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

July 6, 2006

TVA-SQN-TS-06-04 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 06-04, "MONITORING OF CONTROL OR SHUTDOWN ROD POSITION BY AN ALTERNATE MEANS"

Pursuant to 10 CFR 50.90, Tennessee Valley Authority (TVA) is submitting a request for a TS change (TS-06-04) to Licenses DPR-77 and DPR-79 for SQN Units 1 and 2. Action a.1 of TS 3.1.3.2, "Position Indication Systems - Operating," requires the verification of rod position by use of the moveable incore detectors. TVA is proposing a revision to TS 3.1.3.2 to allow the position of the control and shutdown rods to be monitored by a means other than the moveable incore detectors. The amendment will provide a less burdensome monitoring method should problems with the analog rod position indication (ARPI) system be experienced. When a recurring problem in the system requires the monitoring of a rod's position by the alternate means, TVA plans to continue unit operation and to use the alternate means until the unit enters Mode 5 and repairs to the system can safely be implemented.

A001

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the TS change qualifies for categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and enclosures to the Tennessee State Department of Public Health.

Currently, there is no specific date or milestone by which approval of this amendment is required. However, should a problem with an RPI occur, approval of the amendment may need to be expedited. TVA plans to implement the revised TS within 45 days of NRC approval if there are no equipment problems requiring immediate implementation of the change. Therefore, TVA requests that the implementation of the revised TS be within 45 days of NRC approval.

There are no commitments contained in this submittal.

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 6th day of July, 2006.

Sincerely,

for

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

Enclosures:
1. TVA Evaluation of the Proposed Changes
2. Proposed Technical Specifications Changes (mark-up)
3. Application of Watts Bar RAIs to Sequoyah

cc: See page 3

Enclosures
cc (Enclosures):

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ENCLOSURE 1

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

1.0 DESCRIPTION

This letter is a request to amend Operating Licenses DPR-77 and DPR-79 for SQN Units 1 and 2. This letter proposes a revision to Technical Specification (TS) 3.1.3.2, "Position Indication Systems - Operating." Action a.1 of TS 3.1.3.2 requires the verification of rod position by use of the moveable incore detectors. This amendment request proposes a revision to TS 3.1.3.2 to allow the position of the rod to be monitored by a means other than the moveable incore detectors. For a situation where an analog rod position indication (ARPI) problem exists, TVA plans to monitor the test point voltages of the stationary gripper and lift coils of the affected control rod drive mechanism. Monitoring the position of the rod in this manner will allow for historical data retrieval and will also allow the use of the existing rod deviation alarm.

The proposed amendment will provide a less burdensome alternative should problems with the ARPI system be experienced. When a problem in the system requires the monitoring of a rod's position by the alternate means, TVA plans to use the alternate means until the unit enters Mode 5 and repairs to the system can be safely implemented. TVA considers this alternative to be a better monitoring method than to use the movable incore detectors every 12 hours for an extended period to comply with Action a.1 of TS 3.1.3.2. Compliance in this manner could result in excessive wear on the incore system.

2.0 PROPOSED CHANGE

The proposed change to TS 3.1.3.2 will add a new action that allows use of an alternative rod position monitoring technique. Action a.2.a), a.2.b), and a.2.c) will be incorporated to provide for the alternative monitoring. The new requirements are as follows:

2. a) Determine the position of the non-indicating rod indirectly by the movable incore detectors within 8 hours and once every 31 days thereafter and within 8 hours if rod control system parameters indicate unintended movement, and

b) Review the parameters of the rod control system for indications of unintended rod movement for the rod with an inoperable position indicator within 16 hours and once per 8 hours thereafter, and

c) Determine the position of the non-indicating rod indirectly by the movable incore detectors within 8 hours if the rod with an inoperable position indicator is moved greater than 12 steps and prior to increasing THERMAL POWER above 50% RATED THERMAL POWER and within 8 hours of reaching 100% RATED THERMAL POWER, or

In order to maintain proper numbering considering the addition of a new Action a.2, the numbering of current Action a.2 will be revised to be Action a.3. A footnote is also added that will apply to the new Action a.2. This footnote describes the limitations for the use of these new provisions. The following is the wording of the note:

Rod position monitoring by Actions 2.a), 2.b), and 2.c) may only be applied to one inoperable rod position indicator and shall only be allowed: (1) until the end of the current cycle, or (2) until an entry into MODE 5 of sufficient duration, whichever occurs first, when the repair of the inoperable rod position indication can safely be performed. Actions 2.a), 2.b), and 2.c) shall not be allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable rod position indication could have safely been performed.

In summary, the proposed change will add new requirements to allow alternate monitoring of the rod position when the ARPI system is not capable. This allowance can only be used for one rod indication and can only be used until the next opportunity to safely correct the problem. The alternate monitoring provisions will provide a reasonable indication of rod position without subjecting the movable incore detectors to excessive wear.

3.0 BACKGROUND

TS 3.1.3.2 ensures the rod position indicators are capable of determining the position of the control or shutdown rods. Mechanical or electrical failures may cause a rod to become inoperable or to become misaligned from its group. Rod inoperability or misalignment may cause increased power peaking due to the asymmetric reactivity distribution and a

reduction in the total available rod worth for reactor shutdown. Therefore, rod alignment and operability are related to core operation in design power peaking limits and the core design requirement of a minimum shutdown margin.

The axial position of shutdown rods and control rods are determined by two separate and independent systems:

- The Bank Demand Position Indication (BDPI) System (commonly called group step counters).

- The ARPI System.

The BDPI system counts the pulses from the rod control system that moves the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The BDPI system is considered highly precise (± 1 step or ± 5/8 inch).

The ARPI system provides an accurate indication of actual rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center to center distance of 3.75 inches, which is 6 steps. The normal indication accuracy of the ARPI system is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and ARPI, the maximum deviation between actual rod position and the indicated demand position could be 24 steps, or 15 inches.

Operators utilize the ARPI to monitor the position of the rods to establish the plant is operating within the bounds of the accident analysis assumptions. Power peaking, ejected rod worth, or shutdown margin limits may be violated in the event of an accident with the rods operating outside of their limits. Additional information on the design and operation of the ARPI system is provided in the following sections of the Updated Final Safety Analysis Report (UFSAR):

- 4.0, "Reactor"
- 7.7, "Control Systems Not Required for Safety"
- 15.0, "Accident Analyses"

Should a technical problem with ARPI components inside containment arise, no further action can be taken to address the problem as long as the unit is operating. This is due to the adverse radiological and temperature environment that

exist in the reactor head area prior to entering Mode 5, Cold Shutdown. Further complicating the repair is the requirement that the Control Rod Drive Mechanism (CRDM) ventilation be operated when the hot leg temperatures are above 180 degrees Fahrenheit. Accessing the reactor head area with the CRDM ventilation operating is dangerous.

In addition, an ARPI coil stack may have to be lifted by a crane to allow access to the connectors. For this to occur the missile shield must be removed and this cannot be performed until the unit is in Mode 5. Shutdown of the unit to Mode 5 just to implement the needed repairs is considered inappropriate since other options for the monitoring of the status of the rod are available.

TVA considers the proposed monitoring of the status of the stationary gripper and lift coils to be a valid means of monitoring the position of a rod once the position is confirmed through the use of the moveable incore detectors. TVA plans to monitor the coils until the unit enters Mode 5 and repairs to the system can be safely implemented. The monitoring of the position in this manner also has an added benefit in that it will alleviate a concern regarding the potential for excessive wear of the incore system due to the use of the incore detectors every 12 hours to comply with Action a.1 of TS 3.1.3.2. TVA's concern with the continuous use of the moveable incore detectors is similar to concerns expressed in amendments approved for other utilities. The proposed SQN change is essentially identical to a change recently requested by the Watts Bar Nuclear Plant (WBN). TVA submitted the original WBN request on November 21, 2003, and three supplemental responses in response to NRC's requests for additional information (RAIs). This effort resulted in NRC's approval of Amendment 58 for WBN Unit 1 issued on September 20, 2005. The WBN effort involved several RAIs and for completeness and considering very similar design of the SQN and WBN units, Enclosure 3 includes the questions requested of WBN during their effort and responses applicable to SQN.

There have been other instances where exigent amendment requests were needed in response to ARPI failures and to minimize the wear on movable incore detector instrumentation. Florida Power & Light Company (FPL) submitted such an amendment request on July 29, 2002. Carolina Power and Light Company (CPL) submitted a request on January 16, 2003. The FPL amendment was approved on August 20, 2002, and the CPL amendment was approved on February 13, 2003. Both of these efforts were for the remainder of the current operating cycle as opposed to the permanent request proposed for SQN. Additionally, SQN submitted an exigent amendment request to

NRC on June 16, 1989, that resulted in the issuance of Amendment 118 for Unit 1 as a one-time revision to use similar monitoring techniques for the remainder of Cycle 4 operation. This particular request cited concerns with thimble tube thinning as the primary reason for the request. This concern was identified in NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors."

4.0 TECHNICAL ANALYSIS

In order to assess the proposed changes to TS 3.1.3.2, "Position Indication System - Operating," the following discussion contains three key elements:

1. Operational Events Impacted by Rod Drop or Rod Misalignment

   A. Rod Drop or Rod Misalignment During Power Operation

      A full rod drop of a control or shutdown rod will be immediately detectable by means other than the position indication system. Independent indication of a dropped rod is obtained by using the excore power range signals. This rod drop detection circuit is actuated upon sensing a rapid decrease in flux and is designed such that normal load variations do not cause it to be actuated. Furthermore, a negative reactivity insertion corresponding to the reactivity worth of a full rod drop will cause a noticeable change in core parameters including core average temperature and axial flux depending on the relative worth and core location.

      A rod misalignment may also be detectable by other means such as axial flux deviation or a channel deviation alarm. Based on these factors, operator actions will be initiated which are not dependent on the status of the individual rod position indication system. Considering the preceding, the increase in the likelihood of an undetected rod drop or misalignment is considered to be negligible while the alternate monitoring is used in conjunction with the other available rod drop/misalignment parameter indications.

   B. Rod Drop or Misalignment During Reactor Startup

For a situation where there is an unplanned outage that does not result in an entry into Mode 5, TVA plans to use the alternate monitoring. Since the movable incore detectors cannot be used to determine rod position until sometime after entry into Mode 2 when neutron flux becomes adequate, the alternate method will be utilized during a reactor startup to provide initial verification that the affected rod is fully withdrawn. The proposed method would be utilized to verify that the rod is fully withdrawn by monitoring CRDM traces. Rod position verification using this method will permit startup and entry into Mode 2. As a second diverse check, the movable incore detectors will be used to verify rod position when neutron flux becomes adequate. Following verification that the rod is withdrawn, a rod misalignment would be detectable by means other than the ARPI system, e.g. CRDM trace monitoring, axial flux deviation, channel deviation alarm, and the required operator actions would therefore not be dependent on the status of the individual rod position indicator.

