SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 334 TO FACILITY OPERATING LICENSE NO. DPR-77

AND AMENDMENT NO. 327 TO FACILITY OPERATING LICENSE NO. DPR-79

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 **INTRODUCTION**

By letter dated November 22, 2013, as supplemented by letters dated December 16, 2014; June 19, 2015; July 24, 2015; August 5, 2015; and August 31, 2015 (Agencywide Documents and Management System (ADAMS) Accession Nos. ML13329A881, ML14350B364, ML15176A678, ML15205A404, ML15218A185, and ML15244A781, respectively), the Tennessee Valley Authority (TVA, the licensee) requested changes to the technical specifications (TS) for Sequoyah Nuclear Plant (SQN) Units 1 and 2. The proposed changes would revise the current technical specifications (CTS) to the improved technical specifications (ITS).

This Safety Evaluation (SE) of the proposed ITS conversion is based on the application, the information provided to the US Nuclear Regulatory Commission (NRC) through the Sequoyah ITS Conversion web page hosted by Excel Services Corporation (as docketed by the licensee), and supplements provided, as discussed above.

To expedite its review of the application, the NRC staff issued its requests for additional information (RAIs) through the Sequoyah ITS Conversion web page, and the licensee addressed the RAIs by providing responses on the web page. Entry into the database was protected so that only the licensee and NRC reviewers could enter information into the database to add RAIs (NRC) or provide responses to the RAIs (licensee); however, a public, read-only version of the website was available during the review process to allow members of the public to view the questions asked and the responses provided (http://www.excelservices.com/).

To be in compliance with the regulations for written communications for license amendment requests (LARs), the NRC staff required that the licensee docket its responses to the RAIs be submitted under oath or affirmation with regards to its accuracy. The majority of the RAIs were submitted in LAR Supplement 2 dated June 19, 2015. The remaining RAIs KAB069, MHC003, and MHC006 are in LAR Supplement 3 dated July 24, 2015. The revised TS markups for the various Sections are available in the following ADAMS packages:

TS Section	ADAMS Accession No.	TS Section	ADAMS Accession No.
1.0	ML15176A678	3.6	ML15205A404
2.0	ML15176A678	3.7	ML15205A404
3.0	ML15176A678	3.8	ML15205A404
3.1	ML15176A678	3.9	ML15205A404
3.2	ML15176A678	4.0	ML15176A678
3.3	ML15205A404 ML15244A781	5.0	ML15176A678
3.4	ML15176A678		
3.5	ML15176A678		

In the final phase of the review, the questions, responses, and all attachments were submitted as supplemental to the original submittal under oath or affirmation on the licensee's docket.

The additional information provided in the supplemental letters did not expand the scope of the application as noticed and did not change the NRC staff's initial proposed finding of no significant hazards consideration published in the *Federal Register* on June 24, 2014 (79 FR 35807).

2.0 **BACKGROUND**

SQN Units 1 and 2 have been operating in accordance with the TS issued with the original Facility Operating Licenses dated September 17, 1980 and September 15, 1981, respectively, as amended. SQN's CTS is formatted similarly to NUREG-0452, "Standard Technical Specifications [STS] for Westinghouse Pressurized Water Reactors." NUREG-0452 is one of the original versions of the STS. The proposed conversion to the ITS is based upon:

- SQN CTS;
- "Final Policy Statement on Technical Specification Improvements for Nuclear Power Reactors" (Final Policy Statement), published on July 22, 1993 (58 FR 39132);
- Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications," as amended July 19, 1995 (60 FR 36953); and
- NUREG-1431, Revision 4.0, "Standard Technical Specifications – Westinghouse Plants," April 2012 (ADAMS Accession No. ML12100A222) as modified by the following three Technical Specifications Task Force (TSTF) Travelers:
    - TSTF-490, Revision 0, "Deletion of E Bar Definition and Revision to RCS [Reactor Coolant System] Specific Activity Tech Spec."
    - TSTF-510, Revision 2, "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection."
    - TSTF-522, Revision 0, "Revise Ventilation System Surveillance Requirements to Operate for 10 hours per Month."

The TSTF is a group of industry representatives that interacts with NRC staff regarding the improvements to the STS. A TSTF Traveler is a document submitted by the TSTF requesting changes to the STS. The above Travelers, though NRC-approved, have yet to be incorporated in NUREG-1431.

Hereinafter, the proposed TS for SQN are referred to as the ITS, the existing TS are referred to as the CTS, and the improved standard TS, as issued in NUREG-1431, are referred to as the ISTS. The corresponding Bases are ITS Bases, CTS Bases, and ISTS Bases, respectively. In addition to basing the ITS on the ISTS, the Final Policy Statement, and the requirements in 10 CFR 50.36, the licensee retained portions of the CTS as a basis for the ITS.

During the course of its review, the NRC staff utilized the SQN ITS conversion database to issue RAIs. The RAIs served to clarify the ITS with respect to the guidance in the Final Policy Statement and the ISTS. The NRC staff required that the licensee docket the SQN ITS conversion database in a sworn statement with regards to its accuracy, as well as docket all RAIs and responses under oath and affirmation, in a supplement to the license amendment.

Consistent with the Commission's Final Policy Statement and 10 CFR 50.36, the licensee proposed transferring some CTS requirements to licensee-controlled documents (such as the SQN Technical Requirements Manual (TRM)), for which changes to the documents by the licensee are controlled by a regulation (e.g., 10 CFR 50.59) and which may be made without prior NRC approval. NRC-controlled documents, such as the TS, may not be changed by the licensee without prior NRC approval. In addition, human factors principles were emphasized to add clarity to the CTS requirements being retained in the ITS, and to define more clearly the appropriate scope of the ITS. Further, significant changes were proposed to the CTS Bases to make each ITS requirement clearer and easier to understand.

The overall objective of the proposed amendment, consistent with the Final Policy Statement, is to rewrite, reformat, and streamline the SQN CTS to provide clearer, more readily understandable requirements to ensure safer operation of the plant, while still satisfying the requirements of 10 CFR 50.36. During its review, the NRC staff relied on the Final Policy Statement, 10 CFR 50.36, and the ISTS as guidance for acceptance of CTS changes. This SE provides a summary basis for the NRC staff's conclusion that use of the licensee's proposed ITS based on ISTS, as modified by plant-specific changes, is acceptable for continued operation of SQN Units 1 and 2. This SE also explains the NRC staff's conclusion that the ITS is consistent with the SQN current licensing basis (CLB) and the requirements of 10 CFR 50.36.

This SE relies on the following license conditions to be included in the facility operating license: (1) the relocation of CTS requirements into licensee-controlled documents as part of the implementation of the ITS; and (2) the schedule for the first performance of new and revised surveillance requirements (SRs).

3.0 **REGULATORY EVALUATION**

Section 182a of the Atomic Energy Act (the "Act") requires that applicants for nuclear power plant operating licenses will provide:

> [S]uch technical specifications, including information of the amount, kind, and source of special nuclear material required, the place of the use, the specific characteristics of the facility, and such other information as the Commission may, by rule or regulation, deem necessary in order to enable it to find that the utilization . . . of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public. Such technical specifications shall be a part of any license issued.

In 10 CFR 50.36, the Commission established its regulatory requirements related to the content of TS. In doing so, the Commission placed emphasis on those matters related to the prevention of accidents and the mitigation of accident consequences. As recorded in the Statements of Consideration, "Technical Specifications for Facility Licenses; Safety Analysis Reports" (33 FR 18610, December 17, 1968), the Commission noted that applicants were expected to incorporate into their TS "those items that are directly related to maintaining the integrity of the physical barriers designed to contain radioactivity." Pursuant to 10 CFR 50.36, TS are required to include items in the following five specific categories: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation (LCOs); (3) surveillance requirements (SRs); (4) design features; and (5) administrative controls. However, the rule does not specify the particular requirements to be included in a plant's TS.

For several years, the NRC and industry representatives sought to develop guidelines for improving the content and quality of nuclear power plant TS. On February 6, 1987, the Commission issued an interim policy statement on TS improvements, "Interim Policy Statement on Technical Specification Improvements for Nuclear Power Reactors" (52 FR 3788). During the period from 1989 to 1992, utility owners groups and the NRC staff developed ISTS (e.g., NUREG-1431) that would establish model TS based on the Commission's policy for each primary reactor type. In addition, the NRC staff, licensees, and owners groups developed generic administrative and editorial guidelines in the form of a "Writer's Guide" for preparing TS, which gives appropriate consideration to human factors engineering principles and was used throughout the development of plant-specific ITS.

In September 1992, the Commission issued NUREG-1431, Revision 0, which was developed using the guidance and criteria contained in the Commission's Interim Policy Statement. The ISTS in NUREG-1431 were established as a model for developing the ITS for Westinghouse-type plants. The ISTS reflect the results of a detailed review of the application of the Interim Policy Statement criteria, which have been incorporated in 10 CFR 50.36(c)(2)(ii) to generic system functions. The review for retention and relocation of specific TS LCOs, commonly referred to as the "Split Report," is documented in a letter from Thomas E. Murley, NRC, to the nuclear steam supply system vendor owners groups dated May 9, 1988. ISTS also reflect the results of extensive discussions concerning various drafts of ISTS so that the application of the TS criteria and the Writer's Guide would consistently reflect detailed system configurations and operating characteristics for all reactor designs. As such, the generic Bases presented in NUREG-1431 provide an abundance of information regarding the extent to which the ISTS present requirements that are necessary to protect public health and safety.

On July 22, 1993, the Commission issued its Final Policy Statement, expressing the view that satisfying the guidance in the policy statement also satisfies Section 182a of the "Act" and 10 CFR 50.36. The Final Policy Statement described the safety benefits of the ISTS and encouraged licensees to use the ISTS as the basis for plant-specific TS amendments and for complete conversions to ITS based on the ISTS. In addition, the Final Policy Statement gives guidance for evaluating the required scope of the TS and defines the guidance criteria to be used in determining which of the LCOs and associated SRs should remain in the TS. The Commission noted that in allowing certain items to be relocated to licensee-controlled documents while requiring that other items be retained in the TS, it was adopting the qualitative standard enunciated by the Atomic Safety and Licensing Appeal Board in Portland General Electric Co. (Trojan Nuclear Plant), ALAB-531, 9 NRC 263, 273 (1979). There, the Appeal Board observed:

> There is neither a statutory nor a regulatory requirement that every operational detail set forth in an applicant's safety analysis report (or equivalent) be subject to a technical specification, to be included in the license as an absolute condition of operation which is legally binding upon the licensee unless and until changed with specific Commission approval. Rather, as best we can discern it, the contemplation of both the Act and the regulations is that technical specifications are to be reserved for those matters as to which the imposition of rigid conditions or limitations upon reactor operation is deemed necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety.

By this approach, existing LCO requirements that fall within or satisfy any of the criteria in the Final Policy Statement should be retained in the TS; those LCO requirements that do not fall within or satisfy these criteria may be relocated to licensee-controlled documents. The Commission codified the four criteria in 10 CFR 50.36 (60 FR 36953, July 19, 1995). They are stated as follows:

Criterion 1 Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

Criterion 2 A process variable, design feature, or operating restriction that is an initial condition of a design basis accident [DBA] or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 3 A structure, system, or component [SSC] that is part of the primary success path and which functions or actuates to mitigate a DBA or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 4 An SSC which operating experience or probabilistic risk assessment [PRA] has shown to be significant to public health and safety.

Part 4.0 of this SE explains the NRC staff's determination that the conversion of the SQN CTS to ITS based on ISTS, as modified by plant-specific changes, is consistent with the SQN current licensing basis, the requirements and guidance of the Final Policy Statement, and 10 CFR 50.36.

4.0 TECHNICAL EVALUATION

In its review of the SQN ITS application, the NRC staff evaluated five types of CTS changes as defined by the licensee. The NRC staff's review also included an evaluation of whether existing regulatory requirements are adequate for controlling future changes to requirements that are removed from the CTS and placed in licensee-controlled documents. The following are the types of CTS changes:

A Administrative - Changes to the CTS that do not result in new requirements or change operational restrictions and flexibility.

L Less Restrictive - Changes to the CTS that result in reduced restrictions or added flexibility.

M More Restrictive - Changes to the CTS that result in added restrictions or reduced flexibility.

LA Removed Details - Changes to the CTS that eliminate detail and relocate the detail to a licensee-controlled document. Typically, this involves details of system design and system description including design limits, description of system operation, procedural details for meeting TS requirements or reporting requirements, and cycle-specific parameter limits and TS requirements redundantly located in other licensee-controlled documents.

R Relocated Specifications - Changes to the CTS that relocate requirements that do not meet the selection criteria of 10 CFR 50.36(c)(2)(ii).

The ITS application included a justification for each proposed change to the CTS in a numbered discussion of change (DOC), using the above letter designations, as appropriate. In addition, the ITS application included an explanation of each difference between ITS and ISTS requirements in a numbered justification for deviation.

The DOCs for the CTS, as presented in the ITS application, are listed and described in the following four tables (for all ITS Sections) provided as Attachments 7 through 10 to this SE:

- Table A - Administrative Changes
- Table L - Less Restrictive Changes
- Table M - More Restrictive Changes
- Table R - Relocated Specifications (R) and Removed Detail Changes (LA)

These tables provide a summary description of the proposed changes to the CTS. The tables are only meant to summarize the changes being made to the CTS. More details of the technical justifications and how they are being made to the CTS or ITS are provided in the licensee's application and supplemental letters.

The NRC staff's evaluation and additional description of the kinds of changes to the CTS requirements listed in Tables A, L, M, and R attached to this SE are presented in Sections A through E as follows:

- Section A - Administrative Changes (A)
- Section B - Less Restrictive Changes (L)
- Section C - More Restrictive Changes (M)
- Section D - Removed Detail Changes (LA)
- Section E - Relocated Specifications (R)

The control of specifications, requirements, and information relocated from the CTS to licensee-controlled documents is described in Section F below.

A. Administrative Changes to the CTS (A)

Administrative changes are intended to incorporate human factors principles into the form and structure of the ITS so that plant operations personnel can use them more easily. These changes are editorial in nature or involve the reorganization or reformatting of CTS requirements without affecting technical content or operational restrictions. In order to ensure consistency, the NRC staff review of the licensee-proposed ITS used the ISTS as guidance to reformat and make other non-technical changes to CTS. Administrative changes are not intended to add, delete, or relocate any technical requirements of the CTS. Examples of changes that Staff has found acceptable include:

- Identifying plant-specific wording for system names

- Reformatting, renumbering, and rewording of CTS with no change in intent

- Splitting up requirements currently grouped under a single current specification and moving them to more appropriate locations in two or more specifications of the ITS

- Presentation changes that involve rewording or reformatting for clarity (including moving an existing requirement to another location within the TS) but that do not involve a change in requirements

- Wording changes and additions that are consistent with CTS interpretation and practice, and that more clearly or explicitly state existing requirements

- Deletion of obsolete TS

- Deletion of redundant TS requirements that exist elsewhere in the TS

Table A attached to this SE lists the administrative changes being made in the SQN ITS conversion. Table A is organized in ITS order by each A-type DOC to the CTS, provides a summary description of the administrative change that was made, and provides CTS and ITS references. The NRC staff reviewed all of the administrative and editorial changes proposed by the licensee and finds them acceptable because they are compatible with the ISTS, do not result in any change in operating requirements, and are consistent with the Commission's regulations.

B. Less Restrictive Changes to the CTS (L)

Less restrictive changes include deletions of and relaxations to portions of the CTS requirements that are being retained in the ITS. When requirements have been shown to give little or no safety benefit, their relaxation or removal from the TS may be appropriate. In most cases, relaxations previously granted to individual plants on a plant-specific basis were the result of (1) generic NRC actions, (2) new NRC staff positions that have evolved from technological advancements and operating experience, or (3) resolution of the Owners Groups' comments on ISTS. In developing the ISTS, NRC staff reviewed generic relaxations contained in the ISTS and found them acceptable because they are consistent with current licensing practices and the Commission's regulations. The SQN plant design was also reviewed to determine if their specific design basis and licensing basis are consistent with the technical basis for the model requirements in the ISTS and thus provide a basis for ITS.

Most changes to the CTS that involved deletions of or relaxations to portions of CTS requirements can be grouped in the following nine categories. (Changes that do not fit into one of these categories were evaluated individually):

Change Categories:

Category 1 – Relaxation of LCO Requirements

Category 2 – Relaxation of Applicability

Category 3 – Relaxation of Completion Time

Category 4 – Relaxation of Required Action

Category 5 – Deletion of Surveillance Requirement

Category 6 – Relaxation of Surveillance Requirement Acceptance Criteria

Category 7 – Relaxation of Surveillance Frequency

Category 8 – Deletion of Surveillance Requirement Shutdown Performance Requirement

Category 9 – Allowed Outage Time, Surveillance Frequency, and Bypass Time Extensions Based on Generic Topical Reports

The following discussion addresses why these categories of less restrictive changes are acceptable:

Category 1 – Relaxation of LCO Requirement

Certain CTS LCOs specify limits on operational and system parameters beyond those necessary to ensure meeting safety analysis assumptions and, therefore, are considered overly restrictive. The CTS also contain operating limits that have been shown to give little or no safety benefit to the operation of the plant. The ITS, consistent with the guidance in the ISTS, would delete or revise such operating limits.

These changes reflect the ISTS approach to provide LCO requirements that specify the protective conditions required to meet safety analysis assumptions for required features. These conditions replace the lists of specific devices used in the CTS to describe the requirements needed to meet the safety analysis assumptions.

TS changes represented by this category allow operators to more clearly focus on issues important to safety. The resultant ITS LCOs maintain an adequate degree of protection consistent with the safety analysis. They also improve focus on issues important to safety and provide reasonable operational flexibility without adversely affecting the safe operation of the plant. Changes involving the relaxation of LCOs are consistent with the guidance established by the ISTS taking into consideration the SQN CLB. The NRC staff reviewed all of the Category 1 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 2 – Relaxation of Applicability

The CTS require compliance with an LCO during the applicable Mode(s) or other conditions specified in a Specification's Applicability statement. CTS Applicability tends to be more generalized for reactor conditions. ITS takes into consideration the ISTS which adds a level of detail to the applicable conditions that are consistent with the application of the plant safety analyses assumptions for operability of the required features.

Further, where CTS Applicability requirements are inconsistent with the applicable accident analyses assumptions for a system, subsystem, or component specified in the LCO, the licensee proposed to change the LCO to establish a consistent set of requirements in the ITS. These modifications or deletions are acceptable because, during the operational or other conditions specified in the ITS applicability requirements, the LCOs are consistent with the applicable safety analyses. Changes involving relaxation of applicability requirements are consistent with the guidance established by the ISTS, taking into consideration the SQN CLB. The NRC staff reviewed all of the Category 2 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 3 – Relaxation of Completion Time

Upon discovery of a failure to meet an LCO, the TS specify time limits for completing Required Actions of the associated TS Conditions. Required Actions establish remedial measures that must be taken within specified Completion Times. Completion Times specify limits on the duration of plant operation in a degraded condition. Incorporating longer Completion Times is acceptable because such Completion Times continue to be based on the operability status of redundant TS required features, the capacity and capability of remaining TS required features, provision of a reasonable time for repairs or replacement of required features, vendor-developed standard repair times, and the low probability of a DBA occurring during the repair period. Changes involving relaxation of Completion Times are consistent with the guidance established by the Commission, taking into consideration the SQN CLB. These changes are generally made to conform to NUREG-1431, and have been evaluated to not be detrimental to plant safety. The NRC staff reviewed all of the Category 3 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 4 – Relaxation of Required Action

LCOs specify the lowest functional capability or performance level of equipment that is deemed adequate to ensure safe operation of the facility. When an LCO is not met, the TS specify actions to restore the equipment to its required capability or performance level, or to implement remedial measures providing an equivalent level of protection. These actions minimize the risk associated with continued operation while providing time to repair inoperable features. Some of the Required Actions are modified to place the plant in a MODE in which the LCO does not apply. Adopting Required Actions from NUREG-1431 is acceptable because the Required Actions take into account the operability status of redundant systems of required features, the capacity and capability of the remaining features, and the compensatory attributes of the Required Actions as compared to the LCO requirements.

Compared to CTS required actions, certain proposed ITS actions would result in extending the time period during which the licensee may continue to operate the plant with specified equipment inoperable. Upon expiration of this time period, further action, which may include shutting down the plant, is required. These ITS actions provide measures that adequately compensate for the inoperable equipment, and are commensurate with the safety importance of the inoperable equipment, plant design, and industry practice. Therefore, these action requirements will continue to ensure safe operation of the plant. Changes involving relaxations of action requirements are consistent with the guidance established by the ISTS, taking into consideration the SQN CLB. The NRC staff reviewed all of the Category 4 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 5 – Deletion of Surveillance Requirement

The CTS require maintaining LCO specified structures, systems, and components (SSCs) operable by meeting SRs in accordance with specified SR frequencies. This includes conducting tests to demonstrate that such SSCs are operable and that LCO specified parameters are within specified limits. When the test acceptance criteria and any specified conditions for the conduct of the test are met, the equipment is deemed operable. The changes of this category relate to deletion of CTS SRs, deletion of acceptance criteria, and deletion of the conditions required for performing the SR.

The ITS eliminate unnecessary CTS SRs that do not contribute to verification that equipment can perform its required functions to meet an LCO. Deleting the SRs, including acceptance criteria and/or conditions for performing the SRs, for these items is consistent with the objective of the ISTS, without reducing confidence that the equipment is operable. Appropriate equipment continues to be tested in a manner and at a frequency necessary to give confidence that the equipment can perform its safety functions. For example, the CTS contain SRs that are not included in the ISTS for a variety of reasons. These SRs include measuring values and parameters that are not necessary to meet ISTS LCO requirements. In addition, the ISTS may not include reference to specific acceptance criteria contained in the CTS, because these acceptance criteria are not necessary to meet ISTS LCO requirements, or are defined in other licensee controlled documents.

The deletion of SRs is acceptable because appropriate testing standards are retained for determining that the LCO required features are operable as defined by the ISTS taking into consideration the SQN CLB. Therefore, based on the above, staff finds Category 5 changes are acceptable.

