Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37384-2000

May 25, 2006

TVA-SQN-TS-04-01 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Gentlemen:

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

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - TECHNICAL SPECIFICATIONS (TS) CHANGE 04-01, RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI) (TAC NOS. MC4584 AND MC4585)

References:
1. NRC letter to TVA dated January 13, 2006, "Sequoyah Nuclear Plant, Units 1 and 2 - Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications for Loss of Power Diesel Generator Start Instrumentation (TAC Nos. MC4584 and MC4585)"
2. NRC electronic mail letter to TVA dated April, 28, 2006, "Staff Comments on Draft RAI Response to TS-04-01"
3. TVA letter to NRC dated September 30, 2004, "Sequoyah Nuclear Plant (SQN) - Units 1 and 2 - Technical Specification (TS) Change 04-01, 'New Specification for Loss of Power Instrumentation for Emergency Diesel Generator and Auxiliary Feedwater Actuation'"

This letter responds to the requests for additional information in References 1 and 2 associated with the TS change request in Reference 3. The enclosure provides TVA's responses to NRC's requests. There are no commitments contained in this letter.

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If you have any questions about this change, please contact Jim Smith at 843-6672.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 25th day of May, 2006.

Sincerely,

for

P. L. Pace
Manager, Site Licensing and
Industry Affairs

Enclosure:
Response to Request for Additional Information

cc: See page 3

Enclosure
cc (Enclosure):

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ENCLOSURE

TENNESSEE VALLEY AUTHORITY (TVA)
SEQUOYAH NUCLEAR PLANT (SQN)
UNITS 1 AND 2

NRC Requested Information, January 13, 2006:

The license amendment request (LAR) proposes the addition of new upper limit allowable values for 6.9 kv Shutdown Board - Loss of Voltage - Voltage Sensors and 6.9 kv Shutdown Board - Degraded Voltage - Voltage Sensors in Technical Specification (TS) 3.3.3.11, Table 3.3-14 consistent with Standard Technical Specification Traveler (TSTF)-365 and the addition of a lower allowable value for the 6.9 kv Shutdown Board - Degraded Voltage - Diesel Generator Start and Load Shed Timer in TS 3.3.3.11, Table 3.3-14.

In recent public communications available on the Nuclear Regulatory Commission's (NRC) public website, ADAMS Nos. ML052500004, ML050870008, and ML051660447, the NRC staff has identified a concern on the use of allowable values as limits that are used in TSs to satisfy the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Section 50.36, "Technical Specifications." The NRC staff has been working with the Nuclear Energy Institute's Setpoint Methods Task Force to address these concerns.

To assess the acceptability of your LAR related to this issue, the NRC staff requests the following additional information:

1. "*Describe the instrumentation setpoint methodology used at Sequoyah for establishing TS limits. This discussion should include acceptable as found band, acceptable as left band, setting tolerance, and reset criteria used to determine the acceptability of the instrumentation.*"

   Response:

   Example for Loss of Voltage

   TVA Calculation 27DAT Revision 5 (R5) documents the upper and lower allowable values for the loss of voltage setpoint of 5520 volts. The accuracy terms for repeatability (Re), drift (De), temperature effects (TNe) and power supply variations (PSEe) defined within the calculation are based on manufacturer information and field data. These terms are summarized as follows:

   Re = ± 0.25%
   De = ± 1.9%
   TNe = ± 0.54%
   PSEe = ± 2.0%

   The switch setpoint as-left calibration tolerance (Ab) and input calibration test equipment accuracy (ICTe) allowances are:

Ab = ± 0.5%
ICTe = ± 0.2%

The setpoint is defined as 5520 volts and Anf is defined with the following equation:

$$Anf = \sqrt{Re^2 + De^2 + TNe^2 + PSEe^2 + ICTe^2 + Ab^2} \text{ \% of setpoint}$$

$$Anf = \sqrt{0.25\%^2 + 1.9\%^2 + 0.54\%^2 + 2\%^2 + 0.2\%^2 + 0.5\%^2} \text{ \% of setpoint}$$