The increase in the likelihood of an undetected rod drop or misalignment is therefore considered to be negligible.

C. Reactor Trip

Following a reactor trip, the position indication system is used to verify that all rods have fully inserted. Emergency boration is required if more than one rod fails to fully insert. The inoperability of the position indication system will prevent verification of the insertion of a rod during a reactor trip. Administrative controls will be used to heighten reactor operator awareness that a ARPI problem exists. This will ensure that emergency boration is initiated as required if a rod other than the rod with the inoperable position indicator does not fully insert.

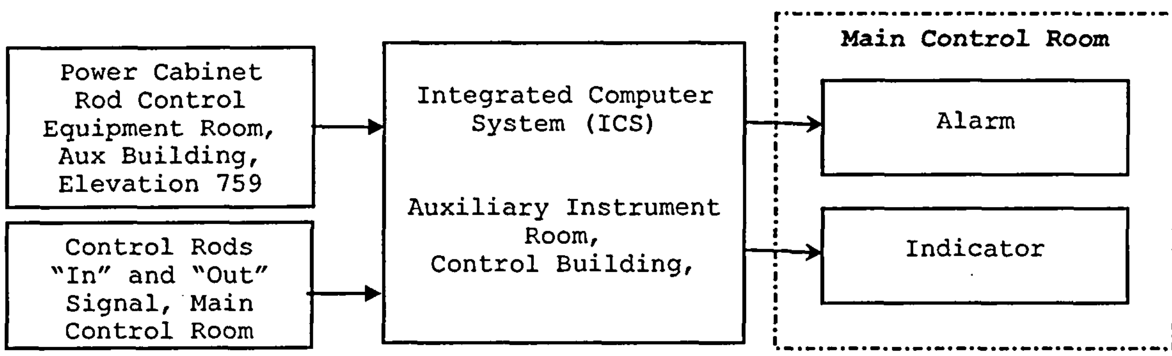
2. Adequacy of the Proposed Monitoring

Compliance with either Action a.1 or the proposed Action a.2.a) will result in the verification of the position of the affected rod within eight hours by use of the moveable incore detectors. Based on available information, the monitoring of the stationary gripper

and lift coils of the CRDM on the non-indicating rod as defined in proposed Action a.2.b) will be initiated.

TVA plans to utilize the plant computer to monitor the stationary gripper and lift coil voltages. Monitoring the inoperable ARPI in this manner will allow for historical data retrieval and will also allow the use of the existing rod deviation alarm. The "Rod at Bottom" status light and the "Rods at Bottom" annunciator for the affected control rod may be disabled. A simplified schematic of the monitoring circuit is provided below:

<u>Proposed Monitoring of Stationary Gripper and Lift Coils</u>



Since the monitoring will be performed by Operations, TVA proposes to continue the monitoring to determine if the coil has changed state on a once every 8 hours basis. Should the parameters of the coils of the monitored rod indicate unintended movement, a determination of the position of the rod will be made using the movable incore detectors within 8 hours. The position of the monitored rod will be established using the movable incore system at least once every 31 days in accordance with proposed Action a.2.a).

The proposed monitoring of rod control system in Action a.2.b) provides a reasonably similar approach to rod position monitoring as that provided by the movable incore detector system. In particular, the ability to immediately detect a rod drop or misalignment is not directly provided by the movable incore detector system or by the monitoring of coil parameters. Additionally, neither the movable incore detector system, nor the monitoring of coil parameters, provides the capability to verify rod position following a reactor trip or shutdown. Therefore, the monitoring of coil parameters, in lieu of the use of the movable incore detector system, provides an equivalent and acceptable method of monitoring rod position while a position

indicator is inoperable and after the initial position is established through use of the movable incore detector system. The proposed Action a.2.b) requires initial review of the rod control system for unintended movement of the affected rod within 16 hours and once every 8 hours thereafter.

Additional requirements are included in Action a.2.c) that require the use of the movable incore system to verify rod position within 8 hours if the rod is moved greater than 12 steps. This provision provides additional assurance that any unintended rod movement is identified in a timely manner. This action also ensures that the position of the inoperable rod is identified during power escalations that result from unit trips or power reductions that do not provide conditions that allow the repair of the ARPI safely. The moveable incore system will be used to verify rod position prior to increasing thermal power above 50 percent rated thermal power (RTP) and within 8 hours of reaching 100 percent RTP. These provisions are intended to establish and confirm the position of the rod with the inoperable ARPI to ensure that power distribution requirements are not violated and to establish a starting point for the proposed alternate monitoring actions.

A note has been added to the proposed actions of TS 3.1.3.2 Action a.2 to clearly describe the conditions that would allow the use of the alternate rod position monitoring provisions. This note specifically limits the use of these provisions to only one rod. This limitation ensures sufficient rod position monitoring on a real time basis to verify core conditions during normal operations and accident conditions. The duration for Action a.2 is limited to the end of the current fuel cycle or an entry into Mode 5 with sufficient duration to repair the ARPI safely. Once the plant has ended the fuel cycle or entered Mode 5 for a sufficient duration, the provisions of proposed Action a.2 are not available for continued power operation. This limitation supports the expectation that the repair of the ARPI must be performed as soon as reasonable conditions exist to safely perform the activities and repeated use of this provision is not acceptable in lieu of the necessary repairs.

3. Potential Impact from Repeated Use of the Moveable Incore Detector System

Based on the preceding information, TVA has concluded that appropriate monitoring of an inoperable ARPI can be achieved without subjecting the movable incore system to repeated use. TVA's concern with the moveable incore detector system is that repeated use of the system could result in:

- A loss of functionality of the system.

- The inability to complete required surveillances.

- A required power reduction and/or shutdown of the unit.

The movable incore detector system is composed of six detector drive units, six 5-path rotary transfer devices, six 10-path rotary transfer devices, and 58 flux thimbles. The 5-path rotary transfer device allows its detector to map its own core locations or another detector's core locations, or to be placed in a shielded storage location. The 10-path rotary transfer device receives the detector from a 5-path device and allows it to access one of up to 10 possible core locations. When a flux trace is taken by a detector, the drive unit pushes the detector through its 5-path rotary transfer device to the selected 10-path rotary transfer device and then through the 10 path to the selected core location. The signal obtained from the detector as it moves through the core is proportional to neutron flux distribution in the core. Although estimated fatigue times are not available for this system, it is judged that repetitive use of the movable incore detector system every 12 hours to fulfill TS 3.1.3.2, Action a.1, could lead to failures of the detectors, drive units, and transfer devices.

If a detector fails, then another detector may be used to map its core locations with no loss of data. However, by using another detector to map both its own and the failed detector's core locations, the wear on the second detector is increased. If a drive unit failure causes a detector to become immovable while inserted into a core location, then the ability to obtain data from the core locations associated with the 10-path device the detector is routed through is lost. If a 5-path rotary transfer device fails, then another detector may be used to map its core locations with no loss of data. However, as with a failed detector, this results in increased wear on the second detector. If a 10-path rotary device fails, then the ability to obtain

data from the core locations associated with that 10-path device is lost.

Failures within the system may prevent the performance of the current Action a.1 of TS 3.1.3.2. Failure to comply with this action results in a power reduction to less than 50 percent in accordance with current TS 3.1.3.2, Action a.2. Failure of the system may also result in the inability to meet the requirements of Technical Requirement (TR) 3.3.3.2, "Movable Incore Detectors." This will prevent the performance of core peaking factor and power distribution measurements every 31 effective full power days (EFPD) as required by the Surveillance Requirements (SRs) for TS 3.2.2, "Heat Flux Hot Channel Factor - FQ(X,Y,Z)," and TS 3.2.3, "Nuclear Enthalpy Rise Hot Channel Factor - $FN_{\Delta H}$ (X,Y)." Additionally, the ability to perform monitoring (SR 4.2.4.2) required by TS 3.2.4, "Quadrant Power Tilt Ratio" may be hindered by system failures. Failure to perform these core peaking factor and power distribution surveillances will require a power reduction and shutdown in accordance with the applicable TS actions.

5.0 REGULATORY SAFETY ANALYSIS

This letter is a request to amend Operating Licenses DPR-77 and DPR-79 for SQN Units 1 and 2. This letter proposes a revision to Technical Specification (TS) 3.1.3.2, "Position Indication Systems - Operating." Action a.1 of TS 3.1.3.2 requires the verification of rod position by use of the moveable incore detectors. This amendment request proposes a revision to TS 3.1.3.2 to allow the position of the rod to be monitored by a means other than the moveable incore detectors. For a situation where an analog rod position indication (ARPI) problem exists, TVA plans to monitor the test point voltages of the stationary gripper and lift coils of the affected control rod drive mechanism. Monitoring the position of the rod in this manner will allow for historical data retrieval and will also allow the use of the existing rod deviation alarm.

5.1 No Significant Hazards Consideration

TVA has evaluated whether or not a significant hazards consideration is involved with the proposed amendments by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No. The proposed change provides an alternative method for the monitoring of the position of a rod once the position of the rod is verified using the moveable incore detector system. The proposed monitoring of rod control system parameters provides a reasonably similar approach to rod position monitoring as that provided by the movable incore detector system. In particular, the ability to immediately detect a rod drop or misalignment is not directly provided by the movable incore detector system or by the monitoring of rod control system parameters. Additionally, neither the movable incore detector system, nor the monitoring of rod control system parameters, provides the capability to verify rod position following a reactor trip or shutdown. Therefore, the monitoring of rod control system parameters, in lieu of the use of the movable incore detector system, provides an equivalent and acceptable method of monitoring rod position while a position indicator is inoperable.

The proposed change does not alter plant equipment that is considered to have the potential to alter the probability of an accident. The affected components are for monitoring only and do not actively affect equipment that interacts with the control of the reactor. Likewise, the affected components are for monitoring and provide an equivalent level of indication of rod position as the current action. This maintains an acceptable level of rod position indication for normal plant operations, as well as post accident mitigation actions. Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No. As described above, the proposed change provides only an alternative method of monitoring the position of a rod. No new accident initiators are introduced by the proposed alternative manner of performing rod position

monitoring. The proposed change does not affect the reactor protection system or the reactor control system. Hence, no new failure modes are created that would cause a new or different kind of accident from any accident previously evaluated.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No. The rod position indicators are required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits. The proposed change does not alter the requirement to determine rod position but provides an alternative method for monitoring the position of the affected rod after the position of the rod is verified using the moveable incore detector system. As a result, the initial conditions of the accident analysis are preserved. The components affected by the alternate rod monitoring will not affect plant setpoints utilized for automatic mitigation of accident conditions or other equipment necessary for accident mitigation.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, TVA concludes that the proposed amendment(s) present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c); and accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The Commission's regulatory requirements related to the content of the TS are contained in Title 10, Code of Federal Regulations (10 CFR), Section 50.36. The TS requirements in 10 CFR 50.36 include the following categories: (1) safety limits, limiting safety systems settings and control settings; (2) limiting conditions for operation; (3) surveillance requirements (SRs);

(4) design features; and (5) administrative controls. The requirements for ARPI are included in the TS in accordance with 10 CFR 50.36(c)(2), "Limiting Conditions for Operation."