Category 6 – Relaxation of Surveillance Requirement Acceptance Criteria

Prior to placing the plant in a specified operational Mode or other condition stated in the Applicability of an LCO, and in accordance with the specified SR time interval thereafter, the CTS require establishing the operability of each LCO-required component by meeting the SRs associated with the LCO. This usually entails performance of tests to demonstrate the operability of the LCO-required components, or the verification that specified parameters are within LCO limits. A successful demonstration of operability requires meeting the specified acceptance criteria, as well as any specified conditions, for the conduct of the test. Relaxations of CTS SRs can include relaxing both the acceptance criteria and the conditions of performance.

For example, the ITS allows some SRs to verify operability under actual or test conditions. Adopting the ITS allowance for these conditions is acceptable because required features cannot distinguish between an "actual" signal or a "test" signal. Also included are changes to CTS SRs that are replaced in the ITS with separate and distinct testing requirements that, when combined, provide operability verification of all components required in the LCO for the features specified in the CTS. Changes that provide exceptions to SRs to allow for variations that do not affect the results of the test are also included in this category.

These relaxations of CTS SRs optimize test requirements for the affected safety systems and increase operational flexibility. These CTS SR relaxations are consistent with the guidance established by the ISTS in consideration of the SQN CLB. The NRC staff reviewed all of the Category 6 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 7 – Relaxation of Surveillance Frequency

Prior to placing the plant in a specified operational Mode or other condition stated in the applicability of an LCO, and in accordance with the specified SR time interval (frequency) thereafter, the CTS require establishing the operability of each LCO required component by meeting the SRs associated with the LCO. This usually entails performance of tests to demonstrate the operability of the LCO-required components, or the verification that specified parameters are within LCO limits. A successful demonstration of operability requires meeting the specified acceptance criteria, as well as any specified conditions, for the conduct of the test, at a specified frequency based on the reliability and availability of the LCO-required components.

Category 7 relaxations of CTS SRs include extending the interval between the SRs. Increasing the time interval between Surveillance tests in the ITS results in decreased equipment unavailability due to testing. Relaxation of Surveillance Frequency can also include the addition of Surveillance Notes that allow testing to be delayed until appropriate unit conditions for the test are established, or exempt testing in certain Modes or specified conditions in which the testing cannot be performed.

Reduced testing is also acceptable where operating experience or other deterministic criteria have demonstrated that these components usually pass the Surveillance when performed at the specified interval, thus the Surveillance Frequency is acceptable from a reliability standpoint. Surveillance Frequency changes to incorporate alternate train testing have also been shown to be acceptable where other qualitative or quantitative test requirements are required that are established predictors of system performance.

These CTS SR frequency relaxations are consistent with the guidance established by the ISTS taking into consideration the SQN CLB. The NRC staff reviewed all of the Category 7 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 8 – Deletion of Surveillance Requirement Shutdown Performance Requirement

The CTS require maintaining LCO specified SSCs operable by meeting SRs in accordance with specified SR frequencies. This includes conducting tests to demonstrate that such SSCs are operable and that LCO specified parameters are within specified limits. When the test acceptance criteria and any specified conditions for the conduct of the test are met, the equipment is deemed operable. The changes of this category relate to deletion of CTS SRs required to be performed during shutdown conditions.

Category 8 changes do not include the restriction on unit conditions. The control of the unit conditions, appropriate to perform a test, is an issue for procedures and scheduling, which give proper regard for surveillance performance and the effect on the safe operation of the plant, and has been determined by the NRC staff to be unnecessary as a TS restriction. As indicated in NRC-issued Generic Letter (GL) 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle," dated April 2, 1991, allowing this control is consistent with the vast majority of other TS Surveillances that do not dictate unit conditions for the Surveillance. This change is designated as less restrictive because the Surveillance may be performed at plant conditions other than shutdown.

New Surveillance Frequencies have been evaluated to ensure that they provide an acceptable level of equipment reliability. The performance of the Surveillances will continue to be limited to conditions where an assessment has determined that plant safety will either be maintained or enhanced. The NRC staff reviewed all of the Category 8 less restrictive changes to the CTS and, based on the above, finds them acceptable.

Category 9 – Allowed Outage Time, Surveillance Frequency, and Bypass Time Extensions Based on Generic Topical Reports

SQN is converting to the ITS as outlined in NUREG-1431, Revision 4.0. Incorporated in the STS are requirements associated with certain reactor protection system channel completion times, bypass times and surveillance test intervals; engineered safety system actuation system surveillance test intervals, logic cabinet completion times, bypass times, and surveillance test intervals; and reactor trip breakers surveillance test interval, completion times, and bypass times.

The proposed changes have been generically evaluated and approved by the NRC staff in WCAP-15376-P-A, Revision 1, "Risk-Informed Assessment of the RTS [reactor trip system] and ESFAS [engineered safety features actuation system] Surveillance Test Intervals and Reactor Trip Breaker Test and Completion Times," March 2003; WCAP 10271-P-A, Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation

System, May 1986; WCAP-10271 Supplement 1-P-A, Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System - Supplement 1, May 1986; WCAP-10271-P-A Supplement 2, Revision 1, Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System Supplement 2, Revision 1; and WCAP-14333-P-A, Revision 1, Probabilistic Risk Analysis of the RPS [Reactor Protection System] and ESFAS Test Times and Completion Times. The NRC staff reviewed all of the Category 9 less restrictive changes to the CTS and, based on the above, finds them acceptable.

In the nine categories presented above, the proposed less restrictive changes to the CTS are acceptable because they will not adversely impact safe operation of the facility. The ITS requirements are consistent with the CLB, operating experience, and plant accident and transient analyses, and provide reasonable assurance that public health and safety will be protected.

Table L attached to this SE lists the less restrictive changes being made in the SQN ITS conversion. Table L, which is organized in ITS order by each L-type DOC to the CTS, provides a summary description of the less restrictive change that was made, the CTS and ITS references, and a reference to the specific change type discussed above.

C. <u>More Restrictive Changes to the CTS (M)</u>

The licensee, in electing to implement the ISTS, proposed a number of requirements that are more restrictive than those in the CTS. The ITS requirements in this category include requirements that are either new to SQN, more conservative than corresponding requirements in the CTS, or have additional restrictions that are not in the CTS, but are in the ISTS.

These changes include additional requirements that decrease allowed outage times, increase the frequency of surveillances, impose additional surveillances, increase the scope of specifications to include additional plant equipment, increase the applicability of specifications, or provide additional actions. These changes are generally made to conform to NUREG-1431 and have been evaluated to not be detrimental to plant safety.

Table M attached to this SE lists the more restrictive changes being made in the SQN ITS conversion. Table M is organized in ITS order by each M-type DOC to the CTS. It provides a summary description of each more restrictive change that was adopted, and references the affected CTS and ITS. The staff reviewed each M-type DOC and found the changes to be acceptable because these changes provide additional restrictions on plant operation that enhance safety.

D. <u>Removed Details (LA)</u>

When requirements or detailed information has been shown to give little or no safety benefit, their removal from the TS may be appropriate. In most cases, relaxations previously granted to individual plants on a plant-specific basis were the result of (1) generic NRC actions, (2) new NRC staff positions that have evolved from technological advancements and operating experience, or (3) resolution of the Owners groups' comments on the ISTS. The NRC staff reviewed generic relaxations contained in the ISTS and found them acceptable because they are consistent with current licensing practices and the Commission's regulations. The SQN design was also reviewed to determine if the specific design basis and licensing basis are consistent with the technical basis for the model requirements in the ISTS and thus provide a basis for ITS.

All of the changes to the CTS involving the removal of specific, detailed information from individual specifications evaluated to be Types 1 through 6 are as described below:

Type 1 - Removing Details of System Design and System Description, Including Design Limits

The design of the facility is required to be described in the Updated Final Safety Analysis Report (UFSAR) by 10 CFR 50.34. In addition, the quality assurance requirements of Appendix B to 10 CFR Part 50 require that plant design be documented in controlled procedures and drawings and maintained in accordance with an NRC-approved Quality Assurance Topical Report (QATR). The regulation at 10 CFR 50.59 specifies controls for changing the facility as described in the UFSAR. The regulation at 10 CFR 50.54(a) specifies criteria for changing the QATR. The TRM is a general reference in the UFSAR and changes to it are accordingly also subject to 10 CFR 50.59. The ITS Bases also contain descriptions of system design. ITS 5.5.12 specifies controls for changing the Bases. Removing details of system design is acceptable because the associated CTS requirements being retained without these details are adequate to ensure safe operation of the facility.

In addition, retaining such details in TS is unnecessary to ensure proper control of changes. Cycle-specific design limits are contained in the Core Operating Limits Report (COLR) in accordance with GL 88-16, “Removal of Cycle-Specific Parameter Limits From Technical Specifications,” dated October 3, 1988. ITS Section 5.6, “Reporting Requirements,” includes the programmatic requirements for the COLR. Therefore, staff finds it acceptable to remove Type 1 details from the CTS and place them in licensee-controlled documents.

Type 2 - Removing Descriptions of System Operation

The plans for normal and emergency operation of the facility are required to be described in the UFSAR by 10 CFR 50.34. ITS 5.4.1.a and 5.4.1.e will require written procedures to be established, implemented, and maintained for plant operating procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, “Quality Assurance Program Requirements (Operation),” dated February 1978, and in all programs specified in ITS Section 5.5, respectively. The ITS Bases also contain descriptions of system operation. Controls specified in 10 CFR 50.59 apply to changes in procedures as described in the UFSAR and TRM. ITS 5.5.12 specifies controls for changing the Bases. Removing details of system operation is acceptable because the associated CTS requirements being retained without these details are adequate to ensure safe operation of the facility. In addition, retaining such details in TS is unnecessary to ensure proper control of changes. Therefore, staff finds it acceptable to remove Type 2 details from the CTS and place them in licensee-controlled documents.

Type 3 - Removing Procedural Details for Meeting TS Requirements or Reporting Requirements

Details for performing TS SRs or for regulatory reporting are more appropriately specified in the plant procedures. Changes to procedural details include those associated with limits retained in the ITS. For example, ITS 5.4.1 requires that written procedures covering activities that include all programs specified in Specification 5.5 be established, implemented, and maintained. ITS 5.5.6, "Inservice Testing Program," requires a program to provide controls for inservice testing (IST) of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves. The program includes testing frequencies specified in the ASME Operation and Maintenance Standards and Codes (OM Codes), and applicable addenda.

Prescriptive procedural information in a TS requirement is unlikely to contain all procedural considerations necessary for the plant operators to comply with TS and all regulatory reporting requirements, and referral to plant procedures is, therefore, required in any event. Therefore, staff finds it acceptable to remove Type 3 details from the CTS and place them in licensee-controlled documents.

Type 4 - Removal of LCO, SR, or other TS requirement to the TRM, UFSAR, ODCM, NQAP, CLRT Program, IST Program, or ISI Program

Certain CTS administrative requirements are redundant with respect to current regulations and thus are relocated to the UFSAR or other appropriate licensee-controlled documents. The Final Policy Statement allows licensees to relocate to licensee-controlled documents and any CTS requirements that do not meet any of the criteria for mandatory inclusion in the TS.

Examples of the proposed changes include moving details out of the CTS and into the Technical Specifications Bases, the Updated Final Safety Analysis Report (UFSAR), the Containment Leakage Rate Testing (CLRT) Program, the Technical Requirements Manual (TRM), and other documents under regulatory control such as the Offsite Dose Calculation Manual (ODCM), the Nuclear Quality Assurance Program (NQAP), the Inservice Testing (IST) Program, and the Inservice Inspection (ISI) Program. The removal of this information is considered to be less restrictive administratively, because it is no longer controlled by the Technical Specification change process. Typically, the information moved is descriptive in nature and its removal conforms to NUREG-1431. Changes made in accordance with the provisions of licensee-controlled documents are subject to the specific requirements of those documents. For example, 10 CFR 50.54(a) governs changes to the NQAP, while ITS 5.5.12 governs changes to the ITS Bases. Therefore, it is acceptable to remove these details from CTS and place them in licensee-controlled documents.

To the extent that information has been relocated to licensee-controlled documents, such information is not required to prevent the possibility of an abnormal situation or event giving rise to an immediate threat to public health and safety. Further, where such information is contained in LCOs and associated requirements in the TS, the NRC staff has concluded that they do not fall within any of the four criteria set forth in 10 CFR 50.36(c)(2)(ii) and discussed in the Final Policy Statement (see Section 2.0 of this SE). Accordingly, existing detailed information, such as generally described above, may be removed from the CTS and not included in the ITS. Therefore, staff finds it acceptable to remove Type 4 requirements from the CTS and place them in licensee-controlled documents.

In its submittal, the licensee stated in DOC 5.5 LA04 that the information would be moved to the Nuclear Facility Quality Assurance Program Description (NFQAPD). This was identified as a typographical error since the actual location should have been the NQAP. The R DOC Table in Attachment 10 has been updated with the correct location.

Type 5 – Removal of SR Frequency to the Surveillance Frequency Control Program

Licensees have the option to retain their SR Frequencies or adopt TSTF-425, Revision 3, ‘‘Relocate Surveillance Frequencies to Licensee Control – RITSTF [Risk-Informed TSTF] Initiative 5b.’’ TSTF-425 is a Traveler that is incorporated in NUREG-1431, Revision 4.0 that requires a formal technical review. When implemented, TSTF-425 relocates most periodic frequencies of TS SRs to the licensee-controlled Surveillance Frequency Control Program (SFCP), and provides requirements for the new program in the Administrative Controls section of the TS. ITS 5.5.17 describes the requirements for the program to control changes to the relocated Surveillance Frequencies. The surveillance test requirements remain in the TS. The SFCP shall ensure that SRs specified in the TS are performed at intervals sufficient to assure the associated LCOs are met. This change is designated as a less restrictive removal of detail change, because the Surveillance Frequencies are being removed from the TS.

The staff finds the removal of SR Frequency details from the TS is acceptable, because this type of information is not necessary to be included in the TS to provide adequate protection of public health and safety. Attachment 3 contains the detailed SE for SQN’s plant-specific adoption of TSTF-425 performed by the Probabilistic Risk Assessment Licensing Branch (APLA).

Type 6 – Removal of Cycle-Specific Parameter Limits from the Technical Specifications to the Core Operating Limits Report

The NRC documented in GL 88-16, “Removal of Cycle-Specific Parameter Limits from Technical Specifications,” that cycle-specific parameter limits are not necessary to be included in the TS to provide adequate protection of public health and safety. The ITS will retain the Shutdown Margin (SDM) requirement. The methodologies used to develop the parameters in the COLR have obtained approval by the NRC in accordance with GL 88-16. The removed information will be adequately controlled in the COLR under the requirements provided in ITS 5.6.3, “Core Operating Limits Report.” ITS 5.6.3 ensures the applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, emergency core cooling system limits, and nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analyses are met. This change is designated as a less restrictive removal of detail change because information relating to cycle-specific parameter limits is being removed from the Technical Specifications.

The staff finds the removal of cycle-specific parameter limits from the TS to the COLR acceptable because the cycle-specific limits are developed or utilized under NRC-approved methodologies that will ensure that the safety limits are met.

Table R attached to this SE lists the relocated specifications and less restrictive removal of detail changes requested as part of the SQN ITS conversion and lists all specifications and details that are being relocated from the CTS to licensee controlled documents. Table R includes the following in columns:

1. The ITS/CTS number, followed by the DOC number, (e.g., LA01, R01);
2. The reference numbers of the associated CTS requirements;
3. A summary description of the relocated details and requirements;

4. The name of the licensee-controlled document to contain the relocated details and requirements (location);
5. The regulation (or ITS Specification) for controlling future changes to relocated requirements (change control process); and
6. A characterization of the type of change (only applicable to LA-type DOCs).

E. Relocated Specifications (R)

The Final Policy Statement states that LCOs and associated requirements that do not satisfy or fall within any of the four specified criteria (now contained in 10 CFR 50.36(c)(2)(ii)) may be relocated from existing TS to appropriate licensee-controlled documents as noted in Section D above.

This section discusses the relocation of entire specifications from the CTS to licensee-controlled documents. These specifications generally would include LCOs, Action Statements (i.e., Actions), and associated SRs. In its application, the licensee proposed relocating such specifications from the CTS to licensee-controlled documents. The NRC staff has reviewed the licensee's submittals and finds that relocation of these requirements is acceptable in that the LCOs and associated requirements were found not to fall within the scope of 10 CFR 50.36(c)(2)(ii) and changes to licensee-controlled documents will be adequately controlled by 10 CFR 50.59, as applicable. These provisions will continue to be implemented by appropriate plant procedures (i.e., operating procedures, maintenance procedures, surveillance and testing procedures, and work control procedures).

Table R attached to this SE lists the relocated specifications and less restrictive removal of detail changes requested as part of the SQN ITS conversion and lists all specifications and details that are being relocated from the CTS to licensee controlled documents. Table R includes columns as stated in Section 4.D above.

The specifications relocated from the CTS are not required to be in the TS because they do not fall within the criteria for mandatory inclusion in the TS as stated in 10 CFR 50.36(c)(2)(ii). These specifications are not needed to obviate the possibility that an abnormal situation or event will give rise to an immediate threat to the public health and safety. The NRC concludes that appropriate controls have been established for all of the current specifications and information being moved to the TRM. Therefore, based on the above, the staff finds this change acceptable. These relocations are the subject of a new license condition discussed in Section 6.0 of this SE. Until incorporated in licensee-controlled documents, changes to these specifications and information will be controlled in accordance with the current applicable procedures and regulations.

F. Control of Specifications, Requirements, and Information Relocated from the CTS

In the ITS conversion, the licensee proposes to relocate specifications, requirements, and detailed information from the CTS to licensee-controlled documents. This is discussed in Sections 4.D and 4.E of this SE. The facility and procedures described in the UFSAR and TRM can be revised in accordance with the provisions of 10 CFR 50.59, to ensure that records are maintained and appropriate controls are established over those requirements removed from the CTS and future changes to the requirements. Other licensee-controlled documents contain provisions for making changes consistent with applicable regulatory requirements. The documentation of these changes will be maintained by the licensee in accordance with the record retention requirements specified in the NQAP and such applicable regulations as 10 CFR 50.59.

The license condition for the relocation of requirements from the CTS, which is discussed in Section 6.0 of this SE, will address the implementation of the ITS conversion and the schedule for the relocation of the CTS requirements into licensee-controlled documents.

G. Evaluation of Other TS Changes (Beyond-Scope Issues) Included in the Application for Conversion to ITS

Before and during the review, several Beyond Scope Issues (BSIs) were identified. BSIs are proposed changes that reflect neither CTS nor ISTS. Many are listed in Enclosure 3 of the ITS LAR dated November 22, 2013. Most of the BSIs were resolved as part of the normal review process. Any changes to the original submittal that were required to address these issues are reflected in the supplements to the LAR, attached DOC tables, and the final TS issued with the ITS amendment.

One of the licensee-identified BSIs required a formal technical branch review as documented in a separate SE (Attachment 1). It evaluates proposed changes to CTS Sections 3.8.1.1 and 3.8.2.1 (ITS Sections 3.8.1 and 3.8.9), which are related to electrical alternating current (AC) power sources and distribution systems.

In Enclosure 6 of the ITS application, the licensee listed four LARs that were already in progress. Two of the LARs affect TS changes. The LARs propose changes to the ultimate heat sink (UHS) (Reference 2) and ice condenser (Reference 3) TS. The licensee embedded proposed changes into the ITS application, assuming the parallel LARs would be reviewed and approved prior to the ITS amendment approval. Due to complex technical issues in the LARs, the reviews of both are past the anticipated issuance dates and are currently under review. The licensee has since decided to remove the changes associated with the parallel LARs to avoid delays in the ITS amendment issuance. The resulting withdrawal of changes to restore the current licensing bases affect the ITS application as follows:

- UHS LAR: Changes to ITS Sections 3.7.8 and 3.7.9 are described in RAI MEH-005 submitted in Supplement 2 dated June 19, 2015. The licensee only withdrew changes related to the UHS LAR which will be reviewed in a separate LAR.

- Ice condenser LAR: Changes to ITS Sections 3.6.12 and 5.5.14 are described on page 3 of the submittal letter for Supplement 3 dated July 24, 2015. The change designator in the TS markup pages is “ICE.”

  In the ice condenser LAR, the licensee stated that the purpose was to correct issues identified with the loss-of-cooling accident mass and energy release calculation with respect to the required total ice weight. The incorrect ice mass values in CTS 3.6.5.1 render it a non-conservative TS (NCTS).

  To address the NCTS, the licensee cited NRC Administrative Letter (AL) 98-10, “Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety,” dated December 29, 1998. AL 98-10 guides licensees to impose administrative controls in response to the discovery of an inadequate TS as an acceptable short-term corrective action, and then follow up by submitting an LAR for NRC review to correct the TS. The ice mass LAR addresses the concern and is currently under review by the Containment and Ventilation Branch.

Therefore, the NRC staff is not making a safety determination in this SE regarding ITS 3.6.12 (the equivalent to CTS 3.6.5.1). The changes to ITS 3.6.12 only reflect ISTS-style formatting and editorial changes. The licensee will continue to impose NCTS administrative controls for ITS 3.6.12, pending NRC approval of the ice condenser amendment. Should the NRC approve the ice condenser amendment request, the licensee will implement the TS corrections. To date, the licensee has addressed the issue appropriately in accordance with AL 98-10.