Anf = ± 2.873% of setpoint = ± 158.59 volts

The setpoint as-found values are:

5520 + 158.59 = 5678.59 volts
5520 - 158.59 = 5361.41 volts

Ab = ± 0.5% x setpoint 5520 = ± 27.6 volts

The setpoint as-left values are:

5520 + 27.6 = 5547.6 volts
5520 - 27.6 = 5492.4 volts

The instrument loop is made up of the under voltage relay and a voltage transformer. The accuracy value for the transformer is 0.3%. Transformer accuracy class 0.3 value (burdens W, X, M, Y, Z) is supplied by vendor and documented in TVA Calculation 27DAT Attachment 7.

The voltage value at the setpoint is:

5520 x .003 = ± 16.56 volts

$$\text{Loop accuracy is LAn} = \pm [(An_{relay})^2 + (\text{Transformer})^2]^{1/2}$$
$$= \pm [(158.59)^2 + (16.56)^2]^{1/2}$$
$$= \pm 159.45 \text{ volts}$$

Per TVA methodology, the maximum lower allowable value for the loss of voltage is based on the following equation:

Lower Allowable Value =
Limit + (LAn - Measurable Accuracy [Anf])

The low limit is 5300 volts from TVA Calculation SQNETAPAC. This value is above the safety bus motor stall voltage. The safety bus motor stall voltage is used in the voltage profile analysis to ensure the motor voltage including voltage drop of the cabling is sufficient to keep from stalling the motor.

$AVmax_{lower}$ = 5300 + (159.45 - 158.59) = 5300.86 volts

The minimum lower allowable value for the loss of voltage is based on the following equation:

Lower Allowable Value = Setpoint - LAn

$AVmin_{lower}$ = 5520 - 159.45 = 5360.55 volts

From above, the lower allowable value can be 5300.86 to 5360.55 volts. Calculation 27DAT defined the lower TS allowable value to be 5331 volts. This value is approximately halfway between the $AVmax_{lower}$ and $AVmin_{lower}$.

The maximum upper allowable value for the loss of voltage is based on the following equation:

Upper Allowable Value =

Limit - (LAn - Measurable Accuracy [Anf])

The upper limit is 5700 volts from TVA Calculation SQNETAPAC. This value is less than the worst-case transient voltage dip as shown in the voltage profile analysis.

$AVmax_{upper}$ = 5700 - (159.45 - 158.59) = 5699.14 volts

The minimum upper allowable value for the loss of voltage is based on the following equation:

Upper Allowable Value = Setpoint + Anf

$AVmin_{upper}$ = 5520 + 158.59 = 5678.59 volts

From above, the upper allowable value can be 5678.59 to 5699.14 volts. Calculation 27DAT defined the upper TS allowable value to be 5688 volts. This value is approximately halfway between the $AVmax_{upper}$ and $AVmin_{upper}$.

Summary of values for the loss of voltage instrument:

Upper Limit (Analytical)	5700 volts
Allowable Value	5688 volts
As-found	5678.59 volts
As-left	5547.6 volts
Set Point	5520 volts
As-left	5492.4 volts
As-found	5361.41 volts
Allowable Value	5331 volts
Lower Limit	5300 volts

Example for Degraded Voltage

TVA Calculation 27DAT R5 documents the upper and lower allowable values for the degraded voltage setpoint of 6456 volts. The accuracy terms for repeatability (Re), drift (De), temperature effects (TNe) and power supply variations (PSEe) defined within the calculation are based on manufacturer information and field data. These terms are summarized as follows:

Re = ± 0.2%
De = ± 0.5%
TNe = ± 0.2%
PSEe = ± 0.2%

The switch setpoint as-left calibration tolerance (Ab) and input calibration test equipment accuracy (ICTe) allowances are:

Ab = ± 0.5%
ICTe = ± 0.2%

The setpoint is defined as 6456 volts and Anf is defined with the following equation:

$$Anf = \sqrt{Re^2 + De^2 + TNe^2 + PSEe^2 + ICTe^2 + Ab^2}\ \%\ \text{of setpoint}$$

$$Anf = \sqrt{0.2\%^2 + 0.5\%^2 + 0.2\%^2 + 0.2\%^2 + 0.2\%^2 + 0.5\%^2}\ \%\ \text{of setpoint}$$

Anf = ± 0.81% of setpoint = ± 52.29 volts

The setpoint as-found values are:

6456 + 52.29 = 6508.29 volts
6456 - 52.29 = 6403.71 volts

Ab = ± 0.5% x setpoint 6456 = ± 32.28 volts

The setpoint as-left values are:

6456 + 32.28 = 6488.28 volts
6456 - 32.28 = 6423.72 volts

The instrument loop is made up of the under voltage relay and a voltage transformer. The accuracy value for the transformer is 0.3 %. Transformer accuracy class 0.3 value (burdens W, X, M, Y, Z) is documented in TVA Calculation 27DAT Attachment 7.

The voltage value at the setpoint is:

6456 x .003 = ± 19.37 volts

Loop accuracy is $LAn = \pm [(An_{relay})^2 + (Transformer)^2]^{1/2}$
$= \pm [(52.29)^2 + (19.37)^2]^{1/2}$
$= \pm 55.77$ volts

Per TVA methodology, the maximum lower allowable value for the degraded voltage is based on the following equation:

Lower Allowable Value =
Limit + (LAn - Measurable Accuracy [Anf])

The low limit is 6400 volts from TVA Calculation SQNETAPAC. This value is above minimum operating voltage per ANSI C84.1

utilization voltages, Range "B" for normal operation of motors.

$$AVmax_{lower} = 6400 + (55.77 - 52.29) = 6403.48 \text{ volts}$$

The calculation 27DAT defined the lower TS allowable value to be 6403.5 volts.

The maximum upper allowable value for the degraded voltage is based on the following equation:

Upper Allowable Value =
Limit - (LAn - Measurable Accuracy [Anf])

The upper limit is 6526 volts, from TVA Calculation SQNETAPAC. This value is less than where normal operation will not actuate (dropout) the relays and the worst-case transient recovery voltage will reset the relay prior to the expiration of the lower boundary of the accident time delay relay. The reset setting voltage is above the minimum starting voltage to ensure that motors and motor-operated valves have adequate starting voltage.

$$AVmax_{upper} = 6526 - (55.77 - 52.29) = 6522.52 \text{ volts}$$

The calculation 27DAT defined the upper TS allowable value to be 6522.5 volts.

Summary of values for the degraded voltage instrument:

Upper Limit (Analytical)	6526 volts
Allowable Value	6522.5 volts
As-found	6508.29 volts
As-left	6488.28 volts
Set Point	6456 volts
As-left	6423.72 volts
As-found	6403.71 volts
Allowable Value	6403.5 volts
Lower Limit	6400 volts

<u>Example for Diesel Generator Start and Load Shed Timer</u>

TVA Calculation 27DAT R5 documents the upper and lower allowable values for the timer relay setpoint of 300 seconds. The accuracy terms for repeatability (Re), drift (De) and temperature effects (TNe) defined within the calculation are based on manufacturer information and field data. These terms are summarized as follows:

Re = ± 10%
De = ± 2.7%
TNe = ± 7.2% random and ± 5.6% bias

The setpoint as-left calibration tolerance (Ab) allowance is:

$$Ab = \pm 10\%$$

The setpoint is defined as 300 seconds and Anf is defined with the following equation:

$$Anf = \sqrt{Re^2 + De^2 + TNe^2(random) + Ab^2} +/- TNe\ (bias)\ \%\ \text{of setpoint}$$

$$Anf = \sqrt{10^2 + 2.7^2 + 7.2^2 + 10^2} +/- 5.6\ \%\ \text{of setpoint}$$

Anf = ± 21.7% of setpoint = ± 65.1 seconds

The setpoint as-found values are:

300 + 65.1 = 365.1 seconds
300 - 65.1 = 234.9 seconds

Ab = ± 10% x setpoint 300 = ± 30 seconds

The setpoint as-left values are:

300 + 30 = 330 seconds
300 - 30 = 270 seconds

Per TVA methodology, the maximum lower allowable value for the timer relay is based on the following equation:

Lower Allowable Value = Limit + (LAn - Anf)

The low limit is 7 seconds from TVA Calculation SQNETAPAC, the minimum voltage recovery is taken at 6599 in 6 seconds. The timer is the only instrument in the timing circuit, therefore LAn and Anf are equal.

$AVmax_{lower}$ = 7 + (65.1 - 65.1) = 7 seconds

The minimum lower allowable value for the timer is based on the following equation:

Lower Allowable Value = Setpoint - LAn
$AVmin_{lower}$ = 300 - 65.1 = 234.9 seconds

From above the lower allowable value can be 7.0 to 234.9 seconds. Calculation 27DAT defined the <u>lower Tech Spec Allowable Value</u> = 218.6 seconds which was defined as a value of Anf plus 25% of Anf from the setpoint will be used for the lower allowable value.

AV_{lower} = setpoint - (125% x Anf) = 300 - (1.25 x 65.1)
= 300 - 81.4 = 218.6 seconds

The maximum upper allowable value for the timer relay is based on the following equation:

Upper Allowable Value = Limit - (LAn - Anf)

The upper limit is 370 seconds from TVA Calculation SQNETAPAC, the upper limit for the non-accident time delay. Protective devices on the 480V safety-related motors that operate during non-accident conditions have been evaluated to consider that the safety bus voltage is equivalent to having the lowest switchyard voltage that could be sustained without instability or collapse. The protective devices were then evaluated to determine the maximum time delay that can be sustained at this voltage and still allow immediate restart on the diesel generator at rated motor voltage without a protective device trip. This upper limit of the time delay is less than this time. The timer is the only instrument in the timing circuit, therefore LAn and Anf are equal.

$$AVmax_{upper} = 370 - (65.1 - 65.1) = 370 \text{ seconds.}$$

Calculation 27DAT defined the upper TS allowable value to be 370 seconds.

Summary of values for the diesel generator start and load shed timers:

Upper Limit	370 seconds
Allowable Value	370 seconds
As-found	365.1 seconds
As-left	330 seconds
Set Point	300 seconds
As-left	270 seconds
As-found	234.9 seconds
Allowable Value	218.6 seconds
Lower Limit	7 seconds

Setting Tolerance and Reset Criteria

During calibration the setpoint value should be found within the as-found values. If the setpoint is found outside the as-found value then the unit supervisor and the power system operation supervisor are notified and the corrective action is documented in the test log. During the periodic calibration, the instrument will be calibrated as needed and must be left inside the as-left values.

The reset criterion is:

A setpoint found within the as-found value requires adjustment to within the as-left value.
A setpoint found within the as-left value does not require adjustment.

References:

1. 1-SI-TDC-202-235.A, "6.9KV Shutdown Board Loss of Voltage and Degraded Voltage Relay Calibration Train A"

2. 1-SI-TDC-202-235.B, "6.9KV Shutdown Board Loss of Voltage and Degraded Voltage Relay Calibration Train B"

2. *"For the allowable values to be added, clarify whether it is a Limiting Safety System Setting (LSSS) as discussed in 10 CFR 50.36(c)(ii)(A). If you determined that it is not, explain why not.*

The staff will generally use the following criteria to determine whether the allowable values being changed fall within the scope of this LSSS issue or not:

(a) Instrument allowable values and setpoints for TS functions in the Reactor Protection (Trip) System.