As stated in 10 CFR 50.59(c)(1)(i), a licensee is required to submit a license amendment pursuant to 10 CFR 50.90 if a change to the TS is required. Furthermore, the requirements of 10 CFR 50.59 necessitate that U.S. Nuclear Regulatory Commission (NRC) approve the TS changes before the changes are implemented. TVA's submittal meets the requirements of 10 CFR 50.59(c)(1)(i) and 10 CFR 50.90.

NUREG-1431, Revision 3, "Standard Technical Specifications Westinghouse Plants," provides generic recommendations for requirements associated with the operation of Westinghouse Electric Company designed nuclear power plants. NUREG-1431 contains specifications for the ARPI. The proposed change requests an alternate method of monitoring rod position when the installed indication components can no longer support that function. This alternate monitoring method is equivalent to the current TS and NUREG-1431 provisions that utilize the movable incore detectors, which are allowed to be utilized for an indefinite period of time. The proposed change offers an equivalent action to the current NUREG-1431 recommendations. TVA believes that the proposed change meets the intent of the NUREG-1431 recommendations and will not reduce the margin of safety provided in these specifications.

10 CFR, Part 50, Appendix A, General Design Criteria 13 (GDC-13) requires that licensee provide instrumentation to monitor the variables and systems over their operating ranges during normal operation, anticipated operational occurrences, and accident conditions. The current requirement for an inoperable ARPI is to perform a flux map to determine rod position every 12 hours or if the rod is moved more than 24 steps in one direction with the movable incore detectors. This action is allowed for an indefinite period of time. As this verification of rod position is typically on a once per 12 hours interval, the position of the rod at any time between these verifications could be in question. Additionally, in the event of a reactor trip, the rod bottom indication would not be available to verify the rod fully inserted into the core. The proposed alternate monitoring technique likewise would not be able to determine if a rod fully inserted on a reactor trip. However, monitoring of the rod control

system provides a better option for detecting unintended motion of the rod and its actual position than the movable incore detector technique. Even with the proposed 31-day verification of rod position with the movable incore detectors, the actual indicated position of the rod is considered to be as good as or better than the current action requirements. Since both of these actions for an inoperable ARPI are essentially equivalent with respect to rod position indication and both are allowed for an indefinite period of time, the GDC-13 requirements continue to be maintained in an acceptable manner when utilizing the alternate rod position monitoring method.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 50.22(b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letters to NRC from Florida Power & Light Company (FPL) dated July 29, 2002, August 14, 2002, and August 16, 2002.

2. NRC's letter to FPL dated August 20, 2002.

3. Letters to NRC from Carolina Power and Light Company (CPL) dated January 16, 2003, and January 31, 2003.

4. NRC's letter to CPL dated February 13, 2003.

5. TVA's letters to NRC dated November 21, 2003, May 5, 2004, August 19, 2004, and July 11, 2005.

6. NRC's letter to TVA dated September 20, 2005.

7. TVA's letter to NRC dated June 16, 1989.

8. NRC's letter to TVA dated June 23, 1989.

ENCLOSURE 2

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

Proposed Technical Specification Changes (mark-up)

I. AFFECTED PAGE LIST

Unit 1

3/4 1-17

Unit 2

3/4 1-17

II. MARKED PAGES

See attached.

Insert

2.* a) Determine the position of the non-indicating rod indirectly by the movable incore detectors within 8 hours and once every 31 days thereafter and within 8 hours if rod control system parameters indicate unintended movement, and

b) Review the parameters of the rod control system for indications of unintended rod movement for the rod with an inoperable position indicator within 16 hours and once per 8 hours thereafter, and

c) Determine the position of the non-indicating rod indirectly by the movable incore detectors within 8 hours if the rod with an inoperable position indicator is moved greater than 12 steps and prior to increasing THERMAL POWER above 50% RATED THERMAL POWER and within 8 hours of reaching 100% RATED THERMAL POWER, or

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* Rod position monitoring by Actions 2.a), 2.b), and 2.c) may only be applied to one inoperable rod position indicator and shall only be allowed: (1) until the end of the current cycle, or (2) until an entry into MODE 5 of sufficient duration, whichever occurs first, when the repair of the inoperable rod position indication can safely be performed. Actions 2.a), 2.b), and 2.c) shall not be allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable rod position indication could have safely been performed.

LIMITING CONDITION FOR OPERATION

3.1.3.2 The shutdown and control rod position indication system and the demand position indication system shall be OPERABLE and capable of determining the control rod positions within ± 12 steps.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. *With a maximum of one rod position indicator per bank inoperable either:*

   1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 12 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, or

   Insert

   ~~2.~~ 3. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

b. With more than one rod position indicator per bank inoperable either:

   1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 12 hours, and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, and

   2. Place the control rods under manual control, and monitor and record Reactor Coolant System average temperature (T_{avg}) at least once per hour, and

   3. Restore the rod position indicators to OPERABLE status within 24 hours such that a maximum of one rod position indicator per bank is inoperable, or

   4. Be in HOT STANDBY within the next 6 hours.

c. With a maximum of one demand position indicator per bank inoperable either:

   1. Verify that all rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 12 steps of each other at least once per 12 hours, or

   2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

POSITION INDICATION SYSTEMS - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.3.2 The shutdown and control rod position indication system and the demand position indication system shall be OPERABLE and capable of determining the control rod positions within ± 12 steps.

APPLICABILITY: Modes 1 and 2.

ACTION:

a. With a maximum of one rod position indicator per bank inoperable either:

1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 12 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, or

Insert

~~2.~~ 3. Reduce THERMAL POWER TO less than 50% of RATED THERMAL POWER within 8 hours.

b. With more than one rod position indicator per bank inoperable either:

1. Determine the position of the non-indicating rod(s) indirectly by the movable incore detectors at least once per 12 hours, and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, and

2. Place the control rods under manual control, and monitor and record Reactor Coolant System average temperature (T_{avg}) at least once per hour, and

3. Restore the rod position indicators to OPERABLE status within 24 hours such that a maximum of one rod position indicator per bank is inoperable, or

4. Be in HOT STANDBY within the next 6 hours.

c. With a maximum of one demand position indicator per bank inoperable either:

1. Verify that all rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 12 steps of each other at least once per 12 hours, or

2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

ENCLOSURE 3

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

Application of Watts Bar Nuclear Plant (WBN) Requests for Additional Information (RAIs) from NRC Regarding Alternate Rod Position Monitoring to the SQN Technical Specification Change

Please note that the NRC questions below have not been altered and the associated references to WBN specific information may differ from the equivalent SQN information. The SQN responses below will utilize the appropriate SQN information in these responses.

RAI from NRC to WBN dated January 22, 2004

NRC Question 1:

The license amendment request proposes an alternate method to verify rod position when one analog rod position indicator (ARPI) per group is inoperable for one or more groups. The licensee intends to use the voltage of the stationary gripper coil as an alternate means to monitor the rod position of the affected ARPI. The license amendment request does not include a detailed description of the proposed alternate monitoring method and its implementation. The staff requests the licensee to provide:

a) a detailed description of the alternate method, including components relied upon in the alternate monitoring method, the correlation between stationary gripper coil voltage and rod motion (criteria for motion), and how the proposed method will allow the use of the existing rod deviation alarm.

b) a description of the reliability of the proposed monitoring method to guarantee the detection of any rod movement.

Clarification of TVA's Response to Question 1.a:

In order to properly address Part "a" of the first question, TVA has divided the response into the following three segments:

NRC Question 1.a.1:

A detailed description of the alternate method, including components relied upon in the alternate monitoring method.

TVA's Response to Question 1.a.1:

The alternate means of monitoring the rod control movement consist of monitoring the affected ARPI rod control lift coil current, the stationary gripper coil current, and the rod in and out demands by the plant process computer (ICS). The lift coil current will be monitored at the rod control cabinet using the permanently installed test points that monitor the voltage drop across a metering resistor. In a similar manner, the stationary gripper coil current will also be monitored via test points using another metering resistor. These test points develop a small voltage signal that varies with the current that is supplied to their respective coils. These measurement voltage signals will be routed to the process computer analog inputs using temporary cables between the test points to permanently installed cables that are used during outages for response time testing that run between junction boxes in the rod control room, the auxiliary instrument room, and the computer room. Temporary connections will be made between the computer room cable ends and the computer input/output (I/O). These sample voltages will pass through isolation resistors and the computer input has very high input impedance such that this measurement will not impact the normal operation of rod control.

The "IN" and "OUT" signals are sent to control board lamp indicators in the main control room (MCR) on M-4. These lamp voltages originate in the rod control cabinet and illuminate anytime there is a demand for a rod in or out motion, whether the rod control is in bank select, manual, or automatic rod control. These lamp voltages will be sampled by the computer after passing through isolation resistors by passing through permanently installed junction boxes in the MCR, auxiliary instrument room, and then the computer room. These junction boxes and cables are normally used during plant outages for response time testing and would be available during plant operation for this purpose. Temporary connections will be made in the MCR in the back of M-4 to access the lamp voltages and the junction box near M-4. Temporary connections again will be made in the computer room between the ends of the response time cables and the computer I/O.

NRC Question 1.a.2:

The correlation between stationary gripper coil voltage and rod motion (criteria for motion).

TVA's Response to Question 1.a.2:

Based on documentation from the Nuclear Steam Supply System (NSSS) vendor for SQN, Westinghouse Electric Company, the stationary gripper coil is supplied with three different current levels; full, reduced, and zero. With no rod motion, the power cabinet's supply reduced current to the stationary gripper coils (approximately 4 amps or 250 mV across the 0.0625 ohm sampling resistor). This current is sufficient to ensure that the stationary gripper is engaged with the jack shaft preventing any rod motion.

During rod motion, the stationary gripper coils of the rod group in motion alternate between reduced current, full current (approximately 8 amps or 500 mV), and zero current. The pattern is very distinct, and highly repeatable. SQN records this profile at the end of every outage to verify no degradation of power cabinet components has occurred. Data obtained from this procedure verifies the repeatability of the profile. Again, with full or reduced current applied to the stationary gripper coils, the rods cannot move. When the stationary gripper current falls to zero, the stationary gripper lets go of the jack shaft, and the movable and lift coils act together to cause the rods to step in or out. Following the step, the stationary coil resumes operating at reduced current.

If stationary gripper coil current does not fall to zero, then the rod cannot move barring a highly unlikely mechanical failure between the stationary gripper and the jack shaft. If stationary current falls below a threshold based on the reduced current signal, then the rod can move. If the stationary coil signal returns above the threshold within a fixed amount of time (the duration of zero current for each rod's drive mechanism is within a few milliseconds as verified by testing), then the signal implies that a rod step was taken versus a rod drop.