H. In-Scope Changes That Required a Formal Technical Branch Review

ITS changes considered "in-scope" are generically-approved by NRC, including NUREG-1431 and approved TSTF Travelers. Some in-scope changes require a formal plant-specific review of the licensee's technical justifications. The attached in-scope SEs are described in the table below:

Attachment	Description	Reviewed By
Attachment 2	Evaluation of proposed changes to CTS 3.9.3, "Nuclear Instrumentation"	Reactor Systems Branch (SRXB)
Attachment 3	Adoption of TSTF-425, Revision 3, "Relocate Surveillance Frequencies to Licensee Control – RITSTF Initiative 5b."	Probabilistic Risk Assessment Licensing Branch (APLA)
Attachment 4	Adoption of TSTF-446, Revision 3, "Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times (WCAP-15791)"	Probabilistic Risk Assessment Licensing Branch (APLA)
Attachment 5	Adoption of TSTF-490, Revision 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec"	Radiation Protection and Consequence Branch (ARCB)
Attachment 6	Adoption of TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360"	Electrical Engineering Branch (EEEB)

The SE Attachments described in Sections G and H share in common the content of SE Sections 7.0 (STATE CONSULTATION), 8.0 (ENVIRONMENTAL CONSIDERATION), and 9.0 (CONCLUSION), which are omitted from the separate attachments. SE Attachments 1 through 6 immediately follow this SE.

I. Withdrawal of Proposed Changes Related to TSTF-51 and TSTF-471

In its second response to RAI MHC003 dated July 2, 2015 (in Supplement 3 dated July 24, 2015), the licensee declared that it would withdraw previously-approved changes to NUREG-1431, Revision 4.0, also known as Travelers TSTF-51 and TSTF-471.

> Based on discussions with the NRC, TVA acknowledges that the NRC staff has on-going generic industry concerns related, in part, to TSTF-51 and TSTF-471 as documented in the letter from Anthony J. Mendiola, [USNRC to TSTF] dated November 7, 2013 [Reference 4]. Therefore, TVA is superseding the response to RAI KAB044 in this response to state that TVA is not requesting the NRC staff to extend the review performed in License Amendment 288 (Unit 1) and 278 (Unit 2) to the requested changes in the SQN ITS conversion.

The NRC staff letter (ML13246A358) dated November 7, 2013, referenced by the licensee includes a discussion of the NRC staff's generic technical concerns with the following three Travelers:

- TSTF-51, Revision 2, "Revise Containment Requirements During Handling Irradiated Fuel and Core Alterations,"
- TSTF-286, Revision 2, "Define 'Operations Involving Positive Reactivity Additions,'" and
- TSTF-471, Revision 1, "Eliminate Use of Term Core Alterations in Actions and Notes."

The changes to the STS associated with these Travelers are currently incorporated in NUREG-1431, Revision 4.0 and under NRC review for generic resolution. NRC staff and the licensee were able to resolve plant-specific issues with SQN's adoption of TSTF-286. Attachment 2 contains the Reactor System Branch's SE.

RAI MHC003 details the licensee's proposed changes that will retain SQN's CTS requirements instead of adopting TSTF-51 and TSTF-471. Specifically, the CTS Section 1.0 defined term, "CORE ALTERATION," will be reflected as it is in CTS in the equivalent ITS sections. Also, the term "recently" added to "recently irradiated fuel" will be deleted from the ITS. The licensee reviewed several RAIs as a result of its decision to withdraw these two Travelers from ITS. The details of the affected changes, including withdrawal of LAR Supplement 1 dated December 16, 2014, and superseded RAIs are in MHC003.

J. <u>Deletion of TPBAR Technical Specification Changes</u>

In its application submittal letter dated November 22, 2013, the licensee stated that there were two NRC-approved License Amendments regarding Tritium-producing burnable absorber rods (TPBARs) that were never implemented at SQN: Amendments 278 and 289 for Unit 1 and Amendments 269 and 279 for Unit 2. The NRC Record Copy of the SQN CTS contains the NRC-approved TPBAR Amendments in anticipation of the licensee implementing them. The TS implementation condition in the associated SEs was "prior to starting up from outage where TVA inserts TPBAR in the core." The licensee describes in RAI MHC007 why the Amendments should be removed from SQN's CLB:

> A license amendment request was submitted on June 17, 2011, that requested an amendment of the licensing basis and the Technical Specifications (TS) to permit the use of AREVA Advanced W17 HTP fuel at SQN. The Safety Evaluation Report (SER) for the approval of this license amendment was issued on September 26, 2012. As a result, the bases for the TPBAR amendments have materially changed such that TVA would need to request and receive NRC approval prior to introducing any tritium-producing burnable absorber rods

(TPBARs) into either SQN unit. At this time, SQN is not licensed to insert tritium-producing burnable absorber rods in the core.

The NRC staff has reviewed and confirmed the discussion above, and concludes that the material changes at SQN have rendered the previous TPBAR Amendments invalid. In addition, the licensee verbally informed the NRC staff that the original TPBAR plan had been postponed indefinitely. The licensee is aware that a new LAR and NRC approval would be required for future TPBAR implementation at SQN. Therefore, the staff finds acceptable the deletion of all TPBAR TS changes related to Amendments 278 and 289 for Unit 1 and Amendments 269 and 279 for Unit 2.

5.0 **LICENSEE COMMITMENTS**

In reviewing the proposed ITS conversion for SQN, the NRC staff has relied upon the licensee's commitment to relocate certain requirements from the CTS to licensee-controlled documents as described in Table R, "Relocated Specifications and Removed Detail Changes" (Attachment 10 to this SE). This table, and Sections 4.D and 4.E of this SE, reflect the relocations described in the licensee's submittals for the TS Conversion. The NRC staff requested and the licensee submitted a set of license conditions to make these commitments enforceable (see Section 6.0 of this SE). Such commitments from the licensee are important to the ITS conversion because the acceptability of removing certain requirements from the TS is based on those requirements being relocated to licensee-controlled documents where further changes to the requirements will be controlled by applicable regulations or other requirements (e.g., 10 CFR 50.59).

6.0 **LICENSE CONDITIONS**

In a supplemental letter to the ITS application dated August 5, 2015, the licensee agreed to license conditions that describe (1) a schedule to begin performing new and revised SRs after ITS implementation, and (2) the relocation of certain CTS requirements and license conditions, as applicable, to other license controlled documents prior to ITS implementation. The following license conditions are included in the renewed Facility Operating Licenses:

1. Relocation of Certain Technical Specification Requirements

   License Amendments (No. 334 for Unit 1 and No. 327 for Unit 2) authorize the relocation of certain Technical Specifications previously included in Appendix A to other licensee-controlled documents. Implementation of this amendment shall include relocation of the requirements to the specified documents, as described in Table R, Relocated Specifications and Removed Detail Changes, attached to the NRC staff's Safety Evaluation, which is enclosed in this amendment.

2. Schedule for New and Revised Surveillance Requirements (SRs)
   The schedule for performing SRs that are new or revised in License Amendments (No. 334 for Unit 1 and No. 327 for Unit 2) shall be as follows:

(a) For SRs that are new in this amendment, the first performance is due at the end of the first Surveillance interval, which begins on the date of implementation of this amendment.

(b) For SRs that existed prior to this amendment, whose intervals of performance are being reduced, the first reduced Surveillance interval begins upon completion of the first Surveillance performed after implementation of this amendment.

(c) For SRs that existed prior to this amendment, whose intervals of performance are being extended, the first extended Surveillance interval begins upon completion of the last Surveillance performed prior to implementation of this amendment.

(d) For SRs that existed prior to this amendment that have modified acceptance criteria, the first performance subject to the modified acceptance criteria is due at the end of the first Surveillance interval that began on the date the Surveillance was last performed prior to the implementation of this amendment.

The NRC staff has reviewed the above schedule for the licensee to begin performing the new and revised SRs, and concludes that it is acceptable because there is no extra time allowed between surveillances beyond what is approved in this Amendment. The schedule allows the licensee to have a reasonable implementation period to prepare for numerous changes. Until the implementation occurs, the licensee stated that its planned implementation period for the new ITS documents is within 180 days of this Amendment.

Because the commitments discussed in Section 5.0 of this SE are being relied upon for the amendment, a license condition is included in the amendment that will enforce the relocation of requirements from the CTS to licensee-controlled documents. The relocations are described in Table R, which is Attachment 10 to this SE. The license condition states that implementation of this amendment shall include relocation of these requirements to the specified documents. The relocation of these requirements to the specified documents is to be implemented within 180 days of this Amendment. The staff finds this acceptable as the licensee is still required to meet their current licensing basis until the time of implementation.

7.0 **STATE CONSULTATION**

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

8.0 **ENVIRONMENTAL CONSIDERATION**

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes SRs. The NRC staff has determined that the amendment involves no significant increase in amounts, and no significant change in the types of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (79 FR 35807). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

9.0 **CONCLUSION**

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

10.0 **REFERENCES**

1. NUREG-1431, Revision 4.0, “Standard Technical Specifications – Westinghouse Plants.” (ADAMS Accession No. ML12100A222)

2. Letter dated October 2, 2013, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plant (SQN), Units 1 and 2 – Proposed Technical Specification (TS) Change, “Ultimate Heat Sink (UHS) Temperature Limitations Supporting Alternate Essential Raw Cooling Water (ERCW) Loop Alignments (TS-SQN-13-01 and 13-02).” (ML13280A267) [Reviewed under TAC Nos. MF2446 and MF2447]

3. Letter dated July 3, 2013, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Application to Modify Ice Condenser Technical Specifications to Address Revisions in Westinghouse Mass and Energy Release Calculation (SQN-TS-12-04). (ML13199A281) [Reviewed under TAC Nos. MF2852 and MF2853]

4. Letter dated November 7, 2013, from Anthony J. Mendiola, USNRC, to Technical Specifications Task Force regarding Potential Issues with Plant-Specific Adoption of Travelers TSTF-51, Revision 2, “Revise Containment Requirements During Handling Irradiated Fuel and Core Alterations,” TSTF-286, Revision 2, “Define ‘Operations Involving Positive Reactivity Additions,’” and TSTF-471, Revision 1, “Eliminate Use of Term Core Alterations in Actions and Notes.” (ML13246A358)

5. Letter dated November 22, 2013, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10). (ML13329A881)

6. Letter dated December 16, 2014, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10) – Supplement 1. (ML14350B364)

7. Letter dated June 19, 2015, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10) – Supplement 2. (ML15176A678)

8. Letter dated July 24, 2015, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10) – Supplement 3. (ML15205A404)

9. Letter dated August 5, 2015, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plant, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10) – Proposed License Conditions. (ML15218A185)

10. Letter dated August 31, 2015, from J. W. Shea, Tennessee Valley Authority, to USNRC regarding Sequoyah Nuclear Plant, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev. 4.0 (SQN-TS-11-10) – Correction to ITS 3.3.7, “Control Room Emergency Ventilation System (CREVS) Actuation Instrumentation.” (ML15244A781)

Attachments:

1. Safety Evaluation from EEEB (Alternating Current)
2. Safety Evaluation from SRXB (Nuclear Instrumentation)
3. Safety Evaluation from APLA (TSTF-425)
4. Safety Evaluation from APLA (TSTF-446)
5. Safety Evaluation from ARCB (TSTF-490)
6. Safety Evaluation from EEEB (TSTF-500)
7. Table A - Administrative Changes
8. Table L - Less Restrictive Changes
9. Table M - More Restrictive Changes
10. Table R - Relocated Specifications and Removed Details Changes

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Date: September 30, 2015

ELECTRICAL ENGINEERING BRANCH SAFETY EVALUATION INPUT

FOR SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 REGARDING

CONVERSION OF CURRENT TECHNICAL SPECIFICATIONS TO IMPROVED TECHNICAL

SPECIFICATIONS (ITS) SECTIONS 3.8.1 AND 3.8.9

(TAC NOS. MF3128 AND MF3129)

1.0 INTRODUCTION

By application dated November 22, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13329A881), Tennessee Valley Authority (the licensee) requested an amendment to the Technical Specifications (TS) for Sequoyah Nuclear Plant (SQN) Units 1 and 2. The proposed license amendment request (LAR) would revise the SQN's Current TS (CTS) to the Improved TS (ITS) to be consistent in format with the Improved Standard TS (ISTS) described in NUREG-1431, "Standard Technical Specifications – Westinghouse Plants," Revision 4.0. In Enclosure 3 of the application, the licensee identified major differences between the ITS and the CTS or ISTS, and, therefore, require a formal review by a Technical Branch. This safety evaluation (SE) input is limited to the ITS Sections 3.8.1, "AC [alternating current] Sources – Operating," and 3.8.9, "Distribution Systems – Operating," relating to the Limiting Conditions of Operation (LCOs), and the associated Actions.

During the LAR review process, the licensee provided draft responses to the staff requests for additional information (RAIs). These responses were formalized in Supplement 2 dated June 19, 2015 (ML15176A678), and Supplement 3 dated July 24, 2015 (ML15205A404), which included an updated set of the proposed TS.

2.0 REGULATORY EVALUATION

The Nuclear Regulatory Commission (NRC) staff ("the staff") applied the following NRC regulations in its review of the LAR:

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 17, "Electric power systems," states, in part, that:

> An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety.… The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under

> operating and postulated accident and environmental conditions…. Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

GDC 18, "Inspection and testing of electric power systems," states, in part, that "electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features…."

GDC 5, "Sharing of structures, systems, and components," requires that structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

GDC 1, "Quality standards and records," requires that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

The SQN plant was designed to meet the intent of the "Proposed GDC for Nuclear Power Plant Construction Permits" published in July 1967. The Sequoyah construction permit was issued in May 1970. In the Updated Final Safety Analysis Report (UFSAR), Section 3.1.2, the licensee addressed the GDC which were published as Appendix A to 10 CFR 50 in July 1971. Each criterion is followed by a discussion of the design features and procedures which meet the intent of the criteria published in July 1971.

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications," establishes the requirements related to the content of the TS. Pursuant to 10 CFR 50.36(c), TS are required to include items in five specific categories related to station operation: (1) Safety limits, limiting safety system settings, and limiting control settings, (2) LCOs, (3) Surveillance requirements (SRs), (4) Design features; and (5) Administrative controls. The proposed changes to the SQN TS discussed in this evaluation relate to the LCO category.

The regulation at 10 CFR 50.65(a)(4), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," states:

> Before performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and corrective and preventive maintenance), the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The scope of the assessment may be limited to structures, systems, and components that a risk-informed evaluation process has shown to be significant to public health and safety.

The staff applied the following NRC guidance documents for review of the LAR:

NUREG-1431, “Standard Technical Specifications – Westinghouse Plants,” Revision 4.0. This NUREG contains the ISTS for Westinghouse plants. The changes reflected in Revision 4.0 result from the experience gained from the various plant operations using the previous revision of ISTS, extensive public technical meetings and discussions among the NRC staff and various nuclear power plant licensees and the Nuclear Steam Supply System Owners Groups. The ISTS were developed based on the criteria in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors dated July 22, 1993 (58 FR 39132), which was subsequently codified by changes to 10 CFR 50.36. Licensees are encouraged to upgrade their TS consistent with those criteria and conforming, to the extent practical with the latest revision of the ISTS.

The NRC’s Office of Nuclear Reactor Regulation’s Office Instruction, LIC-601, “ITS Conversion Amendment Review Procedures” (ADAMS Accession No. ML092040272) provides guidance to the staff to ensure that the overall objectives of an ITS Conversion are met.

Regulatory Guide 1.93, Revision 0, “Availability of Electrical Power Sources,” provides guidance with respect to operating procedures and restrictions acceptable to the Regulatory staff that should be implemented if the available electric power sources are less than the LCO.

3.0 TECHNICAL EVALUATION

3.1 Description of Electrical Power Distribution System

The distribution system sources consist of the offsite power sources (preferred power sources), and the onsite standby power sources (Train A and Train B diesel generators (DGs)). The onsite Class 1E AC Electrical Power Distribution System is divided into two redundant and independent load groups (A and B) with two 6.9 kilovolt (kV) Shutdown Boards in each load group (1A-A and 2A-A in load group A, and 1B-B and 2B-B in load group B) and the associated secondary 480 V Shutdown Boards. Each 6.9 kV Shutdown Board is connected to one of the preferred offsite power sources or to a DG in case the preferred offsite power source is lost. Two DGs associated with one load group (e.g., 1A-A and 2A-A) can provide all safety-related functions to mitigate a loss-of-coolant accident (LOCA) in one unit and safely shut down the other unit. The Train A and Train B engineered safety features systems each provide for the minimum safety functions necessary to shut down the plant and maintain it in a safe shutdown condition.

The offsite power distribution system consists of two 161 kV buses supplied by eight 161 kV transmission lines, and two 500 kV buses supplied by five 500 kV transmission lines. The output of the Unit 1 main generator is fed to the 500 kV buses, and the output of the Unit 2 main generator is fed to the 161 kV buses. The output of each unit's main generator can also serve as an offsite circuit via the associated Unit Station Service Transformers (USSTs) with a Generator Circuit Breaker providing isolation between the main generator and the main bank transformers. When the main generator is not operating, the main bank transformers function as step down transformers and supply electrical power from the grid to the USSTs.

When the unit is online, the offsite power is normally supplied from the main generator to USSTs to 6.9 kV Unit Boards and further on to the 6.9 kV Shutdown Boards. As an alternate source, the offsite power from 161 kV switchyard to the safety-related 6.9 kV Shutdown Boards can be supplied by the Common Station Service Transformers (CSSTs) via the 6.9 kV Start Buses and 6.9 kV Unit Boards. The power from CSST C can serve as an alternate power source for 6.9 kV Shutdown Boards 1A-A and 2A-A, and the power from CSST A can serve as the alternate power source for 6.9 kV Shutdown Boards 1B-B and 2B-B. In addition, CSST B is a spare transformer with two sets of secondary windings that can be used to supply power to two of the start buses. At least two electrically and physically separate circuits can provide AC power through a combination of the USSTs and/or CSSTs to the 6.9 kV Shutdown Boards. Further details of two qualified offsite circuits required per GDC 17 are provided in the ITS and CTS Bases. The ITS is consistent with the CTS regarding the two qualified offsite circuits.

The onsite standby power source for each 6.9 kV Shutdown Board is a dedicated DG. DGs 1A-A, 1B-B, 2A-A, and 2B-B are separate and independent and are dedicated to 6.9 kV Shutdown Boards 1A-A, 1B-B, 2A-A, and 2B-B, respectively. Each diesel generator set consists of two diesel engines in tandem driving a common generator. A DG starts automatically on a safety injection (SI) signal (e.g., low pressurizer pressure, high containment pressure, or low steam line pressure signals) or a 6.9 kV Shutdown Board degraded voltage or a loss-of-voltage signal. After a DG has started, it can automatically tie to its respective 6.9 kV Shutdown Board after offsite power is tripped as a consequence of a 6.9 kV Shutdown Board degraded voltage or loss-of-voltage signal, independent of or coincident with an SI signal.

Following the trip of offsite power, a loss-of-voltage signal strips most of the non-permanent loads from the 6.9 kV Shutdown Board. After the DG is tied to the 6.9 kV Shutdown Board, loads are sequentially connected to its respective 6.9 kV Shutdown Board by individual load sequence timers. The DGs are automatically connected to the 6.9 kV Shutdown Boards in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident such as LOCA. The required loads (needed to recover the unit or maintain it in a safe condition) are returned to service in a predetermined sequence in order to prevent overloading the DG in the process.

The core cooling systems and containment systems (e.g., SI, Auxiliary Feedwater (AFW), Residual Heat Removal, Centrifugal Charging pump, Containment Spray, and Air Return System fan) are unitized (not shared among the Units). However, some safety-related systems (e.g., Essential Raw Cooling Water (ERCW), Component Cooling Water System, Emergency Gas Treatment (EGTS), Auxiliary Building Gas Treatment, (ABGTS), Control Room Emergency Ventilation (CREVS), and Control Room Air-Conditioning (CRACS)) are shared by the two Units. The AC sources for these shared loads are distributed across all four 6.9 kV Shutdown Boards, and associated downstream 480 volt (V) Shutdown Boards.

The onsite Class 1E AC, vital direct current (DC), and vital instrument (120 V) electrical power distribution systems are divided into two redundant and independent trains (two trains per unit).

3.2 Evaluation of the Proposed Change

The licensee provided marked-up changes to ISTS for conversion into ITS. In this SE, the ITS Sections 3.8.1 and 3.8.9 LCOs and Actions are compared and evaluated with respect to the corresponding requirements in ISTS and CTS.

ISTS is written for a single-unit plant. However, with SQN being a two-unit plant, there are separate ITS for each SQN unit. However, the Unit 2 ITS is similar to the Unit 1 ITS. The following evaluation for Unit 1 applies to both Units. For Unit 2, the designations such as 1A-A and 1B-B can be considered as being replaced by 2A-A and 2B-B, and vice versa, unless indicated otherwise. During the review process, the licensee made significant changes to the ITS Sections 3.8.1 and 3.8.9 as compared to the original LAR dated November 22, 2013, to resolve various staff concerns. The following ITS LCOs 3.8.1 and 3.8.9 and the associated Actions reflect the latest version proposed by the licensee in letter dated July 24, 2015.

3.2.1 ITS 3.8.1 AC Sources – Operating

3.2.1.1 ITS 3.8.1 LCO

ITS 3.8.1 LCO states:

LCO 3.8.1 The following AC electrical sources shall be OPERABLE:

a. Two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System; and

b. Four diesel generators (DGs) capable of supplying the onsite Class 1E AC Electrical Power Distribution System.

APPLICABILITY: MODES 1, 2, 3, and 4.

ISTS LCO 3.8.1 states:

LCO 3.8.1 The following AC electrical sources shall be OPERABLE:

a. Two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System,

b. Two diesel generators (DGs) capable of supplying the onsite Class 1E power distribution subsystem(s), and

[c. Automatic load sequencers for Train A and Train B.]

APPLICABILITY: MODES 1, 2, 3, and 4.

Equivalent CTS LCO Requirements:

LCO 3.8.1.1 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

a. Two physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system, and

b. Four separate and independent diesel generators sets each with:

   1. Two diesels driving a common generator

   2. Two engine-mounted fuel tanks containing a minimum volume of 250 gallons of fuel, per tank

   3. A separate fuel storage system containing a minimum volume of 62,000 gallons of fuel,

   4. A separate fuel transfer pump, and

   5. A separate 125-volt D.C. distribution panel, 125-volt D.C. battery bank and associated charger.

APPLICABILITY: MODES 1, 2, 3, and 4.

