be satisfied by administratively controlled voltage and non-safety related load tap changers, in lieu of automatic protection afforded by the safety-related degraded voltage relays. These positions were not stated in previous license amendment applications or their supporting calculations, and were not accepted in NRC SERs.

For example, the NRC reviewed the SERs dated May 24, 1994, and March 1, 1996. Neither these SERs, nor the October 1, 1993 Technical Specification Change Request that preceded them, discuss measures other than the function of the degraded voltage relays for ensuring adequate voltage to safety-related equipment. Specifically, no credit was requested, and no credit was given for voltage above that afforded by the degraded voltage relays, whether it was derived from administratively controlled minimum switchyard voltages, or from non-safety related transformer load tap changers. Therefore, the SER does not provide a licensing basis for crediting administratively controlled switchyard voltage or LTCs when establishing minimum voltage requirements of safety-related equipment in design calculations.

As discussed earlier, the requirements for degraded voltage protection originated from the requirements of GDC 17. Branch Technical Position PSB-1 set forth an acceptable method for complying with the regulations and demonstrating that the applicable setpoints and time delays are adequate to ensure that all safety-related loads are protected and all required safety-related loads have the required minimum voltage at the component terminal to start and run to support a worst-case design basis event (DBE) without any credit for administratively controlled voltage.

The staff has determined that 10 CFR 50.109, "Backfitting" is not applicable to the NCV because the technical position that is stated in the revised Green NCV is consistent with previously issued regulations and communications.

3. TVA questioned the use of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," as the basis for the NCV. The licensee stated that this citation was not consistent with the essential purpose of the regulation as the licensee viewed it as circular logic. TVA stated that as written, the NCV implied that TVA should have used values which were derived from the design basis (i.e. TS) as input requirements to the design basis calculation which itself is the basis from which the TS are derived.

   The NRC determined that calculation SQNETAPAC was subject to the quality assurance requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Processing Plants" because it affects the ability of safety-related components to perform their design basis function. The purpose of calculation SQNETAPAC, "Auxiliary Power System," was to demonstrate that the Sequoyah Nuclear Plant Auxiliary Power System was in conformance with the description of the degraded voltage protection scheme described in UFSAR Section 8.3 and to [confirm] the basis for degraded voltage set points and time delays. It is the staff's position that calculation SQNETAPAC establishes the design basis of the plant and should be used as an input to the TS value for degraded voltage relay settings. As such, the criteria listed in 10 CFR50,

Appendix B, "Design Control" is applicable. The NRC restated the violation, as shown below, to better describe the requirements that were not met.

10 CFR 50, Appendix B, Criterion III, Design Control, states, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis for structures, systems, and components are correctly translated into specifications, drawings, procedures, and instructions.

Contrary to the above, the licensee failed to assure that regulatory requirements of GDC -17 and staff positions described in SPR BTP PSB-1, "Adequacy of Station Electric Distribution System Voltages'" were correctly translated into documents used to establish degraded voltage relay setpoints. Specifically, TVA design calculation SQNETAPAC, "Auxiliary Power System," Revision 38, used to support the Technical Specifications degraded voltage setpoints (TS Section 3/4.3, "Instrumentation," Table 3.3-14, Item 2 specifies the 6900 VC emergency bus undervoltage (degraded) relay trip setpoints to be as follows: Allowable Value ≥ 6403.5 Vac and ≤ 6522.5 Vac, Nominal Trip Setpoint 6456 Vac), credited administrative measures and non-safety related voltage regulation equipment to ensure adequate voltage to all Class 1E equipment, in lieu of demonstrating that the setpoints for the degraded voltage relays specified in Technical Specifications (Allowable Value ≥ 6403.5 Vac) provided adequate voltage to safety-related equipment.

NRC Conclusion

Based on additional inspection and review of the licensee's letter, dated March 31, 2011, disputing the NCV, the staff concludes that: 10 CFR Part 50, Appendix B, Criterion III, "Design Control," and the licensee's commitment to GL 79-36, "Adequacy of Station Electric Distribution Systems Voltage," and staff positions established in NRC letter dated June 2, 1977, "Statement of Staff Positions Relative to Emergency Power Systems for Operating Reactors," are the appropriate requirements for this issue. Specifically, the licensee's failure to adequately check the adequacy of design for the operation of safety-related equipment during degraded voltage conditions constitutes a violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control." Additionally, the staff has determined that 10 CFR 50.109, "Backfitting" is not applicable to the violation because no new requirements are being imposed on TVA. Therefore, the violation occurred as stated in the revised Green NCV.