NRC Question 1.a.3:

How the proposed method will allow the use of the existing rod deviation alarm.

TVA's Response to Question 1.a.3:

Based on the preceding discussion, each time the plant computer detects a drop below the threshold for stationary gripper coil current, an algorithm will begin a timer. If the signal does not return above the threshold within a fixed amount of time, the plant computer will generate alarm indicating the possibility of a dropped rod or a failure in the alternate method of monitoring

rod position. If the signal does return above the threshold within the fixed amount of time, the same computer algorithm will use a signal from the rod control "In" and "Out" lights to determine if a step was demanded by the rod control system. If a step was not demanded, the plant computer will generate an alarm. Otherwise, the computer algorithm will increment or decrement a counter representing rod position based on the signal from the rod control logic cabinet (i.e., step out or step in). The initial value of the counter will be determined from bank demand and verified by a use of the incore detectors after the normal means of rod position indication fails. This counter will then be used by the plant computer to determine deviation from other rods and from the bank associated with the rod with the failed rod position indication. If the counter exceeds deviation limits, then the plant computer will generate a deviation alarm as it does currently.

NRC Question 1.b:

A description of the reliability of the proposed monitoring method to guarantee the detection of any rod movement.

TVA's Response to Question 1b:

The alternate method is highly reliable in determining rod movement based on a highly repeatable stationary gripper current profile. SQN verifies the current profiles to the control rod drive mechanisms for all 53 rods every outage. Testing, to date, has not revealed any discrepancies. This suggests that the stationary gripper coil current profile is a reliable indication of rod motion. A software algorithm in the plant computer monitors this profile to look for the characteristics of rod movement. This software algorithm has been tested, and successfully detected rod steps based on the stationary gripper coil current signal.

As described in TVA's response to Part 1.a.1 of this question above, the alternate method relies on some passive components (test point resistor, temporary cabling, permanent plant cabling) and some active components (plant computer interface channels). If any of these components should fail, the alternate method will detect a zero signal for longer than the normally expected time, and produce a computer alarm informing the operators that the alternate method has malfunctioned, and is no longer reliable.

NRC Question 2:

In the current LCO 3.1.8, if one ARPI per group is inoperable for one or more groups, Required Action A.1 requires rod position verification once per 8 hours by using the movable incore

detectors. The proposed amendment would provide an option to initially verify the position of the rod with inoperable ARPI using the movable incore detectors within 8 hours and then review the rod control system parameters verify any rod movement by using the rod control system parameters once per 12 hours after the first verification is completed within 16 hours. If the rod control system parameters indicate an unintended rod movement, the licensee will proceed to verify the rod position using the movable incore detectors anew, which allows up to 8 hours for completion. This implies that the rod position with the inoperable ARPI could be without verification for up to 20 hours (12 hours completion time to verify the rod control system parameters plus 8 hours to complete the movable incore detectors). The staff requests the licensee to provide the technical bases for the extended completion times as proposed in the changes to Technical Specification (TS) 3.1.8.

TVA's Response to Question 2:

The primary reason for the proposed amendment is TVA's desire to limit the use of the moveable incore detectors. The completion time for Action a.2.a) is set at 16 hours. Within the first 8 hours of the 16-hour period, the incore detectors must be used to establish the position of the affected rod. This will satisfy the 8-hour completion time of Actions a.1 and a.2.a). The remaining 8 hours of the 16 hour period will be used to implement the alternate monitoring scheme. If this cannot be achieved, then another flux map will have to be performed to satisfy Actions a.1 and a.2.a) before the second 8 hour period expires.

Once implemented, the proposed monitoring method provides the ability to continuously monitor the position of the affected rod via a recorder. The plant computer provides an output signal representative of rod position in steps to a digital recorder located on a control board in the MCR. This MCR board is near the control board (M-4) where the displays for the ARPIs are located. Further, the implementation of the proposed monitoring method makes the deviation monitor for the affected rod continuously available.

SQN has adopted the once per 8 hour frequency after the first verification of Action a.2.b) in lieu of the 12-hour interval. This interval is more frequent than other SQN surveillances for rod alignment limits but provides a more conservative position to support the alternate rod monitoring. The 8-hour frequency is consistent with the approved requirement for WBN.

A failure in any portion of the alternate monitoring method will result in the plant computer generating an alarm indicating that alternate method can no longer monitor the position of the rod.

This will require that the position of the rod with the inoperable ARPI be established using the incore detectors in accordance with Action a.1 or Action a.2.a). The 8-hour frequency will start immediately after there is indication that the alternate monitoring is not functioning and will continue until the alternate monitoring can be reestablished.

NRC Question 3:

The license amendment request does not include a discussion regarding the impact of the proposed amendment on specific operators training and plant procedures. The staff requests specific information regarding the plant operating procedures to be revised. Will procedure revisions and operator training be completed prior to implementation of the proposed license amendment?

TVA's Response to Question 3:

The proposed alternate monitoring will be implemented as a Temporary Alteration (TA) in accordance with TVA procedure Standard Programs and Processes (SPP) 9.5, "Temporary Alterations." The wiring configuration for the implementation of the TA is represented in the discussion associated with TVA's response to Question 1.a of the RAI. Depending on which rod is the affected rod, a version of the TA that addresses the specific wiring for the affected rod will have to be initiated and approved. The TA initiation and evaluation processes defined in SPP-9.5 require that the procedures impacted by the TA be identified and revised.

Once the proposed amendment request is approved by NRC, the requirements of Standard Department Procedure NADP-6, "Technical Specifications/Licenses and Amendments," will be followed for the implementation of the amendment. This procedure requires that reviews be performed to identify the procedures impacted by the changes to the TS. This review and the impact review performed for SPP-9.5, require that potential impacts to the Updated Final Safety Analysis Report (UFSAR) and to training be identified. The SPP-9.5 and NADP-6 processes will ensure that the documents (procedures, training lesson plans and UFSAR) impacted by the proposed amendment are updated once the amendment is approved.

NRC Question 4:

The licensee considered the reactor startup within the operational events that can be impacted by rod drop or rod misalignment. The licensee stated that they plan to use the proposed monitoring method for a situation where there is an unplanned outage that does not result in an entry into Mode 5.

Additionally, the licensee stated that the alternate method will be utilized during reactor startup to provide initial verification that the affected rod is fully withdrawn by monitoring control rod drive mechanism (CRDM) traces. According to the licensee, the proposed method would permit start up and entry into Mode 2. The staff requests the licensee to explain:

a) How the proposed method will provide initial verification that the affected rod is fully withdrawn and what CRDM traces will be monitored.

b) The basis for Mode 2 entry with an inoperable ARPI.

c) The requirement(s) applicable to Mode 5, 4, 3 or 2 entry (restart following an outage that involved entry into Modes 5 or 6) with an inoperable ARPI.

TVA's Response to Question 4:

LCO 3.1.3.2 is applicable in Modes 1 and 2. For a situation where one ARPI is inoperable, Action a of LCO 3.1.3.2 is applicable. Action a.1 or a.2 may be entered and the unit may operate for an indefinite period of time, as long as compliance with the actions is maintained. The issue of mode changes while complying with an action was clarified by NRC in Generic Letter 87-09, "Sections 3.0 and 4.0 of the Standard Technical Specifications (STS) on the Applicability of Limiting Conditions for Operation and Surveillance Requirements." The following statement is an excerpt from the Generic Letter:

> "For an LCO that has Action Requirements permitting continued operation for an unlimited period of time, entry into an operational mode or other specified condition of operation should be permitted in accordance with those Action Requirements. This is consistent with NRC's regulatory requirements for an LCO. The restriction on a change in operational modes or other specified conditions should apply only where the Action Requirements establish a specified time interval in which the LCO must be met or a shutdown of the facility would be required . . ."

The above statement is consistent with LCO 3.0.4 in SQN's TS. Therefore, in compliance with the current SQN TS, the unit may be shutdown to a mode where LCO 3.1.3.2 is not applicable (Mode 3, 4, 5 or 6) and returned to power operation, as long as Actions a.1 and a.2 are complied with. Compliance with Action a.2 allows indefinite operation of the unit at less than or equal to 50 percent power with the inoperable ARPI and this power level adequately supports use of the incore detectors for verification that the affected rod is aligned with the bank.

The verification of the rod's position through use of the incore detectors fulfills Action a.1 and a.2.a) for the rod with an inoperable ARPI and consistent with the proposed amendment, the alternate monitoring [Action a.2.b)] may be invoked. In the response to Question 1.a of NRC's RAI, TVA clarifies what data will be cataloged by the plant computer and the digital recorder in the MCR based on the signals from the rod control system. TVA intends to use the incore detectors to establish the position of the affected rod during the process. Once established, the position of the rod can be programmed into the computer and changes in the position of the rod will be logged by the computer and the recorder. Based on this, unit operation for startup following a trip or shutdown will proceed in the following manner:

1. Verification that the equipment for the monitoring of the rod control system is in place and can be used to implement proposed Action a.2.b).

2. Entry into Mode 2 from Mode 3 and operation to less than 50 percent power in accordance with proposed Action a.3.

3. Verification of the position of the affected rod prior to 50 percent power using the incore detectors in accordance with Action a.2.c).

4. Programming of the rod location into the plant computer. At this point the rod control system may be used to monitor the position of the rod.

5. Power escalation to 100 percent power and a verification of the position of the rod using the incore detectors within 8 hours of reaching 100 percent power in accordance with Action a.2.c).

6. Completion of Step 5 will begin the 31-day frequency for the next verification of the position of the rod using the incore detectors in accordance with Action a.2.a)

7. Completion of Step 5 will also begin the 8-hour frequency for the review of the rod control system parameters in accordance with Action a.2.b).

If the affected rod is in either control rod Bank C or D, then the rod will be withdrawn to greater than or equal to the step stipulated for power operation in the Core Operating Limit Report (COLR).

NRC Question 5:

The licensee considered the reactor trip within the operational events that can be impacted by rod drop or rod misalignment. Please describe any impacts that the proposed monitoring method could introduce with respect to ensuring that shutdown margin requirements remain satisfied.

TVA's Response to Question 5:

Section 1.1, "Definitions," of the SQN TS defines shutdown margin (SDM) in the following manner:

> "SHUTDOWN MARGIN shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming all full length rod cluster assemblies (shutdown and control) are fully inserted except for the single rod cluster assembly of highest reactivity worth which is assumed to be fully withdrawn."