Evaluation of ITS 3.8.1 LCO:

By comparing ITS to ISTS, the ITS specifies four (4) DGs, whereas the ISTS specifies two (2) DGs. ITS do not specify the automatic load sequencers, whereas the ISTS specifies optional automatic load sequencers for Train A and Train B. These changes are plant specific and consistent with CTS.

By comparing ITS to CTS, the staff finds that regarding the two qualified offsite circuits, ITS LCO 3.8.1.a is equivalent to CTS LCO 3.8.1.1.a, excepting a minor wording change. The detail of two qualified circuits is provided in the ITS Bases, which is consistent with the detail provided in CTS Bases 3/4.8.1 and 3/4.8.2. Many different combinations of offsite circuits can constitute two offsite circuits from 500 kV and 161 kV switchyards to 6.9 kV Class 1E Shutdown Boards. Each circuit feeds two of the four 6.9 kV shutdown boards either through a three-winding transformer with two secondaries; or through two two-winding transformers sharing a common high-voltage circuit. At any given time, two high-voltage offsite circuits feed a total of four 6.9 kV shutdown boards.

Regarding DGs, the differences between ITS LCO 3.8.1.b and CTS LCO 3.8.1.1.b are discussed as follows:

> CTS LCO 3.8.1.1.b.1 contains the phrase, “two diesels driving a common generator.” This phrase has been deleted in ITS LCO 3.8.1.b. This change is acceptable since the deleted wording does not add value to the plant safety significance.

CTS LCO 3.8.1.1.b.2, the requirement for the DG fuel oil in the engine-mounted fuel day tanks, is moved to ITS SR 3.8.1.4. The change is consistent with the ISTS.

CTS LCO 3.8.1.1.b.3, the requirement for the DG fuel oil in the fuel storage system is moved to ITS 3.8.3, “Diesel Fuel Oil, Lube Oil, and Starting Air.” The change is consistent with the ISTS.

CTS LCO 3.8.1.1.b.4, the requirement for the DG fuel oil transfer (from fuel storage system to the engine-mounted fuel day tanks) is moved to ITS SR 3.8.1.6. The change is consistent with the ISTS.

CTS LCO 3.8.1.1.b.5, the requirement for the DG D.C. system is moved to ITS 3.8.4, “DC Sources - Operating,” and ITS 3.8.9. The change is consistent with the ISTS.

Based on the above comparison, the staff finds that the ITS 3.8.1 LCO is similar to ISTS; and the requirements of CTS are maintained. Therefore, the staff finds the change acceptable.

When the LCO is not met, various Actions statements are applicable. These Action statements are preceded by the following ITS 3.8.1 Actions NOTES 1 and 2.

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1. LCO 3.0.4.b is not applicable to DGs.

2. Enter applicable Conditions and Required Actions of LCO 3.8.9, “Distribution Systems - Operating,” when any Condition(s) is entered with no AC power source to any shutdown board resulting in a de-energized shutdown board.

Note 1 is the same as ISTS 3.8.1 Actions Note, and is similar to that stated in CTS 3.8.1.1 Action f. LCO 3.0.4.b allows entry into a MODE or other specified Condition in the MODE Applicability (if appropriate) when an LCO is not met, after performance of a risk assessment addressing inoperable systems and components.

Note 2 requires simultaneous entry into LCO 3.8.9 if a Condition, such as ITS 3.8.1 Condition E discussed below, results in no AC power source to any shutdown board resulting in a de-energized shutdown board. CTS 3.8.2.1 provides an Action for a de-energized required electrical board. ITS 3.8.1 Note 2 specifically requires the compensatory actions for ITS 3.8.9 to be taken, if a shutdown board is made inoperable and de-energized by inoperable AC Sources. In ITS 3.8.1, the complete de-energization of a shutdown board could be represented by entry into ITS 3.8.1 Condition E or, as an example, concurrent entries into ITS 3.8.1, Conditions B (one or more Train A or one or more Train B DG(s) inoperable) and C (one offsite circuit inoperable solely due to an offsite power source to the opposite unit’s shutdown board). ITS 3.8.1, Conditions B and C do not have a NOTE to state that entry into the applicable Conditions and Required Actions of LCO 3.8.9 is required when Conditions are entered that result in no AC power source to any shutdown board. Therefore, the Note referring to LCO 3.8.9 in ITS 3.8.1, Required Action E will be removed from Required Action E, modified for clarification, and added as ITS 3.8.1 ACTIONS NOTE 2. ITS 3.8.1 ACTIONS NOTE 2 will state, “Enter applicable Conditions and Required Actions of LCO 3.8.9, ‘Distribution Systems - Operating,’ when any Condition(s) is entered with no AC power source to any shutdown board resulting in a de-energized shutdown board.” This will ensure that entry into a Condition or a combination of Conditions that result in the complete de-energization of a shutdown board requires entry into the applicable Conditions and Required Actions of LCO 3.8.9. The licensee added Note 2 to ITS 3.8.1 to correct this potential non-conservatism. This note is similar to that in ISTS Condition 3.8.1.D.

3.2.1.2 ITS 3.8.1 Conditions A and C

In comparison to ISTS 3.8.1 Condition A, the ITS has two equivalent ITS 3.8.1 Conditions A and C. ITS 3.8.1 Condition C applies when an inoperable offsite circuit is associated with only one of the Unit 2 (opposite Unit) 6.9 kV Shutdown Boards (2A-A or 2B-B). ITS 3.8.1 Condition A applies when one of the two offsite circuits is inoperable for any other reason than Condition C.

ITS 3.8.1 Condition A states:

CONDITION A: One offsite circuit inoperable for reasons other than Condition C.

REQUIRED ACTION: A.1 Perform SR 3.8.1.1 for OPERABLE offsite circuit.
COMPLETION TIME: 1 hour AND Once per 8 hours thereafter

AND

A.2 Declare required feature(s) with no offsite power available inoperable when its redundant required feature(s) is inoperable.
COMPLETION TIME: 24 hours from discovery of no offsite power to 6.9 kV Shutdown Board 1A-A or 1B-B concurrent with inoperability of redundant required feature(s)

AND

A.3 Restore offsite circuit to OPERABLE status.
COMPLETION TIME: 72 hours

ITS 3.8.1 Condition C states:

CONDITION C: One offsite circuit inoperable solely due to an offsite power source to 6.9 kV Shutdown Board 2A-A or 2B-B inoperable.

REQUIRED ACTION: C.1 Perform SR 3.8.1.1 for OPERABLE offsite circuit.
COMPLETION TIME: 1 hour AND Once per 8 hours thereafter

AND

C.2 Declare required feature(s) with no offsite power available inoperable when its redundant required feature(s) is inoperable. COMPLETION TIME: 24 hours from discovery of no offsite power to 6.9 kV Shutdown Board 2A-A or 2B-B concurrent with inoperability of redundant required feature(s)

AND

C.3 Restore offsite circuit to OPERABLE status. COMPLETION TIME: 7 days

Equivalent ISTS 3.8.1 Condition A states:

CONDITION A: One [required] offsite circuit inoperable.

REQUIRED ACTION: A.1 Perform SR 3.8.1.1 for [required] OPERABLE offsite circuit. COMPLETION TIME: 1 hour AND Once per 8 hours thereafter

AND

A.2 Declare required feature(s) with no offsite power available inoperable when its redundant required feature(s) is inoperable. COMPLETION TIME: 24 hours from discovery of no offsite power to one train concurrent with inoperability of redundant required feature(s)

AND

A.3 Restore [required] offsite circuit to OPERABLE status. COMPLETION TIME: 72 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in CTS Action 3.8.1.1.a which requires:
With one offsite A.C. circuit of the above required A.C. electrical power source inoperable, demonstrate the OPERABILITY of the remaining offsite A.C. circuit by performing the Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter. Restore at least two offsite circuits to OPERABLE status within 72 hours...

Evaluation of ITS 3.8.1 Condition A and Condition C

Comparing ITS to ISTS, ITS Required Actions A.1 and C.1 are similar to ISTS Required Action A.1.

ITS Required Actions A.2 and C.2 are similar to ISTS Action A.2. ITS Action A.2 pertains to 6.9 kV Shutdown Boards of Unit 1 (1A-A or 1B-B) and Required Action C.2 pertains to 6.9 kV

Shutdown Boards of Unit 2 (2A-A or 2B-B); whereas ISTS Action A.2 pertains to one train (A or B).

ITS Required Action A.3 is similar to ISTS Required Action A.3; both require the offsite circuit to be restored within 72 hours. However, ITS Required Action C.3 is different from ISTS Required Action A.3, since it allows 7 days instead of 72 hours to restore the offsite circuit. ITS makes a distinction that if a portion of offsite circuit becomes inoperable affecting only one of the 6.9 kV shutdown board of opposite unit, restoration of the affected circuit is allowed up to 7 days.

Comparing ITS to CTS, the ITS Required Actions are similar to the equivalent actions in CTS, except ITS Required Action C.3 is different from the CTS.

During the review process (RAI VKG027), the staff requested the licensee to provide justification for a Completion Time of 7 days for ITS Required Action C.3 versus 3 days allowed for ITS Required Action A.3. In the RAI response dated April 9, 2015 (in LAR Supplement 2), the licensee provided the following justification:

> On December 16, 1998, NRC issued Technical Specification Amendments for SQN, Units 1 and 2 (TAC Nos. M96600 and M96601)(TS 96-08)(ADAMS Accession No. 9812210233). The amendments revised the SQN Technical Specifications by extending the allowed outage time (AOT) for the SQN emergency diesel generators (EDG) from 72 hours to 7 days. Although SQN had demonstrated, based on a probabilistic risk assessment (PRA) basis, that the extended EDG AOT would result in no significant increase in risk, the staff also reviewed the submittal from a deterministic approach. Based on the Staff's review, it was determined that a 7 day AOT was acceptable. Regulatory Guide 1.93, Rev. 0 states that "a general distinction does not appear to be warranted for operating restrictions associated with the loss of an offsite source and those restrictions associated with the loss of an onsite a.c. supply." Regulatory Guide 1.93, Rev. 1, Section C. "Regulatory Position" discusses the seven levels of degradation of the electric power system in order of increasing degradation. The lowest level of degradation listed is "The available offsite ac power sources are one less than the LCO." The second lowest level of degradation listed is "The available onsite ac power sources are one less than the LCO." Both of these levels of degradation have the same AOT, which is consistent with the statement made in Rev. 0 of Regulatory Guide 1.93. The revision to ITS 3.8.1 Condition C will align the AOT for an inoperable offsite power source to an opposite unit's 6.9 kV shutdown board to correspond to the AOT for an inoperable onsite (EDG) power source.
>
> At SQN, the majority of the loads necessary to mitigate design basis accidents (DBAs) are powered from the associated unit's two trained 6.9 kV shutdown boards that each have an offsite and onsite (EDG) power source. Consistent with Regulatory Guide 1.93 and ISTS 3.8.1, a loss of the offsite power source to their respective train for the associated unit will require entry into a Condition and Required Action Completion Time of 72 hours. However, there are shared loads

that are powered from the opposite unit's trained power supply. The systems that are shared between Unit 1 and Unit 2 and powered from Unit 1 are the Emergency Gas Treatment System (EGTS), Essential Raw Cooling Water (ERCW) System, Component Cooling Water System (CCS), Control Room Emergency Ventilation System (CREVS), Control Room Air-Conditioning System (CRACS), and the 125V Vital DC System. The shared systems powered from Unit 2 are the Auxiliary Building Gas Treatment System (ABGTS), the Auxiliary Control Air System (ACAS), Essential Raw Cooling Water (ERCW) System, Component Cooling Water System (CCS), and the 125V Vital DC System. In ITS 3.8.1, a loss of an offsite power source to an opposite unit shutdown board would require verification of the breaker alignment and indicated power availability for the OPERABLE offsite circuit within 1 hour, verification that the required features with no offsite power available have OPERABLE redundant features, otherwise declare the required feature inoperable, and entry into a Condition and Required Action Completion Time of 7 days to restore the offsite circuit to OPERABLE status. With a single inoperable offsite power source to an opposite unit shutdown board, all required features remain OPERABLE with redundancy. For a loss of safety function to occur, a complete loss of onsite power along with the offsite power to the redundant train on the opposite unit would have to occur.

SQN has maintenance activities that need to be performed on the shutdown boards. The entire maintenance activity cannot be performed under the current AOT of 72 hours. The extension of the AOT for an inoperable offsite circuit to an opposite unit shutdown board would allow the maintenance activities to be performed during a scheduled outage on the opposite unit. The increased AOT will not increase the probability or consequences of any accident previously evaluated. The power sources are required to be OPERABLE to support the associated unit's required features. Because the offsite circuit is not an initiator of any accident sequence, inoperability of the circuit will not affect the probability of an accident occurring. The consequences of any accident previously evaluated will not be increased.

Recent modifications to the offsite power system and Technical Specification change TS-SQN-12-01 [Amendment approved by NRC, ADAMS Accession No. ML12286A078] has increased the number of qualified circuits that can be used to provide offsite power to the onsite power distribution system. The unit station service transformers (USSTs) now qualify as an offsite power circuit. Additionally, SQN has never experienced a complete loss of offsite power event during commercial operation.

In the NRC staff's review of the 7-day Completion Time for ITS Required Action 3.8.1.C.3 (for an inoperable offsite power supply to an opposite unit's 6.9 kV shutdown board), the following were considered: (1) the limited amount of equipment that is powered from the opposite unit's shutdown board, (2) no impact on the probability of occurrence or consequences of accidents previously evaluated, (3) SQN has a number of qualified offsite circuits for providing offsite power, and (4) the Completion Time is consistent with the Completion Time of 7 days in the case of loss of an onsite power source. The above measures reduce risk to both SQN Units such that the safety systems will not significantly impair their ability to perform their safety functions in accordance with GDC 5. Based on the above, the NRC staff finds the change acceptable.

3.2.1.3 ITS 3.8.1 Condition B

ITS 3.8.1 Condition B states:

CONDITION B: One or more Train A DG(s) inoperable.

OR

One or more Train B DG(s) inoperable.

REQUIRED ACTION: B.1 Perform SR 3.8.1.1 for the offsite circuits.
COMPLETION TIME: 1 hour AND Once per 8 hours thereafter

AND

B.2 Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.
COMPLETION TIME: 4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)

AND

B.3.1 Determine OPERABLE DGs are not inoperable due to common cause failure.
COMPLETION TIME: 24 hours

OR

B.3.2 Perform SR 3.8.1.2 for OPERABLE DGs.
COMPLETION TIME: 24 hours

AND

B.4 Restore DG(s) to OPERABLE status.
COMPLETION TIME: 7 days

Equivalent ISTS 3.8.1 Condition B states:

CONDITION B: One [required] DG inoperable.

REQUIRED ACTION: B.1 Perform SR 3.8.1.1 for the [required] offsite circuit(s).
COMPLETION TIME: 1 hour AND Once per 8 hours thereafter

AND

B.2 Declare required feature(s) supported by the inoperable DG inoperable when its required redundant feature(s) is inoperable.
COMPLETION TIME: 4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)

AND

B.3.1 Determine OPERABLE DG(s) is not inoperable due to common cause failure.
COMPLETION TIME: [24] hours

OR

B.3.2 Perform SR 3.8.1.2 for OPERABLE DG(s).
COMPLETION TIME: [24] hours

AND

B.4 Restore [required] DG to OPERABLE status.
COMPLETION TIME: 72 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action b of CTS LCO 3.8.1.1 which requires: With diesel generator set(s) 1A-A and/or 2A-A or 1B-B and/or 2B-B of the above required A.C. electrical power sources inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter, and determining OPERABLE diesel generator sets are not inoperable due to common cause failure or performing SR 4.8.1.1.2.a.4 within 24 hours; restore at least four diesel generator sets to OPERABLE status within 7 days....

Evaluation of ITS 3.8.1 Condition B

Comparing ITS to ISTS, the ITS Condition B is similar to ISTS Condition B with some minor changes, such as ITS refers to one or more DGs of one train inoperable, whereas ISTS refers to any one DG inoperable (considering a single unit plant). SQN being a dual unit plant has two DGs per train (e.g., 1A-A and 2A-A DGs make up Train A).

ITS Required Action B.4 is similar to ISTS Required Action B.4, except that ISTS requires inoperable DG to be restored within 72 hours. However, ITS Required Action B.4 is different from ISTS Required Action B.4, since it allows 7 days instead of 72 hours to restore the inoperable DG (or inoperable DGs of the same train).

Comparing ITS to CTS, ITS Condition B is similar to CTS. CTS also allows 7 days (similar to ITS Action B.4) to restore the inoperable DG (or inoperable DGs of the same train).

Based on its review of the licensee's application, the staff finds ITS 3.8.1 Condition B acceptable, since it is similar to CTS and also ISTS after allowing for plant specific Completion Time for Required Action B.4 to restore an inoperable DG within 7 days.

3.2.1.4 ITS 3.8.1 Condition

ITS 3.8.1 Condition D states:

CONDITION D: Two offsite circuits inoperable.

REQUIRED ACTION: D.1 Declare required feature(s) inoperable when its redundant required feature(s) is inoperable.
COMPLETION TIME: 12 hours from discovery of Condition D concurrent with inoperability of redundant required features

AND

D.2 Restore one offsite circuit to OPERABLE status.
COMPLETION TIME: 24 hours

Equivalent ISTS 3.8.1 Condition C states:

CONDITION C: Two [required] offsite circuits inoperable.

REQUIRED ACTION: C.1 Declare required feature(s) inoperable when its redundant required feature(s) is inoperable.
COMPLETION TIME: 12 hours from discovery of Condition C concurrent with inoperability of redundant required features

AND

C.2 Restore one [required] offsite circuit to OPERABLE status.
COMPLETION TIME: 24 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action d of CTS LCO 3.8.1.1, which requires: With two of the required offsite circuits inoperable, demonstrate the OPERABILITY of the 4 diesel generator sets by performing SR 4.8.1.1.2.a.4 within 8 hours, unless diesel generator sets are already operating; restore at least one of the inoperable offsite sources to OPERABLE status within 24 hours...

Evaluation of ITS 3.8.1 Condition D

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the staff found the ITS 3.8.1 Condition D is similar to the ISTS 3.8.1 Condition C.

By comparing ITS to CTS, the NRC staff found that the ITS Condition D is similar to CTS, except that CTS 4.8.1.1.2.a.4 requires verification that each DG starts and achieves voltage and frequency within established ranges within 10 seconds. ITS 3.8.1.D does not contain this requirement. The purpose of the CTS SR 4.8.1.1.2.a.4 requirement is to ensure that the DGs are OPERABLE in the case of a loss of offsite power. Since the DGs are tested on a monthly basis, the staff finds that subjecting the DGs to additional testing is not required. Furthermore, the inoperability of two offsite circuits does not affect the operability of the DGs, since the DGs are independent of the offsite circuits. Therefore, there is no need to subject the DGs to additional testing. Based on the above, the NRC staff finds ITS 3.8.1 Condition D acceptable.

3.2.1.5 ITS 3.8.1 Condition E

ITS 3.8.1 Condition E states:

CONDITION E: One offsite circuit inoperable for reasons other than Condition C.

AND

DG 1A-A or 1B-B inoperable.

REQUIRED ACTION: E.1 Restore offsite circuit to OPERABLE status.
COMPLETION TIME: 12 hours.

OR

E.2 Restore DG to OPERABLE status.
COMPLETION TIME: 12 hours.

Equivalent ISTS 3.8.1 Condition D states:

CONDITION D: One [required] offsite circuit inoperable.

AND

One [required] DG inoperable.

REQUIRED ACTION: --------------------------NOTE--------------------------------
Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems – Operating," when Condition D is entered with no AC power source to any train.

D.1 Restore [required] offsite circuit to OPERABLE status.
COMPLETION TIME: 12 hours.

<u>OR</u>

D.2 Restore [required] DG to OPERABLE status.
COMPLETION TIME: 12 hours.

<u>Equivalent CTS Requirements</u>:

Equivalent CTS requirements are provided in Action c of CTS LCO 3.8.1.1, which requires: With one offsite circuit and one diesel generator set inoperable, demonstrate the OPERABILITY of the remaining A.C. sources by performing Surveillance Requirements 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter, and performing Surveillance Requirement 4.8.1.1.2.a.4 within 8 hours; restore at least one of the inoperable sources to OPERABLE status within 12 hours...

<u>Evaluation of ITS 3.8.1 Condition E</u>

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS 3.8.1 Condition E is similar to the ISTS 3.8.1 Condition D. The Note preceding the Required Action in the ISTS 3.8.1 Condition D is similar to ITS ACTIONS NOTE 2, which precedes all of the Action statements in the ITS. Both require entry into applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems – Operating," with no AC power to any shutdown board (or train).

By comparing ITS to CTS, the NRC staff found that the ITS Condition 3.8.1.E is similar to CTS action 3.8.1.1.c except that CTS requires SRs 4.8.1.1.1.a and 4.8.1.1.2.a.4 for the remaining offsite circuits and DGs to ensure that the remaining AC sources are operable. However, ITS 3.8.1.E still meets the intent of CTS. Since, both ITS Conditions 3.8.1.A and 3.8.1.B would be applicable concurrently with ITS Condition 3.8.1.E, equivalent ITS SRs 3.8.1.1 and 3.8.1.2 are still required to be performed for the remaining offsite circuit and DGs, respectively, to ensure they remain operable. Based on the above, the NRC staff finds ITS 3.8.1 Condition E acceptable.

3.2.1.6 <u>ITS 3.8.1 Condition F</u>

<u>ITS 3.8.1 Condition F states</u>:

CONDITION F: One or more Train A DG(s) inoperable.

<u>AND</u>

One or more Train B DG(s) inoperable.

REQUIRED ACTION: F.1 Restore one train of DGs to OPERABLE status.
COMPLETION TIME: 2 hours

Equivalent ISTS 3.8.1 Condition E states:

CONDITION E: Two [required] DG(s) inoperable.