(b) Instrument allowable values and setpoints for TS functions that protect a safety limit (SL) (whether or not the Bases designates the function as an LSSS).

(c) Allowable values and setpoints that are not in instrumentation LCOs but whose function protects an SL (whether or not the Bases designate the function as an LSSS)."

Response:

Loss of power (LOP) instrumentation is used to transfer the plant's power supply from the offsite power system to the onsite standby system under conditions where the offsite supply quality is poor for a predetermined time or degraded. The loss of offsite power instrument settings are intended to be set low enough to cause the transfer from the offsite to onsite supply system when the offsite power system won't support the plant. The setting also should not be set too high that would allow a small transient to cause a switch to the onsite supply. Analytical limits for the 6900 volt shutdown buses have been determined for this purpose and the LOP instrumentation monitors these buses. The LOP instruments include the degraded voltage relays and the loss of voltage relays.

The LOP instrument settings anticipate the offsite power supply loss and are not intended to directly protect any safety limits. The reactor protection system trips the reactor directly for low supply voltage by separate instrumentation not part of the LOP system. Tripping the reactor before the reactor coolant pump speed begins to drop will occur at 5022 volts. This voltage is approximately 7% lower than the loss of voltage transfer at 5520 volts.

The setting for the LOP instruments is based on station equipment voltage requirements to assure that safety-related equipment has an adequate power supply. Instrument settings are determined from analytical limits. The voltage regulation analysis is not directly tied to any safety limit. Additionally, the LOP instruments are not part of the reactor protection system. Since the LOP instrument settings are not derived to directly protect the safety limits by automatic action, they are not a LSSS as specified in 10 CFR 50.36(c)(ii)(A).

3. *"As required by 10 CFR 50.36(c)(ii)(A), if it is determined that the automatic safety system does not function as required, the licensee shall take appropriate action. Describe how the surveillance test results and the associated TS limits as determined by the plant setpoint methodology are used to establish the operability of the safety system. Include a discussion of plant processes for evaluating channels identified to be operable but degraded. If the requirements for determining operability of the instrumentation being tested are located in a document other than the TSs (e.g., plant test procedure), discuss how the requirements of 10 CFR 50.36 are met."*

Response:

Engineering design output setpoint and scaling documents (SSDs) will document the as-left calibration tolerance (Ab) and the as-found tolerance for the trip setting. Periodic plant calibration will incorporate the as-found and as-left calibration tolerance value ensuring compliance with the design basis requirements. For the setpoint value found outside the as-left value and inside the as-found value, the setpoint will be adjusted and left within the as-left tolerance per the surveillance requirements. Finding a component outside of the as-found tolerance will cause further review to determine operability and if TSs are violated.

4. *"As required by 10 CFR 50.36(c)(ii)(A), an LSSS be so chosen that automatic protective action will correct the abnormal situation before an SL is exceeded. Discuss how TS limits established by the plant setpoint methodology will ensure that the SL will not be exceeded. Include in your discussion information on the controls you employ to ensure that the as left trip setting after completing periodic surveillances is consistent with your setpoint methodology. If the controls are located in a document other than the TS (e.g., plant test procedure), discuss how those controls satisfy the requirements of 10 CFR 50.36."*

Response:

This is not an LSSS, see discussion in Question 2.

5. *"For setpoints that are not defined as LSSS in response to question 2, discuss what measures have been taken to ensure that it is capable of performing its specified safety functions. Include in your discussion information on the controls you employ to ensure that the as left trip setting after completing periodic surveillances, is consistent with your setpoint methodology. If the controls are located in a document other than the TSs (e.g., plant test procedure),*

discuss how those controls satisfy operability requirements."