Consistent with this, the TS Bases indicates that SDM is controlled during power operation by operating with the shutdown banks within the limits of LCO 3.1.3.5, "Shutdown Rod Insertion Limits," and the control banks within the limits of LCO 3.1.3.6, "Control Rod Insertion Limits." In addition to this, several LCOs (listed below) require that the SDM be verified:

LCO	Applicable Requirements
3.1.1, SDM – Tavg > 200°F	LCO statement SR 4.1.1.1.1
3.1.2, SDM–Tavg ≤ 200°F	LCO statement SR 4.1.1.2
3.1.3.1, Movable Control Assemblies	Action a Action c
3.1.3.5, Shutdown Rod Insertion Limits	Action b
3.1.3.6, Control Rod Insertion Limits	Action b
3.3.1.1, Reactor Trip System Instrumentation	Action 5

When required, the verification of SDM is performed in accordance with Surveillance Instruction (SI) 0-SI-NUC-000-038.0, "Shutdown Margin." Performance of this SI in Modes 1 and 2 calculates the SDM as if the unit had tripped and is in Mode 3. The response to a unit trip in SQN's current emergency procedures ensures that appropriate action is taken to establish the reactor is shutdown and stable. Operator actions in response to a reactor trip which requires operation of the safety injection system (SIS), are

controlled by Emergency Operating Instruction E-0, "Reactor Trip or Safety Injection." Step 1 of E-0 verifies the reactor is shutdown.

The expected response of an ARPI is for it to be at the bottom of the scale following a reactor trip. This will not occur for the rod with a non-indicating ARPI. Therefore, for a reactor trip where operation of the SIS is not required, the operator's response is controlled by Emergency Operating Instruction ES-0.1. Step 5 of this instruction verifies that all rods have fully inserted and if two or more rods are not indicating fully inserted, emergency boration is initiated in accordance with Emergency Abnormal Procedure EA-68-4, "Emergency Boration."

NRC Question 6:

10 CFR, Part 50, Appendix A, General Design Criteria 13 (GDC-13) requires that licensee provide instrumentation to monitor the variables and systems over their operating ranges during normal operation, anticipated operational occurrences, and accident conditions. The staff requests the licensee to provide a discussion of how the proposed monitoring method satisfies the requirements of GDC-13.

TVA's Response to Question 6:

According to GDC 13, instrumentation must be available for an operational unit to monitor the variables and systems during normal operation, anticipated operational occurrences, and accident conditions. In addition, the operability, including position indication, of the shutdown and control rods is an initial assumption in all safety analyses that assume rod insertion upon reactor trip. The GDC and analysis assumptions are fulfilled by the design of the ARPI system along with the controls imposed by LCO 3.1.3.2.

The principal functions of the ARPI system include the ability to:

1. Maintain control rod alignment and insertion limits.
2. Manage acceptable power distributions.
3. Maintain appropriate shutdown margins.
4. Limit the potential effects of a rod misalignment on associated accidents.

With consideration of the above functions that the ARPI system must satisfy, TVA provided in Section 4.0 of the license amendment request dated November 21, 2003, a discussion of the following operational events:

1. Rod drop or rod misalignment during power operation.
2. Rod drop or rod misalignment during reactor startup.
3. Reactor trip.

The intent of this discussion was to identify how other available instrumentation or operational controls may be used to satisfy the GDC requirements. As stated in Section 15.2.3, "Rod Cluster Control Assembly Misalignment," of the UFSAR, a rod drop during power operation is normally detected by:

1. Sudden drop in the core power level is seen by the nuclear instrumentation system (excore nuclear detectors).
2. Asymmetric power distribution as indicated by the incore detectors or core exit thermocouples.
3. Rod at bottom signal.
4. Rod deviation alarm (control banks only).
5. Rod position indication.

For the rod affected by the inoperable ARPI, rod position indication and the rod bottom signal will not be available. The other three indications are available along with the indications (computer and recorder) provided by the monitoring of the gripper coil. As indicated in TVA's response to Question 1.a of this RAI, the proposed amendment was structured such that any unintended movement of a rod will be alarmed and will result in the use of the incore movable detectors to verify the position of the rod. This is controlled by Action a.2.a) of the proposed amendment once gripper coil monitoring has been implemented and provides added assurance that a rod drop or misalignment will be detected.

TVA is aware that the alternate monitoring equipment does not provide a means by itself to verify full rod insertion following a reactor trip or shutdown as required by GDC-13. However, TVA's response to Question 5 of this RAI regarding SDM describes the actions currently in place in SQN's emergency procedures that address the addition of boron into the reactor coolant system (RCS) following a plant trip.

The use of the alternate monitoring equipment during unit startup is addressed in TVA's response to Question 4 of NRC's RAI. Based on the preceding information, and that provided in Section 4.0 of the license amendment request, TVA considers that sufficient indication and controls will be provided by existing plant equipment, the alternate monitoring equipment, and site procedures to ensure that either the position of the affected rod is known or in the event of a reactor trip or shutdown, procedural controls will ensure adequate SDM is maintained even with an inoperable ARPI. This position is also supported by TVA's response to Question 1.a of this RAI.

NRC Question 7:

The staff requests the licensee to explain if the proposed TS change and use of the alternate method have any impact on verification of power distribution TS's such as peaking factors, Rod Alignment Limits, Rod Insertion Limits, or on the UFSAR Chapter 15 transient analysis.

TVA's Response to Question 7:

There is no impact on the verification of power distribution TSs such as peaking factors, rod alignment limits, or rod insertion limits. In addition, the UFSAR Chapter 15 transient analysis is not impacted by the implementation of this change. The affected control rod will be assumed to remain functional and aligned until verification to the contrary at a reactor power level less than 50 percent. Should the rod be determined to be positioned other than assumed, a flux map will be utilized to confirm the peaking factors and appropriate actions will be taken to correct deviations.

RAI from NRC to WBN dated May 26, 2004

NRC Question 1:

The proposed REQUIRED ACTION A.2.1 requires to verify the position of the rods with inoperable position indicators by using movable incore detectors within 8 hours and once every 31 days thereafter and 8 hours, if stationary gripper coil parameters indicate unintended movement. The NRC staff requests the licensee provide technical justification for the allowed outage times (AOTs) of proposed action A.2.1.

TVA's Response to Question 1:

Action a.2.a) consists of three distinct requirements:

1. Initial verification of the position of the affected rod using the incore detectors.

2. Reverification of the position of the affected rod every 31 days using incore detectors.

3. Verification of the position of the affected rod using incore detectors whenever the rod control system parameters indicate unintended movement.

The technical justification of completion times proposed for the three actions is defined as follows:

Requirements of Action a.2.a):		Proposed Completion Time:	Basis for Completion Time:
1.	Initial verification of the position of the affected rod using incore detectors.	8 hours	Actions a.2.a) and a.1 are essentially the same. Action a.1 (an existing action) currently has a completion time of 12 hours. The proposed 8 hour completion time for Action a.2.a) is more conservative and has been chosen to be consistent with other completion times in the proposed Action a.2.
2.	Reverification of the position of the affected rod every 31 days using incore	31 days	Included in Enclosure 1 is a section titled "Potential Impact from Repeated Use of the Moveable Incore Detector System." This section of the document clarifies TVA's concern

	detectors.		with the repeated use of the incore detectors over a long period of time. Also included in this section, TVA documents the impact a failure of the incore detectors will have on SQN's ability to perform certain Surveillance Requirements (SRs) for core peaking factor and power distribution measurements on the required 31-day frequency [Heat Flux Hot Channel Factor - $F_Q(X,Y,Z)$," and Nuclear Enthalpy Rise Hot Channel Factor - $F^N_{\Delta H}(X,Y)$]. The proposed completion time for the re-verification action is set at 31 days to coincide with implementation of the SRs.
3.	Verification of the position of the affected rod using incore detectors whenever the rod control system parameters indicate unintended movement.	8 hours	Any indication of unintended movement will be treated as if the ARPI had initially failed. This will result in the verification of the position of the affected rod through the use of the incore detectors within 8 hours. This completion time provides a reasonable length of time to perform the rod position verifications in response to an indication that an unintended change in rod position has occurred.

In addition to the above, TVA discussed similar one-time amendments that had been approved for three utilities in the Background section of Enclosure 1. For these amendments, only a review of the gripper coil parameters every 8 hours was required. The additional verification of the position of the affected rod every 31 days using the incore detectors was not specifically required by the approved amendments. In regard to this, Question 4 (below) requests that TVA address why a periodic surveillance is not required to validate that the rod control system monitoring circuit is functioning properly. TVA considers the 31-day verification of the position of the affected rod by use of the incore detectors to be an appropriate measure to confirm the rod control system monitoring circuit is operating correctly. This, along with the computer alarm (discussed under TVA's response to Questions 2 and 3 below) that will be generated if

the circuit fails, provides adequate assurance that the circuit is functioning properly. In addition, SR 4.1.3.1.2 is performed every 92 days to verify the rods move freely. The computer algorithm used for rod control system monitoring will increment or decrement a counter representing rod position based on the signal from the rod control logic cabinet (i.e., step out or step in - refer to TVA's response to Questions 2 and 3 below for additional information). Considering this and the need to clarify in SQN's licensing basis the capabilities provided by the alternate monitoring process, TVA intends to revise Section 7.7.1.3.2, "Rod Position Monitoring of Full Length Rods," of the UFSAR as a part of the implementation process in accordance with NADP-6, "Technical Specifications/Licenses and Amendments." The proposed revision will discuss the rod control system monitoring process and will clarify that while the alternate monitoring is in use, the operation of the system will be periodically verified through the implementation of SRs 4.1.3.1.2, 4.2.2.2 and 4.2.3.3.

NRC Question 2:

The proposed REQUIRED ACTION A.2.2 requires to review the parameters of the stationary gripper coil for indications of unintended rod movement for the rods with inoperable position indicators within 16 hours and once per 12 hours thereafter. Actual Technical Specifications, REQUIRED ACTION A.1, requires the verification of the rod position with inoperable position indicators every 8 hours. That is, the intention of the actual REQUIRED ACTION A.1 is to provide the position of the affected rod every 8 hours. However, the proposed monitoring method will verify the rod position every 12 hours once the position is established with the incore detectors. The NRC staff requests the licensee provide technical justification for the 12 hours frequency of the proposed action A.2.2.

NRC Question 3:

The proposed rod position monitoring method intends to monitor the rod control system parameters for indication of "unintended" rod movement for the rods with inoperable position indicators. The NRC staff requests the licensee provide a technical justification of why the rod position will be monitored with the incore detectors only in case of unintended rod movement. Please provide the justification of why the rod position does not need to be verified using the incore detectors if the rod is intentionally moved.

TVA's Response to Question 2 and Question 3:

In order to address NRC's Question 2 and Question 3, the following factors must be established:

Rod movement - intentional and unintentional:

The control rod banks may be automatically controlled from input signals generated by the reactor control system or by manual means controlled by the unit operator. The shutdown rods are manually controlled by the unit operator. The automatic function of the control rod drive system maintains a programmed average temperature in the RCS by adjusting the position of the rods which regulates core reactivity. During steady-state operation the reactor control system maintains RCS average temperature to within plus or minus 1.5 degrees Fahrenheit of the reference temperature. Consistent with this, intentional rod movement occurs when either:

1. A unit operator manually demands motion from the rod control system, or

2. A temperature or power mismatch demands motion while the rod control system is being controlled automatically.

TVA considers unintended movement to be the release of the stationary gripper (i.e., the loss of stationary gripper coil current) when no action was demanded either manually or automatically from the rod control system. This type of uncontrolled loss of current to the coil may result in an unintended rod step or a rod drop. In addition, TVA has concluded that unintended movement must also include rod motion in a direction other than the direction demanded by the rod control system, and/or release of the stationary gripper when none was demanded by the rod control system.