REQUIRED ACTION: E.1 Restore one [required] DG to OPERABLE status.
COMPLETION TIME: 2 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action e of CTS LCO 3.8.1.1, which requires: With either diesel generator sets 1A-A and/or 2A-A inoperable simultaneous with 1B-B and/or 2B-B, demonstrate the OPERABILITY of two offsite A.C. circuits by performing SR 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter; restore at least 1) 1A-A and 2A-A or 2) 1B-B and 2B-B DG to OPERABLE status within 2 hours…

Evaluation of ITS 3.8.1 Condition F

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS 3.8.1.F is similar to ISTS 3.8.1.E.

By comparing ITS to CTS, the NRC staff found that the ITS is similar to CTS except that CTS requires SR 4.8.1.1.1.a for the two offsite circuits to ensure that they are operable. However, ITS 3.8.1 Condition F still meets the intent of CTS. Since ITS 3.8.1 Condition B would be applicable concurrently with ITS 3.8.1 Condition F, the equivalent SR 3.8.1.1 is still required to be performed to ensure the offsite circuits remain operable. Based on the above, the NRC staff finds ITS 3.8.1 Condition F acceptable.

3.2.1.7 ITS 3.8.1 Condition G

ITS 3.8.1 Condition G states:

CONDITION G: Required Action and associated Completion Time of Condition A, B, C, D, E, or F not met.

REQUIRED ACTION: G.1 Be in MODE 3.
COMPLETION TIME: 6 hours.

AND

G.2 Be in MODE 5.
COMPLETION TIME: 36 hours.

Equivalent ISTS 3.8.1 Condition G states:

CONDITION G: Required Action and associated Completion Time of Condition A, B, C, D, E, or [F] not met.

REQUIRED ACTION: G.1 Be in MODE 3.
COMPLETION TIME: 6 hours.

AND

G.2 Be in MODE 5.
COMPLETION TIME: 36 hours.

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Actions a, b, c, and e of CTS LCO 3.8.1.1, which requires that with the corresponding Actions not met, be in at least HOT STANDBY [Mode 3] within the next 6 hours and in COLD SHUTDOWN [Mode 5] within the following 30 hours. CTS Action d [corresponding two required offsite AC circuits inoperable] requires entry into at least HOT STANDBY [Mode 3] within the next 6 hours.

Evaluation of ITS 3.8.1 Condition G

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS 3.8.1.G is similar to the ISTS 3.8.1.G.

By comparing ITS to CTS, the NRC staff found that ITS 3.8.1 Condition G is similar to Actions a, b, c, d, and e of CTS 3.8.1.1, except that CTS 3.8.1.1.d is the least conservative. CTS 3.8.1.1.d only requires entry into at least HOT STANDBY [Mode 3] within the next 6 hours when requirements are not met. For CTS 3.8.1.1.d, entry into COLD SHUTDOWN [Mode 5] within the following 30 hours is not required. ITS 3.8.1.G requires the licensee to exit the mode of applicability for ITS LCO 3.8.1 when the Required Actions and Completion Times are not met consistent with the ISTS. This change is more conservative than the CTS requirement because additional actions must be taken. Based on the above, the NRC staff finds ITS 3.8.1 Condition G acceptable.

3.2.1.8 ITS 3.8.1 Conditions H and I

ITS 3.8.1 Condition H states:

CONDITION H: Two offsite circuits inoperable.

AND

One or more Train A DG(s) inoperable.

OR

One or more Train B DG(s) inoperable.

REQUIRED ACTION: H.1 Enter LCO 3.0.3.
COMPLETION TIME: Immediately

ITS 3.8.1 Condition I states:

CONDITION I: One offsite circuit inoperable.

AND

One or more Train A DG(s) inoperable.

AND

One or more Train B DG(s) inoperable.

REQUIRED ACTION: I.1 Enter LCO 3.0.3.
COMPLETION TIME: Immediately

Equivalent ISTS Condition H states:

CONDITION H: Three or more [required] AC sources inoperable.

REQUIRED ACTION: H.1 Enter LCO 3.0.3.
COMPLETION TIME: Immediately

Equivalent CTS Requirements:

There is no equivalent CTS Action statement.

Evaluation of ITS 3.8.1 Conditions H and I

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

ITS 3.8.1 Conditions H and I describe plant conditions in which the AC electrical power supplies' redundancy cannot be assured. Therefore, a controlled unit shutdown per LCO 3.0.3 is required. ITS 3.8.1.H is entered when both circuits of offsite power are inoperable concurrent with one or more DGs inoperable. ITS 3.8.1.I is entered when both trains of DGs are inoperable concurrent with one offsite circuit inoperable. These specific plant conditions are undefined in the CTS, and thus specifying them adds clarity to the ITS. ITS Required Actions 3.8.1.H.1 and

3.8.1.I.1 are considered more conservative as compared to ISTS and CTS. Based on the above, the NRC staff finds 3.8.1 Conditions H and I acceptable.

3.2.2 ITS 3.8.9 Distribution Systems – Operating

3.2.2.1 ITS 3.8.9 LCO

ITS 3.8.9 LCO states:

LCO 3.8.9 Two electrical power distribution trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

In the ITS, the details of two electrical power distribution trains are removed to Bases B 3.8.9. As described in ITS B 3.8.9, each train consists of the following electrical power subsystems:

Train A

a. AC electrical power distribution subsystem consisting of:

Unit 1	Unit 2
6900 V SD BD 1A-A	6900 V SD BD 2A-A
480 V SD BDs 1A1-A 1A2-A	480 V SD BDs 2A1-A 2A2-A

b. AC vital instrument power distribution subsystem consisting of:

Unit 1	Unit 2
120 V Boards 1-I 1-III	120 V Boards 2-I 2-III

c. Vital DC electrical power distribution subsystem consisting of:

125 V DC Board I	125 V DC Board III

d. DG DC electrical power distribution subsystem consisting of:

125 V DG DC Distr. Pnl 1A-A	125 V DG DC Distr. Pnl 2A-A

Train B

a. AC electrical power distribution subsystem consisting of:

Unit 1	Unit 2
6900 V SD BD 1B-B	6900 V SD BD 2B-B
480 V SD BDs 1B1-B 1B2-B	480 V SD BDs 2B1-B 2B2-B

b. AC vital instrument power distribution subsystem consisting of:

Unit 1	Unit 2
120 V Boards 1-II 1-IV	120 V Boards 2-II 2-IV

c. Vital DC electrical power distribution subsystem consisting of:

125 V DC Board II	125 V DC Board IV

d. DG DC electrical power distribution subsystem consisting of:

125 V DG DC Distr. Pnl. 1B-B	125 V DG DC Distr. Pnl. 2B-B

ISTS LCO 3.8.9 states:

LCO 3.8.9 Train A and Train B AC, DC, and AC vital bus electrical power distribution subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

Equivalent CTS LCO Requirements:

LCO 3.8.2.1 The following A.C. electrical boards shall be OPERABLE:

6900 Volt Shutdown Board 1A-A
6900 Volt Shutdown Board 1B-B
6900 Volt Shutdown Board 2A-A
6900 Volt Shutdown Board 2B-B

480 Volt Shutdown Board 1A1-A
480 Volt Shutdown Board 1A2-A
480 Volt Shutdown Board 1B1-B
480 Volt Shutdown Board 1B2-B
480 Volt Shutdown Board 2A1-A
480 Volt Shutdown Board 2A2-A
480 Volt Shutdown Board 2B1-B

480 Volt Shutdown Board 2B2-B

120 Volt A.C. Vital Instrument Power Board Channels 1-I and 2-I [energized from inverters 1-I and 2-I connected to D.C. Channel I]
120 Volt A.C. Vital Instrument Power Board Channels 1-II and 2-II [energized from inverters 1-II and 2-II connected to D.C. Channel II]
120 Volt A.C. Vital Instrument Power Board Channels 1-III and 2-III [energized from inverters 1-III and 2-III connected to D.C. Channel III]
120 Volt A.C. Vital Instrument Power Board Channels 1-IV and 2-IV [energized from inverters 1-IV and 2-IV connected to D.C. Channel IV]

[Note: Inverters are addressed in ITS 3.8.7]

LCO 3.8.2.3 The following D.C. vital battery channels shall be OPERABLE:

CHANNEL I Consisting of 125 volt D.C. board No. I [and associated battery bank and charger]
CHANNEL II Consisting of 125 volt D.C. board No. II [and associated battery bank and charger]
CHANNEL III Consisting of 125 volt D.C. board No. III [and associated battery bank and charger]
CHANNEL IV Consisting of 125 volt D.C. board No. IV [and associated battery bank and charger]

[Note: Associated battery bank and charger are addressed in ITS 3.8.4 and ITS 3.8.6]

APPLICABILITY: MODES 1, 2, 3, and 4.

Evaluation of ITS 3.8.9 LCO:

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that the ITS LCO 3.8.9 specifies separate DG DC subsystems (four DG DC panels - one for each DG) to be operable, whereas ISTS LCO 3.8.9 does not have similar requirements. This is due to the fact that for most plants, the DG DC power is provided directly from the plant vital DC electrical power distribution subsystem.

By comparing ITS to CTS, the NRC staff found that the requirement for separate DG DC subsystems is delineated in CTS LCO 3.8.1.1.b.5. The CTS LCO equipment detail is not required for the ITS and has been removed to the ITS bases. ITS 3.8.9 LCO is similar to ISTS LCO 3.8.9, and the equivalent requirements of CTS are maintained. Based on the above, the NRC staff finds ITS 3.8.9 LCO is acceptable.

3.2.2.2 ITS 3.8.9 Condition A

ITS 3.8.9 Condition A states:

CONDITION A: One or more AC electrical power distribution subsystems inoperable due to one or more Unit 1 AC shutdown boards inoperable.

REQUIRED ACTION: A.1 --NOTE----------------------------------
Enter applicable Conditions and Required Actions of LCO 3.8.4, “DC Sources – Operating,” for vital DC electrical power trains made inoperable by inoperable AC electrical power distribution subsystems.

Restore Unit 1 AC electrical power distribution subsystem(s) to OPERABLE status.
COMPLETION TIME: 8 hours

ISTS 3.8.9 Condition A states:

CONDITION A: One or more AC electrical power distribution subsystems inoperable.

REQUIRED ACTION: A.1 -------------------------------------NOTE-------------------------------------
Enter applicable Conditions and Required Actions of LCO 3.8.4, “DC Sources – Operating,” for DC trains made inoperable by inoperable power distribution subsystems.

Restore AC electrical power distribution subsystem(s) to OPERABLE status.
COMPLETION TIME: 8 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action a of CTS LCO 3.8.2.1, which requires: With less than the above complement of A.C. boards OPERABLE and energized, restore the inoperable boards to OPERABLE status within 8 hours...

Evaluation of ITS 3.8.9 Condition A

In the review of the licensee’s application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS Condition 3.8.9.A is similar to ISTS Condition 3.8.9.A, differing in that ITS 3.8.9.A refers to one or more of Unit 1’s (associated unit) AC subsystem(s) shutdown boards becoming inoperable. If any Unit 2 (opposite unit) shutdown boards become inoperable, ITS 3.8.9.E would apply, which is discussed separately in Section 3.2.2.6 below. ISTS is written for single unit plant without shared systems.

By comparing ITS to CTS, the NRC staff found that ITS 3.8.9.A is similar to CTS 3.8.2.1.a. The difference between them is that ITS 3.8.9.A specifies that one or more shutdown boards for Unit 1 have become inoperable. If any Unit 2 shutdown boards become inoperable, ITS 3.8.9 Condition E would apply. CTS 3.8.2.1.a refers to any applicable shutdown board becoming inoperable irrespective of the Train or Unit.

The staff finds CTS 3.8.2.1.a is more conservative than ITS 3.8.9.A. However, the staff finds that plant safety will not be significantly impacted because ITS 3.8.9 considers the inoperability of each train separately. Plant safety is expected to remain same as long as the inoperable subsystem(s) (boards) belong to the same train. If the inoperable subsystems (boards) belong to two different trains, ITS Condition 3.8.9.H (loss of safety function) would apply.

Based on the above, the NRC staff finds ITS 3.8.9 Condition A acceptable, since it meets the intent of the CTS requirement and is similar to ISTS.

3.2.2.3 ITS 3.8.9 Condition B

ITS 3.8.9 Condition B states:

CONDITION B: One or more AC vital instrument power distribution subsystems inoperable.

REQUIRED ACTION: B.1 Restore AC vital instrument power distribution subsystem(s) to OPERABLE status.
COMPLETION TIME: 8 hours

ISTS 3.8.9 Condition B states:

CONDITION B: One or more AC vital buses inoperable.

REQUIRED ACTION: B.1 Restore AC vital bus subsystem(s) to OPERABLE status.
COMPLETION TIME: 2 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action 3.8.2.1.a, which requires: With less than the above complement of A.C. boards OPERABLE and energized, restore the inoperable boards to OPERABLE status within 8 hours...

Evaluation of ITS 3.8.9 Condition B

According to UFSAR, the normal supply of AC power to an instrument power distribution panel is from the inverter in each channel. The inverters consist of four major subassemblies: a DC power supply, an auctioneering circuit, an inverter circuit and a static switch. The spare inverters consist of a DC power supply, an auctioneering circuit, and an inverter circuit but do not have a static switch. The DC power supply subassembly converts the 480-volt AC normal inverter input to direct current. The auctioneering circuit accepts the DC power supply (normal supply) and battery (emergency supply) inputs and permits a switchless bidirectional transfer between them in the event of 480 V AC supply failure and restoration. The DC output of the auctioneering circuit is converted to AC by the inverting circuit. The static switch automatically transfers the load between the inverter circuit output and a regulated bypass source upon overload or system malfunction without interrupting the power to the load.

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS Condition 3.8.9.B and the associated Required Action is very similar to ISTS Condition 3.8.9.B, except the ITS completion time is longer, 8 hours (plant specific) versus 2 hours.

By comparing ITS to CTS, ITS 3.8.9 Condition B maintains the intent of CTS Action 3.8.2.1.a, but specifies which of the boards apply. ITS 3.8.9 Condition A, discussed in Section 3.2.2.2, specifies the associated unit's shutdown boards, while ITS 3.8.9 Condition B specifies the vital instrument power boards for either unit. CTS Action 3.8.2.1.a does not differentiate between the various AC boards. The staff finds the Completion Time of 8 hours is the same in CTS and ITS. Plant safety is expected to remain same as long as the inoperable subsystem(s) (boards) belong to the same train. If the inoperable subsystems (boards) belong to two trains, ITS Condition 3.8.9 Condition H (loss of safety function) would apply.

Based on the above, the NRC staff finds ITS 3.8.9 Condition B acceptable, since it meets the intent of the CTS requirement and is similar to ISTS.

3.2.2.4 ITS 3.8.9 Condition C

ITS 3.8.9 Condition C states:

CONDITION C: One or more vital DC electrical power distribution subsystems inoperable.

REQUIRED ACTION: C.1 Restore vital DC electrical power distribution subsystem(s) to OPERABLE status.
COMPLETION TIME: 2 hours

ISTS 3.8.9 Condition C states:

CONDITION C: One or more DC electrical power distribution subsystems inoperable.

REQUIRED ACTION: C.1 Restore DC electrical power distribution subsystem(s) to OPERABLE status.
COMPLETION TIME: 2 hours

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action a of CTS LCO 3.8.2.3, which requires: With one 125 V D.C. board inoperable, restore the inoperable board to OPERABLE and energized status within 2 hours...

Evaluation of ITS 3.8.9 Condition C

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS Condition 3.8.9.C and associated Required Action is similar to ISTS Condition 3.8.9.C.

Comparing ITS to CTS, the ITS 3.8.9.C and associated Required Action is similar to CTS Action 3.8.2.3.a which also specifies a Completion Time of an inoperable DC board as 2 hours. CTS refers to any applicable board becoming inoperable irrespective of the train. The staff finds CTS is more conservative than ITS. However, the staff finds that plant safety will not be significantly impacted because the ITS considers the inoperability of each train separately. Plant safety is expected to remain the same as long as the inoperable subsystem(s) (boards) belong to the same train. If the inoperable subsystems (boards) belong to two trains, ITS 3.8.9 Condition H (loss of safety function) would apply.

Based on the above, the NRC staff finds ITS 3.8.9 LCO Condition C acceptable, since it meets the intent of the CTS requirement and is similar to ISTS.

3.2.2.5 ITS 3.8.9 Condition D

ITS 3.8.9 Condition D states:

-----------------------NOTES-------------------------
1. Only applicable during planned maintenance.

2. Only applicable when Unit 2 is defueled or in MODE 6 following defueled with Unit 2 refueling water cavity level ≥ 23 ft. above top of reactor vessel flange.

CONDITION D: One or more AC electrical power distribution subsystems inoperable due to one or more Unit 2 AC shutdown boards inoperable.

REQUIRED ACTION: D.1 Declare associated required feature(s) inoperable.
COMPLETION TIME: Immediately

Equivalent ISTS Requirements:

There are no equivalent ISTS Actions.

Equivalent CTS Requirements:

There are no equivalent CTS Actions.

Evaluation of ITS 3.8.9 Condition D

This TS Condition would allow the licensee to perform planned maintenance on 6.9 kV and 480 V shutdown boards of Unit 2, while Unit 2 is defueled or in MODE 6 following defueled condition, while Unit 1 is online [and vice versa], for up to 7 days depending on the allowed completion times of associated required feature(s)/loads declared inoperable. Currently CTS allows only 8 hours for any inoperable of 6.9 kV or 480 V shutdown board before the shutdown of both units becomes necessary. This time is not sufficient to perform any planned maintenance on any shutdown board. In the LAR, the licensee referenced its letter dated September 30, 2013 (ADAMS Accession No. ML13276A049), in which it stated its plan to perform preventive maintenance on the SQN 6900 V and 480 V Shutdown Boards for Units 1 and 2 with one unit in Mode 5 or 6 or defueled and the other unit in Mode 1, 2, 3, or 4.

During the LAR review process, the licensee stated (in response to RAI GMW004) that preventive maintenance activities associated with the 6.9 kV Shutdown Boards include:

- Insulation resistance testing (megger)
- Inspection and micro-ohm resistance measurements
- Inspecting, cleaning, and lubricating primary stabs
- Cleaning rear compartments by vacuuming and wiping buses and insulators with alcohol and rags
- Pulling rear panels of potential transformer cabinets, inspecting components, and lubricating bus connections
- Performing additional work orders to address equipment issues (e.g., cell switch replacements, fuse block replacements) as allowed within the Completion Times

The licensee estimated the duration (i.e., time the Shutdown Board is not OPERABLE) to perform preventive maintenance on a single 6.9 kV Shutdown Board and two associated 480 V Shutdown Boards as approximately 100 hours. This estimate include the following activities:

12 hours for tagging and preparation
20 hours for 6.9 kV Shutdown Board maintenance
26 hours for first 480 V Shutdown Board maintenance
26 hours for second 480 V Shutdown Board maintenance
12 hours for tagging removal and restoration
4 hours for DG warm-up
1 hour for DG testing

Adding some margin for some unforeseen circumstances, the licensee requested 7 days of allowed outage time (AOT) for inoperable offsite/onsite power to a 6.9 kV shutdown board and the associated 480V shutdown boards. ITS 3.8.9.D would allow up to 7 days of planned maintenance to be performed on an inoperable 6.9 kV Shutdown Board and two associated 480 V Shutdown Boards of Unit 2 while Unit 1 is in Mode 1, 2, 3, or 4 (and vice versa). At the time of this amendment, ITS 3.8.9 Required Action D.1 allows only 3 days based on associated required features declared inoperable. This AOT would increase to 7 days with some additional TS changes/plant modifications as discussed below.

During the NRC staff's LAR review process (in the responses to the RAIs VKG004 and VKG007), the licensee provided following details of shared equipment on the opposite unit's shutdown board:

6.9 kV Shutdown Board 1A-A (and associated 480 V shutdown boards)
ERCW Pump J-A (Note 1)
ERCW Pump Q-A (Note 1)
Control Room AHU A-A (Note 2)
Control Room AC Compressor A-A (Note 2)
CCS Pump 1A-A (Note 3)
EGTS Fan A-A (Note 4)
125 V Vital Battery Charger I (Note 5)

6.9 kV Shutdown Board 1B-B (and associated 480 V shutdown boards)
ERCW Pump L-B (Note 1)
ERCW Pump N-B (Note 1)
Control Room AHU B-B (Note 2)
Control Room AC Compressor B-B (Note 2)
CCS Pump 1B-B (Note 3)
EGTS Fan B-B (Note 4)
125 V Vital Battery Charger II (Note 5)

6.9 kV Shutdown Board 2A-A (and associated 480 V shutdown boards)
ERCW Pump R-A (Note 1)
ERCW Pump K-A (Note 1)
CCS Pump 2A-A (Note 3)
ABGTS Fan A-A (Note 6)
Auxiliary Control Air Compressor A-A (Note 7)
125 V Vital Battery Charger III (Note 5)

6.9 kV Shutdown Board 2B-B (and associated 480 V shutdown boards)
ERCW Pump P-B (Note 1)
ERCW Pump M-B (Note 1)
CCS Pump 2B-B (Note 3)
CCS Pump C-S (Note 3)
ABGTS Fan B-B (Note 6)
Auxiliary Control Air Compressor B-B (Note 7)
125 V Vital Battery Charger IV (Note 5)

NOTES:

1. The current requirement is for one operable ERCW pump per 6.9 kV Shutdown Board. Following implementation of an approved license amendment (TS-SQN-13-01 and

TS-SQN-13-02, ML13280A267) an operable ERCW system train can require as few as one ERCW pump with consideration of the UHS temperature requirements. Until then, ITS 3.7.8, Condition A will require an inoperable ERCW system train to be restored in 72 hours.

2. Per ITS 3.7.10, Condition A, an inoperable train of CREVS is required to be restored in 7 days. Per ITS 3.7.11, Condition A, an inoperable CRACS train is required to be restored in 30 days.

3. CCS trains can be aligned and meet the requirements of ITS LCO 3.7.7 with the remaining operable pumps with one 6.9 kV Shutdown Board inoperable.

4. Per ITS 3.6.10, Condition A, an inoperable EGTS train is required to be restored in 7 days.

5. With the adoption of TSTF-500, ITS 3.8.4, Condition A requires an inoperable battery charger to be restored in 7 days, provided battery terminal voltage can be maintained greater than or equal to the minimum established float voltage and battery float current is maintained less than or equal to 2 amps.