Response:

Engineering design output SSDs will specify the as-left calibration tolerance (Ab) and the as-found tolerance for the trip setting as evaluated within TVA Calculation 27DAT R5. Periodic plant calibration will incorporate the as-left calibration tolerance value ensuring compliance with the design basis requirements. The relays are functionally tested monthly. The functional test exercises the relays and verifies operation by relay targets, annunciations and status lights. The functional test does not verify the setpoint value.

A review of the calibrations shows that over a 5 year period, December 2000 through June 2005:

> The relays were never found outside the as-found value.
>
> The relays have been found outside the as-left tolerance only 7 times. This is 7 of 96 relay calibrations.
>
> During the calibration, the relays found inside the as-left value are left as is. These relays have been very reliable and do not require much adjustment, less than 10% of the calibrations.

See Response 1 above for an example of how the values are developed.

References:

1. EEB-TI-28, "Branch Technical Instruction Setpoint Calculations"
2. ISA-S67.04, "Setpoints for Nuclear Safety Related Instrumentation Used in Nuclear Power Plants"
3. TVA Demonstrated Accuracy Calculation 27DAT Rev 5
4. 1-SI-TDC-202-235.A, "6.9KV Shutdown Board Loss of Voltage and Degraded Voltage Relay Calibration Train A"
5. 1-SI-TDC-202-235.B, "6.9KV Shutdown Board Loss of Voltage and Degraded Voltage Relay Calibration Train B"

NRC Requested Information, April 28, 2006:

The following comments are related to the calculations that were included in the Sequoyah draft RAI response for TSC 04-01.

Loss of Voltage

"If Re = ±0.25% shouldn't the first term in the AS-Found Calibration Tolerance (Anf) calculation be "$0.25\%^2$" and not "$0.025\%^2$" ?"

Response:

The response to Question 1 of the RAI has been revised to correct this error.

"If transformer accuracy is not verified at calibration and, therefore, is unmeasurable, how was the transformer accuracy value of 0.3% determined?"

Response:

This information has been included in the response to Question 1.

"How was the lower analytical limit of 5300 volts determined?"

Response:

This information has been included in the response to Question 1.

"Shouldn't the Lower Tech Spec Allowable Value (AV_{lower}) be defined as "a value about halfway between $AVmax_{lower}$ and $AVmin_{lower}$" and not "a value about halfway between the maximum and minimum"?"

Response:

Suggestion has been incorporated as a clarification into the response to Question 1.

"Shouldn't the Upper Tech Spec Allowable Value (AV_{upper}) be defined as "a value about halfway between $AVmax_{upper}$ and $AVmin_{upper}$" and not "a value about halfway between the maximum and minimum"?"

Response:

Suggestion has been incorporated as a clarification into the response to Question 1.

"Please show the calculation for the As-Left values of 5547.6 volts and 5361.6 volts."

Response:

This information has been included in the response to Question 1.

"The value of Anf_{relay} is 158.59 volts. However, it appears that a value of 158.4 volts was used in calculating the As-Found values of 5678.4 volts and 5361.6 volts provided in the summary of values. Please show the calculations for the As-Found values."

Response:

The response to Question 1 of the RAI has been revised to correct this error.

<u>Degraded Voltage</u>

"How was the lower analytical limit of 6400 volts determined?"

<u>Response:</u>

This information has been included in the response to Question 1.

"Please show the calculations for the As-Left values of 6488.28 volts and 6423.72 volts."

<u>Response:</u>

This information has been included in the response to Question 1.

"The value of Anf_{relay} is 52.29 volts. However, it appears that a value of 52.32 volts was used in calculating the As-Found values of 6508.32 volts and 6503.68 volts provided in the summary of values. Please show the calculations for the As-Found values."

<u>Response:</u>

The response to Question 1 of the RAI has been revised to correct this error.

<u>Degraded Voltage Timer</u>

"Why aren't there calculations for the Degraded Voltage Timer similar to the calculations for Loss of Voltage and Degraded Voltage."

<u>Response:</u>

This information has been included in the response to Question 1.