Alarm and monitoring capabilities of the proposed alternate plan:

Once implemented, the proposed alternate monitoring will provide the ability for a unit operator to continuously monitor the position of the affected rod via a recorder. The plant computer provides an output signal representative of rod position in steps to a digital recorder located on a control board (M-5) in the MCR. This MCR board is adjacent to the control board (M-4) where the displays for the ARPIs are located. Further, the implementation of the proposed monitoring method makes the deviation monitor for the affected rod continuously available. The functions of the recorder and the deviation monitor are available to indicate or alarm for intended or unintended rod movements.

Measures proposed by TVA to address Question 2 and Question 3:

The completion time for the review of the parameters of the alternate monitoring system for the SQN proposed change is once every 8 hours to be consistent with the 8-hour completion time for the verification of the position of the affected rod by use of the incore detectors.

In order to monitor if the affected rod stepped in the direction that was demanded, the timing of the lift coil energizing will be analyzed by a software algorithm, and compared to demand signals generated by the rod control system to determine if the rod stepped in the direction demanded.

For any of the following three situations, the software algorithm will generate a plant computer alarm:

1. The rod stepped in the wrong direction.

2. The rod stepped with no demand (whether in automatic or manual control).

3. The alternate monitoring circuit fails.

Once an alarm is received, Action a.2.a) is applicable and the position of the rod will have to be determined within 8 hours of the alarm by use of the incore detectors. In addition, the computer alarm generated by either of the first two conditions may be accompanied by a rod control system urgent alarm which is annunciated in the MCR. The alternate circuit will be tested each 92 days when rods are exercised for SR 4.1.3.1.2 by virtue when the rods step, it should not alarm. If it alarms, then either there was a rod misstep or the detection circuit failed.

NRC Question 4:

In case of rod position indicator failure and entry into LCO 3.1.8, Condition A, the licensee may use the proposed method to monitor the position of the affected rod. The proposed method will use the incore detectors to locate the rod with the inoperable ARPI. Then, the licensee will program the rod location into the plant computer to start monitoring the rod position by reviewing the stationary gripper coil parameters. The NRC staff requests the licensee explain if a test/calibration procedure will be performed in order to ensure the proper functioning of the proposed monitoring method prior to its use and if a surveillance test will be performed on a periodic basis.

TVA's Response to Question 4:

As a means to verify that the operation of the software algorithm, TVA tested software using signal data obtained from CRDM timing tests. Further, TVA considers the 31 day verification of the position of the affected rod by use of the incore detectors to be an appropriate measure to confirm the functionality of the circuit (refer to the responses to Question 1 above). This, along with the computer alarm that will be generated if the circuit fails, provides adequate assurance that the circuit is operating properly. In addition, SR 4.1.3.1.2 is performed every 92 days to verify the rods move freely. This test will be used to establish the monitoring circuit is operating as designed. As stated previously, TVA intends to clarify in SQN's licensing basis the capabilities provided by the alternate monitoring process. This will be accomplished through a revision to Section 7.7.1.3.2, "Rod Position Monitoring of Full Length Rods," of the UFSAR. The proposed revision will discuss the rod control system monitoring process and will clarify that while the alternate monitoring is in use, the operation of the system will be periodically verified through the implementation of SRs 4.1.3.1.2, 4.2.2.2, and 4.2.3.3.

NRC Question 5:

The licensee states the proposed monitoring method will provide a less burdensome alternative should future problems with the Analog Rod Position Indication System be experienced. In Enclosure 1 of the license amendment request, the licensee states that: "When a problem in the system requires the monitoring of a rod's position by the alternate means, TVA plans to use the alternate means until the unit enters MODE 5 and repairs to the system can be safely implemented." Based on this statement, and the licensee's plan to use the proposed method, the staff requests the licensee clarify if a NOTE condition will be implemented in the TS in order to specify the length of time the alternate monitoring method will be used until the ARPI is repaired. An example NOTE addressing the NRC staff concerns regarding the use of the proposed method could be:

NOTE: Rod position monitoring by actions A.2.1 and A.2.2 shall only be allowed: (1) until the end of the current cycle, or (2) until an entry into MODE 5 of sufficient duration, whichever occurs first, when the repair of the inoperable ARPI(s) can safely be performed. Actions A.2.1 and A.2.2 shall not be

allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable ARPI(s) could have safely been performed.

TVA's Response to Question 5:

The suggested note is included in the proposed SQN request. Action a.2.c) has been included in the note as well to address rod movement in excess of 12 steps and the start-up limitations.

RAI from NRC to WBN during teleconference on June 9, 2004

NRC Question:

In TVA's response dated May 5, 2004, to NRC's request for additional information (RAI), TVA listed in the response to Question 4 a series of steps for unit startup and operation following a trip or shutdown. In Step 3, TVA indicated that the position of the affected rod will be verified using the incore detectors at power levels less than 50 percent rated thermal power (RTP). TVA further indicated in the response to Question 7 in the May 5, 2004, letter that position of the affected rod will be verified at less than 50 percent power. NRC questioned that the proposed amendment contains no formal controls to ensure that the position of the rod with the inoperable Analog Rod Position Indicator (ARPI) will be verified at power levels less than 50 percent.

TVA's Response to NRC's Question:

Action a.2.c) is included in the proposed SQN amendment request. This action has the following three requirements and addresses the situation where the unit is shutdown to Mode 3 and will be returned to full power operation without repair of the ARPI:

1. Verification of the position of the rod using the incore detectors within 8 hours if the affected rod is moved greater than 12 steps.

2. Verification of the position of the rod using the incore detectors prior to escalating power above 50 percent RTP, and

3. Reverification of the position of the rod using the incore detectors within 8 hours of the unit returning to 100 percent RTP from a power level less than 50 percent RTP.

Based on the requirements of Action a.2.c), unit operation for startup following a trip or shutdown to Mode 3 will proceed in the following manner:

1. Verification that the equipment for the monitoring of the rod control system is in place and can be used to implement proposed Action a.2.b).

2. Entry into Mode 2 from Mode 3 and operation to less than 50 percent power in accordance proposed Action a.3.

3. Verification of the position of the affected rod using the incore detectors in accordance with Action a.2.c).

4. Programming of the rod location into the plant computer. At this point the parameters of the rod control system may be used to monitor the position of the rod.

5. Power escalation to 100 percent power and reverification of the position of the rod using the incore detectors in accordance with Action a.2.c).

6. Completion of Step 5 will begin the 31-day frequency for the next verification of the position of the rod using the incore detectors in accordance with Action a.2.a)

7. Completion of Step 5 will also begin the 8 hour frequency for the review of the rod control system parameters in accordance with Action a.2.b).

RAI from NRC to WBN during teleconference on August 6, 2004

NRC Question:

A teleconference was held with NRC on August 6, 2004, to discuss the information provided in Enclosures 1 and 2 of this letter. As a result of this discussion NRC indicated that TVA should clarify the alarm functions that will be available once an Analog Rod Position Indication (ARPI) has failed. The question was that the monitoring of the Rod Control System (RCS) parameters proposed in the amendment request may not provide adequate feedback to the unit operators. Therefore, a comparison of the alarm functions available when the position of the rod is verified using the incore detectors and the RCS monitoring should be provided.

TVA's Response to NRC's Question:

The process computer presently provides several alarm functions that are concerned with rod positioning. In particular, alarm windown XA-55-4B-25, is a common alarm that originates in the computer that provides these rod control alarm functions:

- Incorrect Rod Overlap or Sequence
- Rod to Rod Deviation Status
- Rod > 12 Steps from Bank Demand Counter

The rod overlap or sequence alarm is not impacted by the failure of the RPIs since it originates from the rod control cabinets themselves and the addition of these monitoring circuits will in not impact its operation. Since the rod-to-rod deviation status and the rod > 12 steps from bank demand counter depends upon the operation of the RPIs, the rod representative position signal generated via the computer algorithm will be substituted into the calculation for these two alarms and will annunciate in the same manner as before. In the event of an alarm, the operators will respond to the alarm in a similar way as if the RPI had still been in service. He will then observe his RPI gauges, demand counters, as well as the recorder showing the failed RPI position to ascertain the cause of the alarm.

Alarm Functions Available During the Use of the Incore Detectors

Should an ARPI fail prior to the approval of the amendment for the alternate monitoring process, the incore detectors will be used to determine the position of the rod every 12 hours. In addition to the periodic flux map, the actions taken may include the removal of the failed ARPI field cable from the RPI electronics in the auxiliary instrument room and that particular

channel scaled with a resistor pack to show a constant rod position equal to the demand for its bank. This action would be necessary to clear the rod bottom alarm for the affected rod in the plant annunciator system and ICS computer system.

The constant rod position will also clear rod deviation alarms for rod to rod and the rod to bank deviations. The deviation alarm may not be valid for the rod with the failed ARPI. Therefore the input to the plant computer from the rod with the failed ARPI would no longer be used in the rod supervisory program on the computer. This would prevent a meaningless alarm from being generated by the affected rod since the position of the affected rod is unknown until a flux map is performed. This also disables the rod deviation monitor function for the one affected rod.

Alarm Functions Available During Monitoring of the Rod Control System Parameters

The temporary alteration that implements the monitoring of the RCS parameters will specify using a resistor pack in the RPI electronics in the auxiliary instrument room. The resistor pack will impact the operation of the "ROD BOTTOM" alarm as discussed above. The addition of the resistors will also cause the MCR board RPI indicators to display constant rod position for the affected rod even if the rod was moving with or independent of its bank.

The ARPI to the plant computer will no longer be used in the rod supervisory program which would eliminate the meaningless alarm. The proposed rod monitoring algorithm will provide the input to the rod supervisory program for the affected rod. This will allow the rod deviation monitor to continue to operate for the rod with the failed ARPI. If the proposed monitoring determines that too many or not enough steps occurred within the bank, the rod supervisory program on the plant computer will alert the operator with an audible plant computer generated alarm.

Rod Position Monitoring Method	Rod Bottom Indication	Rod Deviation Monitor
Incore Detectors	• Unavailable for rod with failed ARPI. • "RODS AT BOTTOM" alarm unavailable for rod with failed ARPI. Available for other 52 rods.	• Both rod-to-rod and rod-to-bank deviation monitors unavailable for rod with failed ARPI. Available for other 52 rods.
Rod Parameters	• Unavailable for rod with failed ARPI • "RODS AT BOTTOM" alarm unavailable for rod with failed ARPI. Available for other 52 rods.	• Both rod-to-rod and rod-to-bank deviation monitors are available for the rod with the failed ARPI. Also available for other 52 rods.