6. Per ITS 3.7.12, Condition A, an inoperable ABGTS train is required to be restored in 7 days.

7. Following implementation of the proposed plant modification to install one or more additional auxiliary control air compressor(s), two trains of auxiliary control air can be maintained with either 6.9 kV Shutdown Board 2A-A or 2B-B inoperable. Until then, the most limiting components are the Atmospheric Relief Valves (ARVs) and the Auxiliary Feedwater System (AFW) level control valves. ITS 3.7.4, ARVs, Condition A requires one or more ARV lines inoperable due to one train of auxiliary control air nonfunctional to be restored in 72 hours. ITS 3.7.5, AFW, Condition B requires (in MODE 1, 2, or 3) one AFW train inoperable for reasons other than an inoperable steam supply valve to a turbine driven train to be restored in 72 hours.

The inoperable electrical power subsystem Completion Time will be restricted by the AOT (same as allowed restoration time) of the supported equipment as indicated in Notes (1), (5), and (7) above. The licensee would need to implement TS changes and plant modifications in order to get 7 days of AOT for all the supported equipment.

During the LAR review process (in response to the RAI VKG025), the licensee stated that during planned maintenance with the opposite unit in either a defueled condition or in MODE 6 flooded up following being defueled, the de-energization of the opposite unit’s shutdown boards is covered by ITS Condition 3.8.9.D. The Required Action ITS 3.8.9.D.1 requires that with one or more opposite unit's shutdown boards inoperable, that the licensee must declare the associated supported required features inoperable immediately. The associated supported required features are limited to the shared safety-related features previously discussed. The TS ACTIONS associated with these inoperable shared safety-related features have Completion Times that range from 72 hours to 7 days to restore OPERABILITY. Therefore, as compared to the ITS 3.8.9.A Completion Time of 8 hours established for loss of an associated unit's shutdown board(s), the ITS 3.8.9.D Completion Time established for the loss of an opposite unit's shutdown board(s), immediately addresses the multiple, concurrent Completion Times associated with the inoperability of shared safety-related features.

The ITS 3.8.9.D Notes restrict the use of this Condition to during planned maintenance and when the opposite unit is defueled or in MODE 6 following defueled with refueling water cavity level ≥ 23 ft above top of the reactor vessel flange. ITS 3.8.9.D Note 1, addressing planned maintenance, limits the use of ITS 3.8.9.D to a time when the operators have sufficient time to evaluate system alignments and the associated impact prior to making the opposite unit's AC shutdown board(s) inoperable. ITS 3.8.9.D Note 2 addresses the shared system risks for the opposite unit in refueling as it relates to availability of power in support of shutdown cooling. Management and assessment of risk during the performance of on-line and outage maintenance will be ensured by SQN's compliance with 10 CFR 50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

The NRC staff finds ITS 3.8.9 Condition D acceptable based on the fact the use of this condition will be restricted to planned maintenance when the operators have sufficient time to evaluate system alignments, and the risk will be evaluated and managed according to 10 CFR 50.65. Also, when one of the units is defueled, the remaining common systems have to mainly serve the operating unit.

3.2.2.6 ITS 3.8.9 Condition E

ITS 3.8.9 Condition E states:

CONDITION E: One or more AC electrical power distribution subsystems inoperable due to one or more Unit 2 AC shutdown boards inoperable for reasons other than Condition D.

REQUIRED ACTION: E.1 Restore Unit 2 AC electrical power distribution subsystems(s) to OPERABLE status.
COMPLETION TIME: 24 hours

Equivalent ISTS Requirements:

There is no equivalent ISTS Action. However, this condition is similar to ISTS 3.8.9.A, but applicable only to Unit 2 AC subsystem(s) (boards).

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in Action a of CTS LCO 3.8.2.1, which requires that with less than the required AC boards OPERABLE, restore the inoperable boards to OPERABLE status within 8 hours.

Evaluation of ITS 3.8.9 Condition E

ITS Condition 3.8.9.E is similar to ITS Condition 3.8.9.A except that it concerns one or more inoperable AC electrical power distribution subsystems which belong to the opposite unit. Since there are limited shared features and systems powered from the opposite unit, the Completion Time is 24 hours as compared to 8 hours in ITS 3.8.9.A.

During the NRC Staff's review of the LAR (in the responses to the RAI VKG025), the licensee stated that the opposite unit's AC shutdown boards are not as critical to the operating unit (fewer operating unit loads) as compared to the operating unit's AC shutdown boards. The major features that are shared by the units and powered from Unit 1 AC shutdown boards include the emergency gas treatment system (EGTS), essential raw cooling water (ERCW) system, component cooling water system (CCS), control room emergency ventilation system (CREVS), control room air conditioning system (CRACS), and the 125 V vital DC system. The shared features powered from Unit 2 AC shutdown boards include the auxiliary building gas treatment system (ABGTS), essential raw cooling water (ERCW) system, component cooling water system (CCS), and the 125 V vital DC system. Additionally, the auxiliary control air system (ACAS) is a technical specification support feature and is powered from Unit 2.

The ITS 3.8.9.E Completion Time of 24 hours is more conservative than any of the Completion Times allowed for the components that would be without power. Additional consideration for the 24 hour Completion Time is the limited potential for an event in conjunction with a single failure of a redundant component (e.g., ABGTS, EGTS, CCS, etc.).

The ITS 3.8.9.E Required Action is similar to ITS 3.8.9.A, except that the Completion Time allowed is 24 hours instead of 8 hours. The NRC staff finds ITS 3.8.9 Condition E acceptable, since in comparison to ITS 3.8.9.A, there are limited common shared features and systems powered from the opposite unit. In addition, there is a limited potential for an event in conjunction with a single failure of a redundant component and, therefore, comparatively a lesser risk.

3.2.2.7 ITS 3.8.9 Condition F

ITS 3.8.9 Condition F states:

CONDITION F: One or more DG DC electrical power distribution panels inoperable.

REQUIRED ACTION: F.1 Declare associated supported DG inoperable.
COMPLETION TIME: Immediately

Equivalent ISTS Requirements:

There is no equivalent ISTS Action. This is due to the fact, that in most plants, the DC requirement for DGs are provided directly from the plant vital DC electrical power distribution subsystems. Generally, most plants do not have separate DG DC electrical power distribution panels.

Equivalent CTS Requirements:

CTS LCO 3.8.1.1.b.5 requires: A separate 125-volt D.C. distribution panel...[associated with each DG].

Evaluation of ITS 3.8.9; Condition F

In the review of the licensee's application, the NRC staff compared the ITS to CTS.

By comparing ITS to CTS, the NRC staff found that, for a DG to be operable, CTS LCO 3.8.1.1.b.5 requires the 125 V DC distribution panel associated with each DG set to be operable. ITS Required Action 3.8.9.F.1 meets the intent of CTS by requiring each DG to be declared inoperable immediately if its associated DC electrical power distribution panel is inoperable.

Based on the above, the NRC staff finds ITS 3.8.9 Condition F acceptable.

3.2.2.8 ITS 3.8.9 Condition G

ITS 3.8.9 Condition G states:

CONDITION G: Required Action and associated Completion Time not met.

REQUIRED ACTION: G.1 Be in MODE 3.
COMPLETION TIME: 6 hours.

AND

G.2 Be in MODE 5.
COMPLETION TIME: 36 hours.

Equivalent ISTS 3.8.9 Condition D states:

CONDITION D: Required Action and associated Completion Time not met.

REQUIRED ACTION: D.1 Be in MODE 3.
COMPLETION TIME: 6 hours.

AND

D.2 Be in MODE 5.
COMPLETION TIME: 36 hours.

Equivalent CTS Requirements:

Equivalent CTS requirements are provided in CTS Actions 3.8.2.1.a, 3.8.2.1.b, and 3.8.2.3.a, which require that with the corresponding Actions not met, be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

Evaluation of ITS 3.8.9 Condition G

In the review of the licensee's application, the NRC staff compared the ITS to CTS and ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS Condition 3.8.9.G is similar to the ISTS Condition 3.8.9.D. ITS Condition 3.8.9.G is also similar to CTS Actions 3.8.2.1.a, 3.8.2.1.b, and 3.8.2.3.a, as it requires the licensee to commence reactor shutdown and to be in HOT STANDBY (MODE 3) in 6 hours, and subsequently, COLD SHUTDOWN (MODE 5) in 36 hours, starting at the time of entry into ITS 3.8.9.G.

The NRC staff finds ITS 3.8.9 Condition G acceptable since it maintains the requirements of CTS and is similar to ISTS.

3.2.2.9 ITS 3.8.9 Condition H

ITS 3.8.9 Condition H states:

CONDITION H: Two or more electrical power distribution subsystems inoperable that result in a loss of safety function.

REQUIRED ACTION: H.1 Enter LCO 3.0.3.
COMPLETION TIME: Immediately.

Equivalent ISTS 3.8.9 Condition E states:

CONDITION E: Two or more electrical power distribution subsystems inoperable that result in a loss of safety function.

REQUIRED ACTION: E.1 Enter LCO 3.0.3.
COMPLETION TIME: Immediately

Equivalent CTS Requirements:

There is no equivalent CTS Action statement.

Evaluation of ITS 3.8.9 Condition H

In the review of the licensee's application, the NRC staff compared the ITS to ISTS.

By comparing ITS to ISTS, the NRC staff found that ITS Condition 3.8.9.H is similar to ISTS Condition 3.8.9.E.

ITS 3.8.9.H corresponds to a level of degradation in the electrical power distribution system that results in a loss of safety function. When more than one inoperable electrical power distribution subsystem results in the loss of a safety function, the plant is in a condition outside the accident analyses. Therefore, no additional time is justified for continued operation. LCO 3.0.3 must be entered immediately, which requires the licensee to commence a controlled shutdown.

There is no equivalent Action statement in CTS, although CTS LCO 3.0.3 requires that steps be taken to initiate a unit shutdown whenever an LCO and associated Actions are not met. ITS 3.8.9.H has an explicit statement in the LCO itself that provides clarity to the requirements. In the CTS, each inoperable electrical distribution board or panel has an action statement regardless of redundancy.

Based on the above, the NRC staff finds ITS 3.8.9 Condition H acceptable since it is consistent with the intent of the CTS and the ISTS.

3.3 Summary and Conclusions

Based on the above evaluation, the NRC staff finds that the proposed TS Sections 3.8.1, and 3.8.9 LCOs and associated ACTIONS provide assurance of the continued availability of the required AC power to shut down the reactor and to maintain the reactor in a safe condition after an anticipated operational occurrence or a postulated design-basis accident. Based on the above, the NRC staff concludes that the proposed TS changes are in accordance with 10 CFR 50.36 and do not impact the licensee's current compliance with GDCs 1, 5, 17 and 18. Therefore, the NRC staff finds the proposed TS changes reviewed in the LAR acceptable.

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REACTOR SYSTEMS BRANCH SAFETY EVALUATION INPUT

REQUEST TO REVISE CURRENT TECHNICAL SPECIFICATIONS

TO IMPROVED TECHNICAL SPECIFICATIONS

SEQUOYAH NUCLEAR PLANTS, UNITS 1 AND 2, TENNESSEE VALLEY AUTHORITY

FACILITY OPERATING LICENSE NOS. DPR-077/079

DOCKET NOS. 50-327/50-328

1.0 INTRODUCTION

By letter dated November 22, 2013 (Agencywide Document Access and Management System (ADAMS) Accession No. ML13329A881), Tennessee Valley Authority (TVA), the licensee for Sequoyah Nuclear Plants Unit 1 and 2 (Sequoyah), requested to revise Sequoyah's current Technical Specifications (CTS) to Improved Technical Specifications (ITS) consistent with the Improved Standard Technical Specifications (ISTS) documented in NUREG-1431, Revision 4.0, "Standard Technical Specifications – Westinghouse Plants." TVA proposes to revise current Technical Specifications (TS) 3.9.2, Nuclear Instrumentation, for source range flux monitors (SRMs) operability in Enclosure 2, Volume 14, "Improved Technical Specifications Conversion, ITS Section 3.9 Refueling Operations."

The U.S. Nuclear Regulatory Commission (NRC) staff evaluated the application to determine whether the proposed changes are in accordance with NRC requirements related to conversion of CTS to ITS.

2.0 REGULATORY EVALUATION

2.1 System Description

The SRMs are used during refueling operations (MODE 6) to monitor the reactivity conditions of the core. The SRMs are part of the Nuclear Instrumentation System in which these detectors are located external to the reactor vessel and detect neutrons leaking from the core. The SRMs monitor the neutron flux in counts per second (cps), with the instrument range covering 6 decades of neutron flux (1E+6 cps) with a given instrument accuracy. These detectors also provide continuous visual indication to the control room.

2.2 Proposed Changes

Sequoyah's CTS state that if one SRM is inoperable or not operating, then the licensee must immediately suspend all operations involving CORE ALTERATIONS and suspend operations that would cause introduction of coolant into the Reactor Coolant System (RCS) with boron concentration less than required to meet Limiting Conditions for Operations (LCO) 3.9.1. In TVA's proposed ITS conversion, TS 3.9.3, Nuclear Instrumentation, is revised so that when one source range neutron flux monitor is inoperable, positive reactivity additions and operations that would cause an introduction of coolant into the RCS with boron concentration less than the required concentration required by LCO 3.9.1, Boron Concentration, are suspended.

2.3 Applicable Regulatory Requirements

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 13 for Instrumentation and Control states:

> Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TS as part of the license. The Commission's regulatory requirements related to the content of the TS are contained in 10 CFR 50.36, "Technical specifications." 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, (4) design features, and (5) administrative controls.

3.0 **TECHNICAL EVALUATION**

3.1 Summary of Technical Information Provided by Licensee

The licensee provides the justifications for the revisions from the CTS to the ITS in the Discussion of Changes (DOCs) for ITS 3.9.3 via an administrative DOC (A02) and a less restrictive DOC (L02). A02 removes the phrase "or not operating" from the TS. A02 states the following:

> CTS 3.9.2 requires, in part, that two source range neutron flux monitors are to be OPERABLE and operating. Additionally, CTS 3.9.2 ACTIONS a and b contain compensatory actions to take when one or more source range neutron flux monitors are not operating. ITS LCO 3.9.3 requires, in part, two source range neutron flux monitors to be OPERABLE, but does not require the source range monitors to be operating. Furthermore, ITS 3.9.3 ACTIONS A and B do not contain compensatory actions to take when one or more of the source range neutron monitors are not operating. This changes the CTS by removing the statement that the source range neutron flux monitors are required to be operating.
>
> The purpose of the source range neutron flux monitors is to monitor core reactivity during refueling operations and provide a signal to the operators if an unexpected reactivity change occurs. This change is acceptable because the requirements have not changed. In accordance with the ITS definition of OPERABLE, to be OPERABLE a device a must be capable of performing its specified safety function. For the source range neutron flux monitors, this also requires them to be operating in order to perform

their safety function. This change is considered administrative and acceptable because it does not result in a technical change to the CTS.

L02 removes the term CORE ALTERATIONS from the TS, which is a relaxation of the Required Action. This change would not require the suspension of CORE ALTERATIONS with one SRM inoperable. L02 states the following:

> CTS 3.9.2 Action a requires, in part, with one source range neutron flux monitor inoperable to immediately suspend all operations involving CORE ALTERATIONS. Under similar conditions, ITS 3.9.3 Required Action A.1 requires suspension of positive reactive additions. This changes the CTS by requiring suspension of positive reactivity additions instead of suspending CORE ALTERATIONS.
>
> The purpose of the source range neutron flux monitors is to monitor core reactivity during refueling operations and provide a signal to the operators if an unexpected reactivity change occurs. Thus, when a source range monitor is inoperable, CORE ALTERATIONS are suspended to preclude an unmonitored reactivity change. CORE ALTERATIONS is defined in CTS 1.9, in part, as "the movement of any fuel, sources, reactivity control components or other components affecting reactivity within the reactor vessel with the head removed and fuel in the vessel." CORE ALERATIONS only occur when the reactor vessel head is removed; therefore, it only applies to MODE 6. There are two evolutions encompassed under the term CORE ALTERATION that could affect the reactivity of the core. They are the addition of fuel to the reactor vessel and the withdrawal of control rods. However, ITS 3.9.3 Required Action A.1 requires immediate suspension of positive reactivity changes, except the introduction of coolant into the RCS. This would include both the addition of fuel to the reactor vessel and the withdrawal of control rods. Therefore, since the CORE ALTERATIONS of concern are only those that could affect positive reactivity in the core and these are suspended by ITS 3.9.3 Required Action A.1, changing the requirement from suspending "CORE ALTERATIONS" to suspending "positive reactivity additions" is acceptable. This change has been designated as less restrictive because a less stringent Required Action is being applied in the ITS than was applied in the CTS.

3.2 Summary of NRC Staff Review

The NRC staff reviewed the licensee's proposed CTS revisions for the ITS conversion, which included a proposal to remove the TS term "CORE ALTERATIONS." After discussions with the licensee resulting in issuance of Request for Additional Information MHC001 submitted in ITS application Supplement 2 dated June 19, 2015 (ML15176A678), it was determined that the term "CORE ALTERATIONS" would remain for the ITS conversion. Consequently, ITS 3.9.3 for Nuclear Instrumentation maintains its current licensing basis requiring suspension of CORE ALTERATIONS with one SRM inoperable. The NRC staff reviewed ITS 3.9.3 with respect to maintaining its current licensing basis and found that only administrative changes were made in accordance with ITS format. The NRC staff finds this acceptable as the current licensing basis is maintained. The revisions to ITS 3.9.3 are documented in Supplement 3 to the application dated July 24, 2015 (ML15205A404).

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PROBABILISTIC RISK ASSESSMENT LICENSING BRANCH SAFETY EVALUATION INPUT

FOR SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2

LICENSE AMENDMENT REQUEST: REVISION TO TECHNICAL SPECIFICATIONS

TO IMPLEMENT TSTF-425, REVISION 3, RELOCATE SURVEILLANCE

FREQUENCIES TO LICENSEE CONTROL

(TAC NOS. MF3128 AND MF3129)

1.0 **INTRODUCTION**

By letter dated November 22, 2013, and supplemented by letter documenting request for additional information (RAI) responses for the Sequoyah Nuclear Plant (SQN) Improved Technical Specification (ITS) (Reference 11) dated June 19, 2015, Tennessee Valley Authority (TVA, the licensee) submitted a request for changes to the SQN Units 1 and 2 Technical Specifications (TS). The requested change is the adoption of Nuclear Regulatory Commission (NRC)-approved TS Task Force (TSTF) traveler TSTF-425, Revision 3, ''Relocate Surveillance Frequencies to Licensee Control – RITSTF [Risk-Informed TSTF] Initiative 5b'' (Reference 1). When implemented, TSTF-425 relocates most periodic frequencies of TS surveillances to a licensee-controlled program, the Surveillance Frequency Control Program (SFCP), and provides requirements for the new program in the Administrative Controls section of the TS. All surveillance frequencies can be relocated except:

- Frequencies that reference other approved programs for the specific interval (such as the Inservice Testing Program or the Primary Containment Leakage Rate Testing Program);
- Frequencies that are purely event-driven (e.g., ''each time the control rod is withdrawn to the 'full out' position'');
- Frequencies that are event-driven, but have a time component for performing the surveillance on a one-time basis once the event occurs (e.g., ''within 24 hours after thermal power reaching ≥ 95% RTP [Rated Thermal Power]''); and
- Frequencies that are related to specific conditions (e.g., battery degradation, age, and capacity) or conditions for the performance of a surveillance requirement (e.g., ''drywell to suppression chamber differential pressure decrease'').

A new program would be added to the Administrative Controls in TS Section 5.5.17. The new program is called the SFCP and describes the requirements for the program to control changes to the relocated surveillance frequencies. The proposed licensee changes to the Administrative Controls of the TS to incorporate the SFCP include a specific reference to Nuclear Energy Institute (NEI) 04-10, ''Risk-Informed Technical Specifications Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies,'' Revision 1 (Reference 2), as the basis for making any changes to the surveillance frequencies once they are relocated out of the TS.

In a letter dated September 19, 2007 (Reference 9), the NRC staff approved NEI 04-10, Revision 1, as acceptable for referencing by licensees proposing to amend their TS to establish a SFCP, to the extent specified and under the limitations delineated in NEI 04-10, and the NRC staff's safety evaluation (SE) providing the basis for its acceptance of NEI 04-10.

The NRC staff issued a Notice of Availability for TSTF-425, Revision 3, in the *Federal Register* (FR) on July 6, 2009 (74 FR 31996). The notice included a model SE. In its application dated November 22, 2013, the licensee stated that "TVA is incorporating TSTF-425, Relocate Surveillance Frequencies to Licensee Control - RITSTF Initiative 5b." This SE that follows is based, in large part, on the model SE for TSTF-425.

2.0 **REGULATORY EVALUATION**

2.1 Applicable Commission Policy Statements

In the "Final Policy Statement: Technical Specifications for Nuclear Power Plants" published in the FR (58 FR 39132, July 22, 1993), the NRC addressed the use of Probabilistic Safety Analysis (PSA, currently referred to as Probabilistic Risk Assessment or PRA) in STS. In this 1993 publication, the NRC states, in part:

> The Commission believes that it would be inappropriate at this time to allow requirements which meet one or more of the first three criteria [of 10 CFR 50.36][1] to be deleted from Technical Specifications based solely on PSA (Criterion 4). However, if the results of PSA indicate that Technical Specifications can be relaxed or removed, a deterministic review will be performed.
>
> The Commission Policy in this regard is consistent with its Policy Statement on "Safety Goals for the operation of Nuclear Power Plants," 51 FR 30028, published on August 21, 1986. The Policy Statement on Safety Goals states in part, "* * * probabilistic results should also be reasonably balanced and supported through use of deterministic arguments. In this way, judgments can be made * * * about the degree of confidence to be given these [probabilistic][2] estimates and assumptions. This is a key part of the process for determining the degree of regulatory conservatism that may be warranted for particular decisions. This defense-in-depth approach is expected to continue to ensure the protection of public health and safety."
>
> The Commission will continue to use PSA, consistent with its policy on Safety Goals, as a tool in evaluating specific line item improvements to Technical Specifications, new requirements, and industry proposals for risk-based Technical Specification changes.