RAI from NRC to WBN during teleconference on April 8, 2005

NRC Question 1:

The licensee proposed to determine the rod position within eight hours for unintended rod movement only of an inoperable Analog Rod Position Indicator (ARPI). Shutdown rods are not expected to move throughout the cycle without operator action. Therefore, any rod movement would require the operator to determine its position. In the case of control rods, the rods may move intentionally due to operator demand on the Rod Control System or temperature mismatch when in automatic control, or unintentionally due to loss of current to gripper coils, or rod motion in a direction not demanded by the Rod Control System. Monitoring the gripper coil voltage would not identify a mechanically stuck rod. The proposed alternate method, as described in the August 19, 2004 RAI Response submittal, monitors the rod movement demanded by the Rod Control System, not the actual rod position for the control rods. Under the proposed alternate method, the rod-to-rod deviation alarm and the rod-to-bank deviation alarm that are available receive input from the resistor pack (demanded position) that will be installed, instead of the ARPI system (actual position). The licensee may become unaware of a misaligned rod for an extended period of time for intended rod movement. If the rod is moved with no ARPI available to indicate the actual rod position, there ought to be some verification that the rod moved as demanded, whether intended or unintended. The staff's concern is that the requirement should be tied to actual moved rod position, not intent.

TVA's Response to Question 1:

The maximum rod misalignment (greater than 12 steps) is an initial assumption in the safety analysis that directly affects core power distributions and assumptions of available SDM. However, it is important to understand that during an operational cycle, rod movement is generally within the limits of the deviation monitor (12 steps) unless the unit experiences a transient. For general reactivity adjustments, the only rod group that is moved is Control Bank D. The other control banks or all of the shutdown banks are routinely not moved for reactivity adjustments and for these banks, the monitoring and alarm functions provided by the alternate means are fully adequate to ensure that the position/status of the rod with the inoperable ARPI is known.

The proposed SQN amendment request includes Action a.2.c) which requires verification of rod position with the movable incore detectors within 8 hours if the rod with the inoperable position indicator is moved greater than 12 steps.

NRC Question 2:

To perform S.R. 3.1.5.1, "Rod Group Alignment Limits", the position of the rod banks are read from the Computer Enhanced Rod Position Indication (CERPI) system which obtains its information from the ARPI system. For a rod with an inoperable ARPI, the position of the rod is assumed from the alternate proposed method, which does not provide the same assurance of rod position as the ARPI or the incore flux map. An unknown rod position may affect the power peaking in the core. This in effect, may reduce the total rod worth available for a safe reactor shutdown in a design basis accident. The staff's concern is the proposed alternate method results in a reduction in safety margin since the assumed initial conditions of the accident analyses may no longer be preserved. The staff is also concerned how the licensee will assure shutdown margin and other Chapter 15 requirements are met under this condition.

The licensee proposed to have only two inoperable ARPIs at the same time. Currently, the plant is analyzed for one rod of the highest worth stuck out. The staff requests the licensee provide the calculations and analytical results which show the plant will meet shutdown margin and be brought down to a safe shutdown condition with two inoperable ARPIs (whether two control rods, two shutdown rods, or one control and one shutdown rod) misplaced in the core. The number of ARPI(s) that can be inoperable should be based on the ability to meet the shutdown margin (SDM). Rod Bottom Indication will not be available for the rod with the failed ARPI. The licensee can no longer verify the rod position for the inoperable ARPI(s) after a reactor trip, which places the plant in an unanalyzed condition. For every ARPI that is inoperable, the licensee should assume the affected rod is not capable of providing negative reactivity following a reactor trip and the licensee should count that ARPI against the SDM to ensure SDM can still be met.

TVA's Response to Question 2:

SDM calculations performed in accordance with SI 0-SI-NUC-000-038.0, "Shutdown Margin," account for the rod of most worth being stuck in the full-out position. Emergency operating instructions are then relied upon to address the SDM requirements following a

unit trip. The following information clarifies the actions of the two principal instructions that address a unit trip and how stuck rods and/or SDM are addressed. Also provided below is a discussion on the boration sources available and the TS required actions:

E-0, "Reactor Trip or Safety Injection"

This instruction contains the Operator actions that are taken to respond to a reactor trip which requires operation of the safety injection system. The safety injection system is one of the key three systems that constitute the emergency core cooling system (ECCS). The ECCS initially feeds borated water to the RCS from the refueling water storage tank (RWST).

Step 1 of E-0 verifies the reactor is shutdown. If it is determined that the reactor did not trip (reactor trip breakers will not open or no rod bottom indication), the operator is instructed to initiate instruction FR-S.1, "Nuclear Power Generation/ATWS." Step 20 of FR-S.1 instructs the operator to perform a SDM calculation in accordance with 0-SI-NUC-000-038.0. The SDM calculation takes into account the number of stuck or untrippable rods and adjusts the boron concentration to compensate for the loss of negative reactivity. Further, Step 22 of E-0 initiates the termination of the operation of the safety injection system in accordance with Emergency Operating Instruction ES-1.1, "SI Termination." Step 36 of ES-1.1 initiates the implementation of Appendix C, "Surveillances and Reports," of ES-1.1. Step 1.c of the appendix initiates the performance of an SDM calculation in accordance with 0-SI-NUC-000-038.0.

ES-0.1, "Reactor Trip Response"

For a reactor trip where operation of the safety injection system is not required, the operator's response is controlled by Emergency Operating Instruction ES-0.1. Step 5 of this instruction verifies that all rods have fully inserted and if two or more rods are not indicating fully inserted, action is taken to initiate an emergency boration.

The following statement is made as part of NRC's Question 2:

> ". . . The number of ARPI(s) that can be inoperable should be based on the ability to meet the shutdown margin (SDM). Rod Bottom Indication will not be available for the rod with the failed ARPI. The licensee can no longer verify the rod position for the inoperable ARPI(s) after a reactor trip, which places the plant in an unanalyzed condition . . ."

The second sentence of the above statement is correct in that the rod bottom light will not function for the rod with an inoperable ARPI. The first sentence implies that the number of inoperable ARPIs must be based on the ability to meet SDM requirements. Action a of the current approved version of LCO 3.1.3.2 allows one ARPI per bank to be inoperable.

It is important to remember that the rod cluster control assemblies are divided into four control banks and four shutdown banks. Six of the banks are divided into two groups (12 groups total). Shutdown Banks C and D have only one group each. This results in there being 14 groups total for all banks and a total of 8 banks. Although TVA management will not permit operation in this condition, the current "Action a" of LCO 3.1.3.2 will allow SQN to operate with up to 8 ARPIs inoperable at the same time. This means that if, a unit trip occurs during the period the 8 ARPIs were inoperable, the operator will not receive the rod bottom lights for 8 rods. The current mechanism available to the operator to address an event such as this is the emergency operating instructions. Accordingly, operating in this manner is not "an unanalyzed condition." The use of the emergency operating instructions for this function is not unique to SQN.

NRC Question 3:

Describe how the alternate monitoring process will be implemented. Include in this discussion, details on the work control processes that will be followed during the installation and use of the temporary equipment.

TVA Response to Question 3:

TVA currently plans to implement the changes to the ARPI circuit to install the alternate monitoring equipment as a TA in accordance with TVA SPP 9.5, "Temporary Alterations." Section 3.3, "Temporary Alteration Control Form (TACF)," of the SPP governs the type of TA that will be developed to support the alternate monitoring. Permanent plant modifications are implemented in accordance with SPP-9.3, "Plant Modifications and Design Change Control."

The process defined in SPP-9.5 for the type of TA that will be implemented is broken into eight parts: (1) Initiation; (2) Evaluation; (3) Approval; (4) Installation, (which includes revising affected drawings, procedures, instructions, and documents); (5) Return to Normal; and (6) Closure.

During the evaluation phase, the same effort goes into the TA that goes into a permanent plant design change. A 10 CFR 50.59 screening review is performed and a complete 10 CFR 50.59

evaluation is performed when required. A TA is also performed using the guidelines contained in SPP-9.3. Part of this will include a design review of the TA. This process is defined in SPP-9.3 and will involve all organizations responsible for site documents impacted by the TA. This will ensure that the impacted documents are identified and updated to properly implement the TA. Following this portion of the process, plant management reviews the package and either approves it or recommends cancellation or revision. The approval process includes the review and approval by the Plant Operations Review Committee (PORC). The PORC is a multidisciplined committee responsible for providing an oversight review of documents required for the safe operation of the plant. The PORC advises the Plant Manager on matters related to nuclear safety.

Upon approval by PORC and plant management, the TA will be implemented by a work order (WO). The initiation and implementation of a WO is controlled by SPP-7.1, "On Line Work Management." The planning process for a WO used to implement a TA is the same as that used for a permanent plant modification. If the work is identified as critical (trip sensitive), the WO is screened by plant management to ensure the appropriate precautions are placed in the WO. Once the TA is installed, the modification is tested as part of the WO to ensure it functions properly. The removal of the TA and the return of the circuit to its original configuration also requires testing to verify the affected equipment is performing properly. This testing is also performed as an element of the WO process. Further, the removal of the TA from the circuit will require a review to ensure the documents revised as a result of the TA are returned to the original plant configuration.

The preceding discussion was a general overview of SQN's work control process. The following discussion is provided to detail the work control process. TVA considers this process to be very robust since both the TA and the implementing WO pass through numerous reviews and approvals prior to implementation. Also provided below is a discussion on the testing of the software algorithm.

Work Planning and Control of Risk:

In addition to SPP-7.1, Technical Instruction 0-TI-DSM-000-007.1, "Risk Assessment Guidelines" controls SQN's work control risk evaluation processes. SPP-7.1 specifies the general responsibilities and standard programmatic controls for the work control process during plant operation. This procedure applies

to all work activities that affect or have the potential to affect a plant component, system, or unit configuration. Work performed during a planned or forced outage is controlled by SPP-7.2, "Outage Management."

SQN's long-term maintenance plan is a product of the preventive and surveillance process and specifies the frequency for implementation of maintenance and surveillance activities necessary for the reliability of critical components in each system. An established 12-week rolling schedule includes the preliminary defense-in-depth assessment, which documents the allowable combinations of system and functional equipment groups (FEGs) that may be simultaneously worked online or during shutdown conditions. FEGs are sets of equipment that have been evaluated for acceptable out-of-service combinations. They are used to schedule planned maintenance and establish equipment clearances.

Predetermined FEG work windows are established for online maintenance and outage periods. The work windows are based on recommended maintenance frequencies and sequenced to minimize the risk of online maintenance. Work windows are defined by week and repeat at 12-week intervals. The work windows ensure required surveillances are performed within their required frequency and that division/train/loop/channel interferences are minimized. The SQN Scheduling organization maintains a long-range schedule based on required surveillance testing of online activities and plant conditions.