Approximately 2 years later, the NRC provided additional detail concerning the use of PRA in the "Final Policy Statement: Use of Probabilistic Risk Assessment in Nuclear Regulatory

1 This clarification is not part of the original policy statement.
2 The *Federal Register* Notice 58 FR 39135 (Alteration in Original) explains the brackets.

Activities" published in the FR (60 *FR* 42622, August 16, 1995). In this publication, the NRC states, in part:

> The Commission believes that an overall policy on the use of PRA methods in nuclear regulatory activities should be established so that the many potential applications of PRA can be implemented in a consistent and predictable manner that would promote regulatory stability and efficiency. In addition, the Commission believes that the use of PRA technology in NRC regulatory activities should be increased to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach. …
>
> PRA addresses a broad spectrum of initiating events by assessing the event frequency. Mitigating system reliability is then assessed, including the potential for multiple and common cause failures. The treatment therefore goes beyond the single failure requirements in the deterministic approach. The probabilistic approach to regulation is, therefore, considered an extension and enhancement of traditional regulation by considering risk in a more coherent and complete manner. …
>
> … Therefore, the Commission believes that an overall policy on the use of PRA in nuclear regulatory activities should be established so that the many potential applications of PRA can be implemented in a consistent and predictable manner that promotes regulatory stability and efficiency. This policy statement sets forth the Commission's intention to encourage the use of PRA and to expand the scope of PRA applications in all nuclear regulatory matters to the extent supported by the state-of-the-art in terms of methods and data. …
>
> Therefore, the Commission adopts the following policy statement regarding the expanded NRC use of PRA:
>
> (1) The use of PRA technology should be increased in all regulatory matters to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy.
>
> (2) PRA and associated analyses (e.g., sensitivity studies, uncertainty analyses, and importance measures) should be used in regulatory matters, where practical within the bounds of the state-of-the-art, to reduce unnecessary conservatism associated with current regulatory requirements, regulatory guides, license commitments, and staff practices. Where appropriate, PRA should be used to support the proposal for additional regulatory requirements in accordance with 10 CFR 50.109 (Backfit Rule). Appropriate procedures for including PRA in the process for changing regulatory requirements should be developed and followed. It is, of course, understood that the intent of this policy is that existing rules and regulations shall be complied with unless these rules and regulations are revised.

(3) PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review.

(4) The Commission's safety goals for nuclear power plants and subsidiary numerical objectives are to be used with appropriate consideration of uncertainties in making regulatory judgments on the need for proposing and backfitting new generic requirements on nuclear power plant licensees.

2.2 Applicable Regulations

In Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, the NRC established its regulatory requirements related to the content of TS. Pursuant to 10 CFR 50.36, TS are required to include items in the following five specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation; (3) Surveillance Requirements; (4) design features; and (5) administrative controls. As stated in 10 CFR 50.36(c)(3), "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met." These categories will remain in the TS.

The new TS SFCP provides the necessary administrative controls to require that surveillances relocated to the SFCP are conducted at a frequency to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. Changes to surveillance frequencies in the SFCP are made using the methodology contained in NEI 04-10, Revision 1, including qualitative considerations, results of risk analyses, sensitivity studies and any bounding analyses, and recommended monitoring of structures, systems, and components (SSCs), and are required to be documented. Furthermore, changes to frequencies are subject to regulatory review and oversight of the SFCP implementation through the rigorous NRC review of safety-related SSC performance provided by the reactor oversight program (ROP).

Existing regulatory requirements, such as 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and 10 CFR 50, Appendix B, Criterion XVI (corrective action program), require licensee monitoring of surveillance test failures and implementing corrective actions to address such failures. One of these actions may be to consider increasing the frequency at which a surveillance test is performed. In addition, the SFCP implementation guidance in NEI 04-10, Revision 1, requires monitoring the performance of SSCs for which surveillance frequencies are decreased to assure reduced testing does not adversely impact the SSCs.

2.3 Applicable Regulatory Guidelines

Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Reference 5), describes a risk-informed approach, acceptable to the NRC, for assessing the nature and impact of proposed permanent licensing-basis changes by considering engineering issues and applying risk insights. This regulatory guide also provides risk acceptance guidelines for evaluating the results of such evaluations.

RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications" (Reference 3), describes an acceptable risk-informed approach specifically for assessing proposed TS changes.

RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities (Reference 4), describes an acceptable approach for determining whether the quality of the PRA, in total or the parts that are used to support an application, is sufficient to provide confidence in the results, such that the PRA can be used in regulatory decision making for light-water reactors.

3.0 **TECHNICAL EVALUATION**

The licensee's adoption of TSTF-425 for SQN Units 1 and 2 provides for administrative relocation of applicable surveillance frequencies, and provides for the addition of the SFCP to the Administrative Controls section of the TS. TSTF-425 also requires the application of NEI 04-10 for any changes to surveillance frequencies within the SFCP. The licensee's application for the changes proposed in TSTF-425 included documentation regarding the PRA technical adequacy consistent with the requirements of RG 1.200. In accordance with NEI 04-10, PRA methods are used, in combination with plant performance data and other considerations, to identify and justify modifications to the surveillance frequencies of equipment at nuclear power plants. This is consistent with the guidance provided in RG 1.174 and RG 1.177.

3.1 Regulatory Guide (RG) 1.177 Five Key Safety Principles

RG 1.177 identifies five key safety principles required for risk-informed changes to the TS. Each of these principles is addressed by the industry methodology document, NEI 04-10, and is evaluated below in SE Sections 3.1.1 through 3.1.5 with respect to the proposed amendment.

3.1.1 The Proposed Change Meets Current Regulations

Paragraph (c)(3) in 10 CFR 50.36 requires that TS will include surveillance requirements that are "requirements relating to test, calibration, or inspection to assure that necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met." The proposed amendment would relocate most periodic surveillance requirement frequencies, currently shown in the SQN Units 1 and 2 TS, to a licensee-controlled program (i.e., the SFCP). The surveillance requirements themselves would remain in the TS, as required by 10 CFR 50.36(c)(3). The requirements for the SFCP would be added to new TS Section 5.0. In accordance with TS Section 5.0, any changes to the surveillance requirement frequencies would be made in accordance with NEI 04-10, Revision 1. By letter dated September 19, 2007 (Reference 9), the NRC staff found that the methodology in NEI 04-10, Revision 1, met NRC regulations, specifically 10 CFR 50.36(c)(3), and was an acceptable program for controlling changes to surveillance requirement frequencies.

Based on the above considerations, the NRC staff concludes that the proposed change is consistent with the requirements in 10 CFR 50.36(c)(3). Therefore, the proposed change satisfies the first key safety principle of RG 1.177.

3.1.2 The Proposed Change Is Consistent With the Defense-in-Depth Philosophy

Consistency with the defense-in-depth philosophy, the second key safety principle of RG 1.177, is met if:

- A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation.

- Over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided.

- System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties (e.g., no risk outliers).

- Defenses against potential common cause failures are preserved, and the potential for the introduction of new common cause failure mechanisms is assessed.

- Independence of barriers is not degraded.

- Defenses against human errors are preserved.

- The intent of the General Design Criteria in 10 CFR Part 50, Appendix A, is maintained.

TSTF-425 requires the application of NEI 04-10 for any changes to surveillance requirement frequencies within the SFCP. NEI 04-10 uses both the core damage frequency (CDF) and the large early release frequency (LERF) metrics to evaluate the impact of proposed changes to surveillance frequencies. The guidance of RG 1.174 and RG 1.177 for changes to CDF and LERF is achieved by evaluation using a comprehensive risk analysis, which assesses the impact of proposed changes including contributions from human errors and common cause failures. Defense-in-depth is also included in the methodology explicitly as a qualitative consideration outside of the risk analysis, as is the potential impact on detection of component degradation that could lead to an increased likelihood of common cause failures. The NRC staff concludes that both the quantitative risk analysis and the qualitative considerations assure that a reasonable balance of defense-in-depth is maintained. Therefore, the proposed change satisfies the second key safety principle of RG 1.177.

3.1.3 The Proposed Change Maintains Sufficient Safety Margins

The engineering evaluation that will be conducted by the licensee under the SFCP, when surveillance requirement frequencies are revised, will assess the impact of the proposed frequency change in accordance with the principle that sufficient safety margins are maintained. The guidelines used for making that assessment will include ensuring the proposed surveillance test frequency change is not in conflict with approved industry codes and standards or adversely affects any assumptions or inputs to the safety analysis, or, if such inputs are affected, justification is provided to ensure sufficient safety margin will continue to exist.

The design, operation, testing methods, and acceptance criteria for SSCs, specified in applicable codes and standards (or alternatives approved for use by the NRC) will continue to be met as described in the plant licensing basis (including the Final Safety Analysis Report and Bases to the TS), since these are not affected by changes to the surveillance requirement frequencies. Similarly, there is no impact to safety analysis acceptance criteria as described in the plant licensing basis.

Based on the above considerations, the NRC staff concludes that there is reasonable assurance that safety margins will be maintained through the use of the SFCP methodology. Therefore, the proposed change satisfies the third key safety principle of RG 1.177.

3.1.4 When Proposed Changes Result in an Increase in Core Damage Frequency or Risk, the Increases Should Be Small and Consistent with the Intent of the Commission's Safety Goal Policy Statement

RG 1.177 provides a framework for risk evaluation of proposed changes to surveillance frequencies. This requires the identification of the risk contribution from impacted surveillances, determination of the risk impact from the change to the proposed surveillance frequency, and performance of sensitivity and uncertainty evaluations. TSTF-425 requires application of NEI 04-10 in the SFCP. NEI 04-10 satisfies the intent of RG 1.177 requirements for evaluating the change in risk, and for assuring that such changes are small.

3.1.4.1 Quality of the PRA

The quality of the Sequoyah Nuclear Plant's PRA is compatible with the safety implications of the proposed TS change and the role the PRA plays in justifying the change. That is, the more the potential change in risk or the greater the uncertainty in that risk from the requested TS change, or both, the more rigor that must go into ensuring the quality of the PRA.

A full scope peer review was performed for the SQN internal events (including internal flooding) PRA model in July 2011. According to RAI KNH-006 (Reference 11), a full scope peer review was performed against the American Society of Mechanical Engineers/ American Nuclear Society (ASME/ANS)-RA-Sa-2009 PRA standard requirements, as clarified by RG 1.200, Revision 2 (Reference 4), to address the SQN PRA technical adequacy. The peer review followed NEI 00-02, "PRA Peer Review Process Guidelines" (Reference 7). Capability category II of ASME RA-Sa-2009 was applied as the standard. SQN will treat internal fires, seismic, and other external hazards qualitatively or by the use of bounding analyses, consistent with NEI 04-10 guidance. According to the response to RAI KNH-007 (Reference 11), there have been no PRA upgrades since the 2011 full scope peer review, so that no focused scope peer reviews were necessary since the peer review.

The NRC staff reviewed the remaining open deficiencies of the internal events PRA that do not conform to capability category II of the ASME PRA standard. The peer review facts and observations (F&Os) were provided in the license amendment request (LAR), and in response to RAI KNH-001 (Reference 11). The staff found that the licensee adequately addressed the open F&Os by showing no impact for the application (e.g., documentation issue only), satisfactorily resolving the peer review comments in the F&O, or demonstrating that the F&O can be addressed using NEI 04-10 guidance. The staff's evaluation of licensee's resolution of F&Os significant for the application is discussed below.

F&O 1-14 (SR DA-C6): The licensee includes credit for post-maintenance test events, which the Supporting Requirement (SR) explicitly does not allow. The licensee responded to RAI KNH-011 (Reference 11) which requested confirmation that the credit for all post-maintenance tests has been removed from the analysis. The licensee stated that "the post maintenance testing totals were subtracted from the actual demand totals obtained from the plant process computer and documented per type code in the SQN Data Analysis calculation." The staff finds this acceptable because the licensee resolved the F&O consistent with the SR.

F&O 1-15 (SRs AS-A10, AS-B1, and SC-B3): The peer review team stated that the licensee's accident sequence does not contain enough detail to capture important system requirements and required operator interactions for all initiating events. Some of those contributors to the initiating events include loss of station power and loss of direct current power that may prevent power operated relief valve operation and challenge the pressurizer safety valves. The peer review team also observed that the licensee did not develop station blackout (SBO) sequences following power recovery prior to core damage.

The peer review team suggested three different options for the licensee to address this F&O. The licensee adequately resolved the peer review team's comments with the exception of the peer review comment regarding undeveloped SBO sequences. These sequences may include equipment for an SFCP evaluation, and contribute to the increase in the CDF and LERF. In response to RAI KNH-010 (Reference 11), concerning the evaluation of the risk for these sequences, the licensee determined that the SFCP evaluation will consider the CDF and LERF from these undeveloped sequences, and that hardware failures will be either directly calculated in a future SQN PRA model or will use a bounding approach. In addition, regarding the LERF modeling of undeveloped high-pressure sequences, the licensee explained that the conditional large early release probability in NUREG/CR-6595, "An Approach for Estimating the Frequencies of Various Containment Failure Modes and Bypass Events" (Reference 12), had not been used. Plant-specific analyses had been performed related to direct containment heating and hydrogen combustion to justify split fractions other than those suggested in NUREG/CR-6595. Justification of alternate split fractions is acceptable per the NUREG/CR-6595 guidance. In addition, the licensee stated that the methodology was reviewed as part of the SQN PRA peer review and there were no related findings.

Therefore, based on the licensee's inclusion of these undeveloped sequences for the SFCP evaluation, and the licensee's justification for alternate split fractions for LERF PRA modeling, the staff finds that these undeveloped sequences can be treated by a bounding analysis for CDF and LERF using NEI 04-10 guidance. Also, the staff finds that the licensee's disposition of the other peer review comments for this F&O adequately addressed the peer review suggestions for this application based on information provided in the LAR and in responses to RAIs KNH-008 and KNH-010 (Reference 11).

F&O 4-12 (DA-C10): The peer review team stated that the licensee's documentation did not indicate that a review of surveillance test procedures was performed to determine if sub-elements were tested on the same frequency. The licensee addressed this F&O by reviewing procedures to ensure that the procedure actually tested all portions of the component within the component boundary, and its use in calculating run-time and demands. Based on the licensee's review, the staff finds this F&O was adequately addressed for the application.

Based on the peer review using the applicable PRA standard and RG 1.200, the level of PRA quality, combined with the proposed evaluation and disposition of gaps, is sufficient to support the evaluation of changes proposed to surveillance frequencies within the SFCP, and is consistent with Regulatory Position 2.3.1 of RG 1.177.

3.1.4.2 Scope of the PRA

The licensee is required to evaluate each proposed change to a relocated surveillance frequency using the guidance contained in NEI 04-10 to determine its potential impact on risk, due to impacts from internal events, fires, seismic, other external events, and from shutdown conditions. Consideration is made of both CDF and LERF metrics. In cases where a PRA of sufficient scope or where quantitative risk models are unavailable, the licensee uses bounding analyses, or other conservative quantitative evaluations. A qualitative screening analysis may be used when the surveillance frequency impact on plant risk is shown to be negligible or zero.

The SQN internal events (including internal flooding) PRA model had received peer review against RG 1.200, Revision 2. SQN external events analyses, however, rely on the Individual Plant Examination of External Events (IPEEE) seismic margins assessment, fire methodology, and other external events analyses. For these analyses, the licensee uses qualitative or bounding analysis in accordance with NEI 04-10. According to the response to KNH-022 (Reference 11), SQN considers the latest seismic plant information through the evaluation completed by the ongoing Fukushima project requirements and will consider additional risk insights subsequent to the IPEEE submittal in the surveillance test interval (STI) evaluations. SQN utilizes the Fire Induced Vulnerability Evaluation to qualitatively evaluate the fire risk, and considers risk insights subsequent to the IPEEE submittal as well as plant modifications made to address fire-related risk. For other external events including high winds, tornados, external flooding, transportation, and nearby industrial facilities, an external hazards screening evaluation had been performed to support the requirements of the IPEEE. Any risk insights subsequent to the IPEEE submittal with respect to other external hazards will be considered as part of the STI evaluation.

According to RAI KNH-004 (Reference 11), the licensee plans to use the bounding approach for STI changes when the qualitative assessment alone is deemed insufficient to bring before the Integrated Decisionmaking Panel (IDP). The licensee assesses changes to the design and operation of the plant for SQN PRA models, and for bounding analysis, the use of surrogate basic events will represent the as-built, as-operated plant.

In response to RAI KNH-005 (Reference 11), the licensee states that it will utilize the plant shutdown safety assessment developed to support implementation of NUMARC 91-06 to support qualitative risk evaluation of the surveillance frequency change in accordance with NEI 04-10 guidance.

The licensee's evaluation methodology is sufficient to ensure the scope of the risk contribution of each surveillance frequency change is properly identified for evaluation, and is consistent with Regulatory Position 2.3.2 of RG 1.177.

3.1.4.3 PRA Modeling

The licensee will determine whether the SSCs affected by a proposed change to a surveillance frequency are modeled in the PRA. Where the SSC is directly or implicitly modeled, a quantitative evaluation of the risk impact may be carried out. The methodology adjusts the failure probability of the impacted SSCs, including any impacted common cause failure modes, based on the proposed change to the surveillance frequency. Where the SSC is not modeled in the PRA, bounding analyses are performed to characterize the impact of the proposed change to the surveillance frequency. Potential impacts on the risk analyses due to screening criteria and truncation levels are addressed by the requirements for PRA technical adequacy consistent with guidance contained in RG 1.200, and by sensitivity studies identified in NEI 04-10. The licensee will perform quantitative evaluations of the impact of selected testing strategy (i.e., staggered testing or sequential testing) consistent with the guidance of NUREG/CR-6141 and NUREG/CR-5497, as discussed in NEI 04-10.

Thus, through the application of NEI 04-10 the SQN Units 1 and 2 PRA modeling is sufficient to ensure an acceptable evaluation of risk for the proposed changes in surveillance frequency, and is consistent with Regulatory Position 2.3.3 of RG 1.177.

3.1.4.4 Assumptions for Time-Related Failure Contributions

In response to RAI KNH-003 (Reference 11), the licensee stated that the failure probabilities of SSCs modeled in the SQN Units 1 and 2 PRA do not distinguish between standby time-related contribution and cyclic demand-related contribution. NEI 04-10 criteria adjust the time-related failure contribution of SSCs affected by the proposed change to surveillance frequency. The available data does not support distinguishing between the time-related failures and demand failures, so all failures will be assumed to be time-related to obtain the maximum test-limited risk contribution. The SSC failure rate (per unit time) is assumed to be unaffected by the change in test frequency, and will be confirmed by the required monitoring and feedback implemented after the change in surveillance frequency is implemented. Sensitivity studies will be performed on those basic events whose probability is being impacted by the change in surveillance frequency. The process requires consideration of qualitative sources of information with regard to potential impacts of test frequency on SSC performance, including industry and plant-specific operating experience, vendor recommendations, industry standards, and code-specified test intervals.

The potential beneficial risk impacts of reduced surveillance frequency, including reduced downtime, lesser potential for restoration errors, reduction of potential for test caused transients, and reduced test-caused wear of equipment, are identified qualitatively, but are conservatively not required to be quantitatively assessed. Thus, through the application of NEI 04-10, the licensee has employed reasonable assumptions with regard to extensions of surveillance test intervals, and its approach is consistent with Regulatory Position 2.3.4 of RG 1.177.

3.1.4.5 Sensitivity and Uncertainty Analyses

NEI 04-10 requires sensitivity studies to assess the impact of uncertainties from key assumptions of the PRA, uncertainty in the failure probabilities of the affected SSCs, impact to the frequency of initiating events, and of any identified deviations from capability category II of ASME PRA Standard ASME RA-Sb-2005. Where the sensitivity analyses identify a potential impact on the proposed change, revised surveillance frequencies are considered, along with any qualitative considerations that may bear on the results of such sensitivity studies. Required monitoring and feedback of SSC performance once the revised surveillance frequencies are implemented will also be performed. Thus, through the application of NEI 04-10, the licensee has appropriately considered the possible impact of PRA model uncertainty and sensitivity to key assumptions and model limitations, and is consistent with Regulatory Position 2.3.5 of RG 1.177.

3.1.4.6 Acceptance Guidelines

The licensee will quantitatively evaluate the change in total risk (including internal and external events contributions) in terms of CDF and LERF for both the individual risk impact of a proposed change in surveillance frequency and the cumulative impact from all individual changes to surveillance frequencies using the guidance contained in NRC-approved NEI 04-10 in accordance with the TS SFCP. Each individual change to surveillance frequency must show a risk impact below 1E-6 per year for change to CDF, and below 1E-7 per year for change to LERF. These criteria are consistent with the limits of RG 1.174 for very small changes in risk. Where the RG 1.174 limits are not met, the process either considers revised surveillance frequencies that are consistent with RG 1.174 or the process terminates without permitting the proposed changes. Where quantitative results are unavailable to permit comparison to acceptance guidelines, appropriate qualitative analyses are required to demonstrate that the associated risk impact of a proposed change to surveillance frequency is negligible or zero. Otherwise, bounding quantitative analyses are required that demonstrate the risk impact is at least one order of magnitude lower than the RG 1.174 acceptance guidelines for very small changes in risk. In addition to assessing each individual SSC surveillance frequency change, the cumulative impact of all changes must result in a risk impact below 1E-5 per year for change to CDF, and below 1E-6 per year for change to LERF, and the total CDF and total LERF must be reasonably shown to be less than 1E-4 per year and 1E-5 per year, respectively. These are consistent with the limits of RG 1.174 for acceptable changes in risk, as referenced by RG 1.177 for changes to surveillance frequencies. The NRC staff interprets this assessment of cumulative risk as a requirement to calculate the change in risk from a baseline model utilizing failure probabilities based on the surveillance frequencies prior to implementation of the SFCP, compared to a revised model with failure probabilities based on changed surveillance frequencies. The NRC staff further notes that the licensee includes a provision to exclude the contribution to cumulative risk from individual changes to surveillance frequencies associated with insignificant risk increases (less than 5E-8 CDF and 5E-9 LERF) once the baseline PRA models are updated to include the effects of the revised surveillance frequencies.