The surveillance testing schedule provides the "backbone" for the long-term maintenance plan. Other periodic activities (preventive maintenance items) are scheduled with related surveillance tests to maximize component availability. FEGs are used to ensure work on related components is evaluated for inclusion in the work window. Related corrective maintenance (CM) activities are also evaluated for inclusion in the work window provided by surveillance and preventive maintenance performance. The inclusion of identified work in the FEG work window with the surveillance tests and preventive maintenance items maximizes component availability and operability.

The 0-TI-DSM-000-007.1 risk assessment methodology is used for online maintenance activities. For online maintenance a risk assessment is performed prior to work window implementation and emergent work is evaluated against the assessed scope.

The 0-TI-DSM-000-007.1 risk assessment guidelines utilize the results of the SQN Probabilistic Safety Analysis (PSA). Other safety considerations, such as TSs, are also used to determine which system, component, and FEG combinations may be worked

online. In addition, an assessment of scheduled activities is performed before implementation of a work window. The assessment includes reviews for the following:

- The schedule is evaluated against the risk basis outlined in the SQN PSA.
- Maximizing safety (reduce risk) when performing online work.
- Avoidance of recurrent entry into a specific LCO for multiple activities. Activities that require entering the same LCO are combined to limit the number of times an LCO must be established, thus maximizing the equipment's availability.
- If the risk associated with a particular activity cannot be determined, Nuclear Engineering is requested to perform a risk assessment.

Testing of the Software Algorithm:

As a means to verify that the operation of the software algorithm, TVA tested similar software using signal data obtained from CRDM timing tests. Further, TVA considers the 31 day verification of the position of the affected rod by use of the incore detectors to be an appropriate measure to confirm the functionality of the circuit (refer to the responses to Question 1 above). This, along with the computer alarm that will be generated if the circuit fails, provides adequate assurance that the circuit is operating properly. In addition, SR 4.1.3.1.2 is performed every 92 days to verify the rods move freely. This test will be used to establish the monitoring circuit is operating as designed. TVA intends to clarify in SQN's licensing basis the capabilities provided by the alternate monitoring process. This will be accomplished through a revision to Section 7.7.1.3.2, "Rod Position Monitoring of Full Length Rods," of the UFSAR. The proposed revision will discuss the rod control system monitoring process and will clarify that while the alternate monitoring is in use, the operation of the system will be periodically verified through the implementation of SRs 4.1.3.1.2, 4.2.2.2, and 4.2.3.3.

NRC Question 4:

Provide a detailed description of the functions provided by the software algorithm used to support the alternate monitoring process.

TVA Response to Question 4:

Listed below are the key functions supported by the software algorithm:

1. Numerical Display of Rod Position:

   The software in the Integrated Computer System (ICS) will maintain the position for the affected ARPI by counting successful "IN" or "OUT" steps taken by the rod. The position of the rod is displayed in the number of steps the rod is removed from fully inserted (e.g., 0-243 steps) and is available on the ICS. In addition, the ICS provides an output signal representative of rod position in steps to a digital recorder located on a control board (M-5) in the MCR. This MCR board is adjacent to the control board (M-4) where the displays for the ARPIs are located.

2. Rod-to-Rod Deviation Alarm:

   The software will compare the ARPI it is monitoring to the other ARPIs in the bank and generate a rod-to-rod deviation alarm if a difference of more than 12 steps exists. The alarm will be displayed in the same alarm window (XA-55-4B-25) as that used for the normal rod-to-rod deviation algorithm.

3. Rod-to-Bank Deviation Alarm:

   The software will compare the ARPI it is monitoring to the associated bank demand and generate a rod-to-bank deviation alarm if a difference of more than 12 steps exists. As with the rod-to-rod deviation alarm, the alarm will be displayed in alarm window (XA-55-4B-25).

4. Monitoring of Rod Position:

   The software will analyze the CRDM coil currents to determine if an inward or outward step was demanded and taken and decrement or increment a counter accordingly. Provided below is additional information regarding the monitoring functions provided by the alternate monitoring process:

Rod movement - intentional and unintentional:

The control rod banks may be automatically controlled from input signals generated by the reactor control system or by manual means controlled by the unit operator. The shutdown rods are manually controlled by the unit operator. The automatic function of the control rod drive system maintains a programmed average temperature in the RCS by adjusting the position of the rods which regulates core reactivity. During steady-state operation the reactor control system maintains RCS average temperature to within plus or minus 1.5 degrees Fahrenheit of the reference temperature. Consistent with this, intentional rod movement occurs when either:

1. A unit operator manually demands motion from the rod control system, or

2. A temperature or power mismatch demands motion while the rod control system is being controlled automatically.

Alarm and monitoring capabilities of the proposed alternate plan:

Once implemented, the proposed alternate monitoring will provide the ability for a unit operator to continuously monitor the position of the affected rod via a recorder. The plant computer will be configured to provide an output signal representative of the failed ARPI rod position in steps to a digital recorder located on the control board on M5 or M6. These boards are located near the control board (M-4) where the ARPI indicating meters are located. Further, the implementation of the proposed monitoring method makes the deviation monitor for the affected rod continuously available. The functions of the recorder and the deviation monitor are available to indicate or alarm for intended or unintended rod movements.

In order to monitor if the affected rod stepped in the direction that was demanded, the timing of the lift coil energizing will be analyzed by a software algorithm, and compared to demand signals generated by the rod control system to determine if the rod stepped in the direction demanded.

For any of the following three situations, the software algorithm will generate a plant computer alarm:

1. The rod stepped in the wrong direction.

2. The rod stepped with no demand (whether in automatic or manual control).

3. The alternate monitoring circuit fails.

Once an alarm is received, Action a.2.a) is applicable and the position of the rod will have to be determined within 8 hours of the alarm by use of the incore detectors. In addition, the computer alarm generated by either of the first two conditions may be accompanied by a rod control system urgent alarm which is annunciated in the MCR.

If a malfunction of the rod control system occurs or the temporary alteration fails, the software will cause an annunciation via the ICS with the statement that the alternate means is not reliable. The following conditions will cause this alarm:

- The loss of the signal from the stationary coil with no change in the lift coil signal. For this condition there will be no indication of rod motion which suggests the alternate means failed or rod control malfunctioned.

- The indication of outward rod motion (sequencing of stationary and lift coil) when inward rod motion was demanded.

- The indication of inward rod motion when outward rod motion was demanded.

- The loss of the stationary coil signal for an extended (abnormal) duration.

NRC Question 5:

Provide design and licensing basis information related to the rod of most worth.

TVA Response to Question 5:

As indicated in Section 4.3.1.5, "Shutdown Margins" of the UFSAR, all Sequoyah analyses which involve a reactor trip assume that the single, highest worth rod cluster control assembly (RCCA) remains in the full-out position following the reactor trip. This is consistent with the "stuck rod" requirement discussed in General Design Criterion (GDC) No. 26 contained in 10 CFR 50, Appendix A. Compliance with the requirements of GDC No. 26, "Reactivity Control System Redundancy and Capability," (and related GDC No. 27, "Combined Reactivity Control Systems Capability) is summarized in Section 3.1.2 of the Sequoyah UFSAR. References to other sections of the UFSAR which contain details regarding Sequoyah compliance with GDC Nos. 26 and 27 are

included in general discussion in Section 3.1.2.

The Sequoyah design basis transients are summarized in Section 15.0 of the Sequoyah UFSAR. Consistent with Section 4.3.1.5 of the UFSAR, the following design basis transients assume that the highest worth RCCA fails to insert into the core following a reactor trip.

UFSAR Section	Title
15.2.1	Uncontrolled RCCA Bank Withdrawal from a Subcritical Condition
15.2.2	Uncontrolled RCCA Bank Withdrawal at Power
15.2.4	Uncontrolled Boron Dilution
15.2.5	Partial Loss of Reactor Coolant System Flow
15.2.7	Loss of External Electrical Load and/or Turbine trip
15.2.8	Loss of Normal Feedwater
15.2.9	Loss of All Off-Site Power to the Station Auxiliaries (Station Blackout)
15.2.10	Excessive Heat Removal Due to Feedwater System Malfunctions
15.2.11	Excessive Load Increase Incident
15.2.12	Accidental Depressurization of the Reactor Coolant System
15.2.13	Accidental Depressurization of the Main Steam System
15.2.14	Spurious Operation of the Safety Injection System at Power
15.3.4	Complete Loss of Forced Reactor Coolant Flow
15.3.6	Single RCCA Withdrawal at Full Power
15.3.7	Steamline Break with RCCA Withdrawal
15.4.2.1	Main Steamline Break
15.4.2.2.	Main Feedline Break
15.4.3	Steam Generator Tube Rupture
15.4.4	Single Reactor Coolant Pump Locked Rotor

NRC Question 6:

Update the proposed changes to LCO 3.1.8 to clarify that the alternate process may only be applied to one inoperable ARPI. Also clarify in the Bases for LCO 3.1.8, the rod control system parameters that will monitored by the alternate process.

TVA Response to Question 6:

This provision is included in the SQN proposed amendment request.

NRC Question 7:

Describe the procedural controls that will be in place, whenever the alternate monitoring process is used, to ensure the Operators will be aware that the rod bottom light will not work for the affected rod.

TVA Response to Question 7:

Described in the response to Question 3 above is the process that will be followed to determine the plant documents that must be revised when the TA is implemented. Key documents like SIs and other procedures will be addressed by this process. The intent of Question 7 was to specifically identify the measures that will be taken to ensure the Operations staff is aware that the TA has been implemented and the alternate monitoring must be implemented. TVA intends to use two established processes (discussed below) to ensure the Operations staff is aware of the changes being made to the circuit for the inoperable ARPI. Both of these processes are controlled by Standard Department Procedure OPDP-1, "Conduct of Operations:"

1. Issuance of a Standing Order:

   Standing orders are used to convey information such as administrative policy, designation of turnover times, requirements to transmit particular operating data to management, limitations of access to certain areas and equipment, shipping and receiving instructions, and other similar long-term or policy matters. For the implementation of the TA addressed in the proposed amendment, use of a standing order ensures the staff is aware the TA is in place, the equipment malfunction the TA addresses and any relevant precautions or additional information.

2. Shift Turnover Checklist:

   Procedure OPDP-1, "Conduct of Operations," Attachment J, "Shift Turnover," documents two requirements relevant to the control of the implementation of the TA. First, the oncoming operators must review the documents specified on their checklists before assuming responsibility for their shift position. For the oncoming shift the checklist requires the review of standing orders and TAs. Secondly, the individual being relieved is responsible for passing on all pertinent information concerning work under his jurisdiction to the operator coming on-shift.

In addition, an overview of the standing order may be included in requalification training for the licensed operators. This will be contingent on the time period the standing order remains in effect.