The quantitative acceptance guidance of RG 1.174 is supplemented by qualitative information to evaluate the proposed changes to surveillance frequencies, including industry and plant-specific operating experience, vendor recommendations, industry standards, the results of sensitivity studies, and SSC performance data and test history.

The final acceptability of the proposed change is based on all of these considerations and not solely on the PRA results compared to numerical acceptance guidelines. Post implementation performance monitoring and feedback are also required to assure continued reliability of the components. The NRC concludes that the licensee's application of NEI 04-10 provides reasonable acceptance guidelines and methods for evaluating the risk increase of proposed changes to surveillance frequencies, consistent with Regulatory Position 2.4 of RG 1.177. Therefore, the proposed change satisfies the fourth key safety principle of RG 1.177 by assuring that any increase in risk is small and consistent with the intent of the Commission's Safety Goal Policy Statement.

3.1.5 The Impact of the Proposed Change Should Be Monitored Using Performance Measurement Strategies

The licensee's adoption of TSTF-425 requires application of NEI 04-10 in the SFCP. NEI 04-10 requires performance monitoring of SSCs whose surveillance frequency has been revised as part of a feedback process to assure that the change in test frequency has not resulted in degradation of equipment performance and operational safety. The monitoring and feedback includes consideration of maintenance rule monitoring of equipment performance. In the event of degradation of SSC performance, the surveillance frequency will be reassessed in accordance with the methodology, in addition to any corrective actions which may apply as part of the maintenance rule requirements. The NRC staff concludes that the performance monitoring and feedback specified in NEI 04-10 is sufficient to reasonably assure acceptable SSC performance and is consistent with Regulatory Position 3.2 of RG 1.177. Therefore, the proposed change satisfies the fifth key safety principle of RG 1.177.

3.2 Addition of Surveillance Frequency Control Program to TS Section 5

The proposed amendment would add the SFCP into the Administrative Controls section of the Sequoyah Nuclear Plant Units 1 and 2 TS. Specifically, new TS 5.5.17, "Surveillance Frequency Control Program," would read as follows:

This program provides controls for Surveillance Frequencies. The program shall ensure that Surveillance Requirements specified in the Technical Specifications are performed at intervals sufficient to assure that the associated Limiting Conditions for Operation are met.

a. The Surveillance Frequency Control Program shall contain a list of Frequencies of the Surveillance Requirements for which the Frequency is controlled by the program.

b. Changes to the Frequencies listed in the Surveillance Frequency Control Program shall be made in accordance with NEI 04–10, ''Risk-Informed Method for Control of Surveillance Frequencies,'' Revision 1.

c. The provisions of Surveillance Requirements [3.0.2 and 3.0.3] are applicable to the Frequencies established in the Surveillance Frequency Control Program.

The NRC staff concludes that the proposed addition to the Administrative Controls section of the TS adequately identifies the scope of the SFCP and defines the methodology to be used in a revision of surveillance frequencies. Therefore, the proposed TS change is acceptable.

3.3 TS Bases Changes

TVA's application dated November 22, 2013 provided proposed changes to the TS Bases to be implemented with the associated TS changes. These pages were provided for information only and will be revised in accordance with the Sequoyah Nuclear Plant Units 1 and 2 TS Bases Control Program.

3.3 Technical Evaluation Conclusion

The NRC staff has reviewed the licensee's proposed relocation of surveillance frequencies, consistent with the licensee's application, to a new licensee-controlled program, the SFCP, and its proposal to control changes to surveillance frequencies in accordance with the new program. Based on the above considerations, the NRC staff concludes that the proposed amendment is acceptable.

4.0 **REFERENCES**

1. TSTF–425, Revision 3, ''Relocate Surveillance Frequencies to Licensee Control—RITSTF Initiative 5b,'' March 18, 2009 (ADAMS Accession No. ML090850642).

2. NEI 04–10, Revision 1, ''Risk-Informed Technical Specifications Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies,'' April 2007 (ADAMS Accession No. ML071360456).

3. Regulatory Guide 1.177, ''An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,'' August 1998 (ADAMS Accession No. ML003740176).

4. Regulatory Guide 1.200, ''An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,'' Revision 2, March 2009 (ADAMS Accession No. ML090410014).

5. Regulatory Guide 1.174, ''An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant- Specific Changes to the Licensing Basis,'' NRC, August 1998 (ADAMS Accession No. ML003740133).

6. ASME PRA Standard ASME RA–Sa–2009, "Addenda to ASME RA–S–2009, ''Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Application.''

7. NEI 00–02, Revision. 1 ''Probabilistic Risk Assessment (PRA) Peer Review Process Guidance" Revision. 1, May 2006 (ADAMS Accession No. ML061510621).

8. NEI 05–04, ''Process for Performing Follow-On PRA Peer Reviews Using the ASME PRA Standard,'' Revision 0, August 2006.

9. Letter, H. K. Neih to B. Bradley, Final Safety Evaluation for Nuclear Energy Institute (NEI) Topical Report 04-10, Revision 1, “Risk-Informed Technical Specification Initiative 5b, Risk-Informed Method for Control of Surveillance Frequencies, (TAC No. MD6111),” September 19, 2007 (ADAMS Accession No. ML07257026).

10. Letter from J. W. Shea, Tennessee Valley Authority to USNRC, “Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Revision 4.0 (SQN-TS-11-10) Enclosure 10: Relocate Surveillance Frequencies to Licensee Control RITS-TF Initiative 5b (TSTF-425),” November 22, 2013 (ADAMS Accession Nos.: Package ML13329A881, Individual ML13329A718).

11. J. W. Shea, Tennessee Valley Authority to USNRC, “Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Revision 4.0 (SQN-TS-11-10) - Supplement 2” June 19, 2015 (ADAMS Accession No. ML15176A678).

12. NUREG/CR-6595, “An Approach for Estimating the Frequencies of Various Containment Failure Modes and Bypass Events,” October 2004 (ADAMS Accession No. ML043240040).

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PROBABILISTIC RISK ASSESSMENT LICENSING BRANCH SAFETY EVALUATION INPUT

FOR SEQUOYAH NUCLEAR PLANT UNITS 1 AND 2 LICENSE AMENDMENT REQUEST:

REVISION TO TECHNICAL SPECIFICATIONS TO IMPLEMENT

TSTF-446, REVISION 3, RISK INFORMED EVALUATION OF EXTENSIONS TO

CONTAINMENT ISOLATION VALVE COMPLETION TIMES (WCAP-15791)

(TAC NOS. MF3128 AND MF3129)

1.0 **INTRODUCTION**

By application dated November 22, 2013, as supplemented by letter dated June 19, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML13329A881 and ML15176A678, respectively), Tennessee Valley Authority (TVA, the licensee) proposed changes to the Technical Specifications (TS) for Sequoyah Nuclear Plant Units 1 and 2 (SQN or Sequoyah). The requested change is part of the Improved Technical Specifications Conversion that will also adopt U.S. Nuclear Regulatory Commission (NRC) approved Technical Specifications Task Force (TSTF) Standard Technical Specifications (STS) Change Traveler TSTF-446, Revision 3, “Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times (WCAP-15791),” dated February 19, 2008 (ADAMS Accession No. ML080510164). TSTF-446, Revision 3, implements containment isolation valve (CIV) completion time (CT) changes justified in Topical Report (TR) WCAP-15791-P-A, Revision 2 (Proprietary), “Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times,” dated June 2008 (the non-proprietary, publicly available version is located at ADAMS Accession No. ML082120239). When implemented, the proposed change would extend the CIV CTs for TS Limiting Condition for Operation (LCO) 3.6.3, “Containment Isolation Valves,” from 4 hours up to 168 hours (7 days). For CIVs where acceptable results could not be demonstrated for 168 hours, shorter times are considered and evaluated.

2.0 **REGULATORY EVALUATION**

2.1 Applicable Regulations and General Design Criteria for Nuclear Power Plants

In Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36, “Technical Specifications,” the NRC established its regulatory requirements related to the content of TS. Pursuant to 10 CFR 50.36, TS are required to include items in the following five specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings, (2) LCOs, (3) surveillance requirements, (4) design features, and (5) administrative controls. However, the regulation does not specify the particular TS to be included in a plant’s license. TSTF-446, Revision 3, proposes changes to the TS LCO that concerns CIVs. The LCOs are the lowest functional capability, or performance levels, of equipment required for safe operation of the facility.

When an LCO of a nuclear reactor is not met, the licensee shall follow any remedial actions permitted by the TS until the condition can be met or shall shut down the reactor.

Furthermore, the CTs specified in the TS must be based on the reasonable protection of public health and safety. As set forth in 10 CFR 50.36, a licensee's TS must establish the LCOs that are the lowest functional capability, or performance levels, of equipment required for safe operation of the facility. The TS specify CTs for structures, systems, and components (SSCs), such as CIVs. These CTs allow a certain amount of time in which to correct a condition that does not meet the LCO before the reactor must be brought to a condition that exits the mode of applicability, in most cases resulting in the reactor being shut down.

The Maintenance Rule, 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," requires licensees to monitor the performance, or condition, of SSCs against licensee-established goals in a manner sufficient to provide reasonable assurance that SSCs are capable of fulfilling their intended functions. The implementation and monitoring program guidance in Section 3 of Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk Informed Decisions on Plant-Specific Changes to the Licensing Basis" (ADAMS Accession No. ML100910006), states that monitoring performed in conformance with the Maintenance Rule can be used when such monitoring is sufficient for the SSCs affected by the risk informed application recognizing the additional guidance for a configuration risk management program (CRMP) identified in RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications" (ADAMS Accession No. ML100910008). In addition, 10 CFR 50.65(a)(4), as it relates to the proposed extension of CIV CTs, requires the assessment and management of the increase in risk that may result from the proposed maintenance activity.

The CIVs help ensure that adequate primary containment boundaries are maintained during and after accidents by minimizing potential pathways to the environment and help ensure that the primary containment function assumed in the safety analysis is maintained. The following general design criteria (GDC) apply to this change and establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs important to safety, which provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public.

- GDC 54, "Piping Systems Penetrating Containment," states:

  Piping systems penetrating primary reactor containment shall be provided with leak detection, isolation, and containment capabilities having redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating these piping systems. Such piping systems shall be designed with a capability to test periodically the operability of the isolation valves and associated apparatus and to determine if valve leakage is within acceptable limits.

- GDC 55, "Reactor Coolant Pressure Boundary Penetrating Containment," states:

  Each line that is part of the reactor coolant pressure boundary and that penetrates primary reactor containment shall be provided with CIVs as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis:

(1) One locked closed isolation valve inside and one locked closed isolation valve outside containment; or

(2) One automatic isolation valve inside and one locked closed isolation valve outside containment; or

(3) One locked closed isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment; or

(4) One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.

Isolation valves outside containment shall be located as close to containment as practical and upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety.

Other appropriate requirements to minimize the probability or consequences of an accidental rupture of these lines or of lines connected to them shall be provided as necessary to assure adequate safety. Determination of the appropriateness of these requirements, such as higher quality in design, fabrication, and testing, additional provisions for inservice inspection, protection against more severe natural phenomena, and additional isolation valves and containment, shall include consideration of the population density, use characteristics, and physical characteristics of the site environs.

- GDC 56, "Primary Containment Isolation," states:

Each line that connects directly to the containment atmosphere and penetrates primary reactor containment shall be provided with CIVs as follows, unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis:

(1) One locked closed isolation valve inside and one locked closed isolation valve outside containment; or

(2) One automatic isolation valve inside and one locked closed isolation valve outside containment; or

(3) One locked closed isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment; or

(4) One automatic isolation valve inside and one automatic isolation valve outside containment. A simple check valve may not be used as the automatic isolation valve outside containment.

Isolation valves outside containment shall be located as close to the containment as practical and upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety.

- GDC 57, “Closed System Isolation Valves,” states:

  Each line that penetrates the primary reactor containment and is neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere shall have at least one CIV which shall be either automatic, or locked closed, or capable of remote manual operation. This valve shall be outside containment and located as close to the containment as practical. A simple check valve may not be used as the automatic isolation valve.

2.2 Applicable NRC Regulatory Guides and Review Plans

General guidance for evaluating the technical basis for proposed risk-informed changes is provided in Chapter 19, Section 19.2, “Use of Probabilistic Risk Assessment in Plant-Specific, Risk-Informed Decisionmaking: General Guidance” (ADAMS Accession No. ML071700658), of NUREG-0800, “Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition.” Guidance on evaluating probabilistic risk assessment (PRA) technical adequacy is provided in the SRP, Chapter 19, Section 19.1, “Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed License Amendment Requests after Initial Fuel Load” (ADAMS Accession No. ML12193A107). More specific guidance related to risk-informed TS changes is provided in SRP, Chapter 16, Section 16.1, “Risk-Informed Decisionmaking: Technical Specifications” (ADAMS Accession No. ML070380228), which includes changes to CTs as part of risk-informed decision making. Section 19.2 of the SRP references the same criteria as RG 1.177 and RG 1.174 and states that a risk-informed application should be evaluated to ensure that the proposed changes meet the following key principles.

- The proposed change meets the current regulations, unless it explicitly relates to a requested exemption or rule change.

- The proposed change is consistent with the defense-in-depth philosophy.

- The proposed change maintains sufficient safety margins.

- When proposed changes result in an increase in core damage frequency (CDF) or risk, the increase(s) should be small and consistent with the intent of the Commission’s Safety Goal Policy Statement.

- The impact of the proposed change should be monitored using performance measurement strategies.

RG 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (ADAMS Accession No. ML090410014), describes an acceptable approach for determining whether the quality of the PRA, in total or the parts that are used to support an application, is sufficient to provide confidence in the results, such that the PRA can be used in regulatory decision making for light water-reactors.

RG 1.174 and RG 1.177 provide specific guidance and acceptance guidelines for assessing the nature and impact of licensing-basis changes by considering engineering issues and applying risk insights. RG 1.177 identifies an acceptable risk-informed approach, including additional guidance specifically geared toward the assessment of proposed TS CT changes. Specifically, RG 1.177 identifies a three-tiered approach for the evaluation of the risk associated with a proposed TS CT change as identified below:

- Tier 1 is an evaluation of the plant-specific risk associated with the proposed TS change, as shown by the change in core damage frequency (ΔCDF) and incremental conditional core damage probability (ICCDP), change in large early release frequency (ΔLERF), and incremental conditional large early release probability (ICLERP). This tier also addresses the technical adequacy of the licensee's plant-specific probabilistic risk assessment (PRA) for the subject application.

- Tier 2 identifies and evaluates, with respect to defense-in-depth, any potential risk significant plant equipment outage configurations associated with the proposed change. The licensee should provide reasonable assurance that the risk-significant plant equipment outage configurations will not occur when equipment associated with the proposed TS change is out of service.

- Tier 3 provides for the establishment of an overall CRMP and confirmation that its insights are incorporated into the decisionmaking process before taking equipment out of service prior to or during the CT. Compared with Tier 2, Tier 3 provides additional coverage to ensure risk-significant plant equipment outage configurations are identified in a timely manner and that the risk impact of out-of-service equipment during planned and unplanned maintenance activities is appropriately evaluated prior to performing any maintenance activity over extended periods of plant operation. Tier 3 guidance can be satisfied by the Maintenance Rule (i.e., 10 CFR 50.65(a)(4)), where that program provides an adequate quality basis which requires a licensee to assess and manage the increase in risk that may result from activities such as surveillance, post-maintenance testing, and corrective and preventive maintenance.

3.0 TECHNICAL EVALUATION

3.1 Probabilistic Risk Assessment for the Proposed Changes

TVA's adoption of TSTF-446, Revision 3, would allow extending CIV CTs specified in TS LCO 3.6.3, "Containment Isolation Valves." TR WCAP-15791-P-A, Revision 2, referenced in TSTF-446, Revision 3, describes a method to revise the CT for specific conditions in TS LCO 3.6.3. The NRC staff reviewed the risk impact using the three-tiered approach referenced in RG 1.174 and RG 1.177 associated with the proposed TS changes. The first tier evaluates the PRA and the impact of the proposed extension of CTs for CIVs on plant operational risk. The second tier addresses the need to preclude potentially high-risk plant equipment outage configurations by identifying the need for additional controls or compensatory actions to be implemented during the time a CIV is unavailable because of maintenance. The third tier evaluates the licensee's overall configuration risk management program and confirms that risk insights are incorporated into the decision-making process before equipment is taken out of service before or during CIV maintenance.

The NRC approved TR WCAP-15791-P-A, Revision 2, for referencing in license applications to the extent specified and under the limitations and conditions stated in the TR and Section 4.0 of the NRC safety evaluation (SE) dated February 13, 2008 (ADAMS Accession No. ML080170680). In addition, per the SE, applications referencing TR WCAP-15791-P-A, Revision 2, must address items specified in Section 3.4, "Regulatory Commitments," and Section 5.0, "Additional Information Needed" of the SE. The licensee included the regulatory commitment associated with TSTF-446, Revision 3, in Enclosure 8 of the application, which addresses Section 3.4 and Section 5.0, Item 10, from the SE for the TR. The NRC staff notes that this regulatory commitment is not necessary to establish the conclusions of this SE.

In the NRC SE for TR WCAP-15791-P, Revision 2, the NRC staff determined that the risk analysis methodology and approach used by the TR to estimate the risk impact of CIV CT extensions was reasonable. The NRC staff stated in the SE that the risk impact of the proposed extended CTs for CIVs, as estimated by ΔCDF, ΔLERF, ICCDP (or Incremental Core Damage Probability [ICDP]) and ICLERP (or Incremental Large Early Release Probability [ILERP]), is consistent with the acceptance guidelines specified in RG 1.174 and RG 1.177 and the associated NRC guidance outlined in SRP Sections 16.1, 19.1, and 19.2. The NRC staff notes that RG 1.174, Revision 1 (ADAMS Accession No. ML023240437), and RG 1.177, Revision 0 (ADAMS Accession No. ML003740176), were referenced in TR WCAP-15791-P-A, Revision 2. At the time of the Sequoyah application, there were later revisions of both RGs and updated acceptance guidelines. The RG 1.177, Revision 0, risk acceptance guidelines used in this application (5E-8 for ICLERP and 1E-7 for ΔLERF) are more conservative than or equivalent to the values in the currently approved revisions of these RGs and, therefore, the ICLERP and ΔLERF risk thresholds remain acceptable.

The RG 1.177, Revision 1, ICCDP and ICLERP acceptance guidelines of 1.0E-6 and 1.0E-7, respectively, are established for consistency with the ICDP and ILERP limits of Section 11 in NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" applicable for maintenance activities involving normal work controls. The NRC currently endorses NUMARC 93-01, Revision 4A (ADAMS Accession No. ML11116A198), in RG 1.160, Revision 3 (ADAMS Accession No. ML113610098).

3.1.1 Tier 1 – Probabilistic Risk Assessment Capability and Insights

The first tier evaluates the impact of the proposed changes on plant operational risk based on the Sequoyah Nuclear Plant Units 1 and 2 implementation of TR WCAP-15791-P-A, Revision 2. The Tier 1 staff review involves (1) evaluation of the validity of the PRA and its application to the proposed changes, and (2) evaluation of the PRA results and insights based on the licensee's proposed application.

TR WCAP-15791-P-A, Revision 2, provides a generic PRA model for the evaluation of the applicable CIV CT extensions. The staff found this generic model and the TR evaluation to be acceptable on a generic basis in the SE dated February 13, 2008. Although the SE accepted the use of a representative model as generally reasonable, the application of the representative model and the associated results to a specific plant introduces a degree of uncertainty because of modeling, design, and operational differences. Therefore, each licensee adopting TR WCAP-15791-P-A, Revision 2, needs to confirm that the TR's analysis and results are applicable to its plant. CIV configurations, CTs, or non-bounding risk analysis parameters not evaluated by TR WCAP-15791-P-A, Revision 2, require additional justification for the proposed CIV CTs. (This is also required information per Section 5.0, Item 2, from the SE for the TR.)

Not all penetrations have the same impact on CDF, LERF, ICCDP, or ICLERP; therefore, the licensee verified the applicability of TR WCAP-15791-P-A, Revision 2, to Sequoyah in Enclosure 5, Section 4.6, "SQN Inputs / Specific and Generic," of the application and discussed plant-specific evaluations in Enclosure 5, Section 4.8, "SQN Specific Analysis." In Enclosure 5, Section 4.6, the licensee confirmed that the plant specific input was bounded by the generic input in the TR or reanalyzed the risk using the SQN specific information when it was not bounded by the TR. In response to Request for Additional Information (RAI) KNH-024 submitted in letter dated June 19, 2015, where NRC staff requested clarification on how the licensee performed the evaluation for plant specific configurations, the licensee confirmed that it followed a similar penetration classification methodology and risk analyses as that used for the generic analyses described by TR WCAP-15791-P-A, Revision 2. The licensee noted that the generic data from the TR was replaced with SQN specific data to potentially justify increased CIV CTs. This approach is also consistent with the approved TR and TSTF-446, Revision 3. Therefore, the NRC staff finds that the TR generic analyses are applicable to SQN Units 1 and 2 and that the licensee use plant-specific information for the Tier 1 analyses, as necessary.

Per Section 5.0, Item 5, from the SE for the TR, the licensee should also demonstrate that the PRA quality is acceptable for Tier 3 assessments associated with implementing the CIV CT changes in the application, in accordance with the guidelines given in RG 1.174 and RG 1.177. The PRA technical adequacy for Sequoyah is discussed in Section 4.7 of Enclosure 5. The licensee stated that a full-scope PRA peer review of the SQN PRA model was conducted in 2011. This review was on internal events, including internal flooding, and used the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) Standard, RA-Sa-2009, "Addenda to ASME RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," as endorsed and clarified by RG 1.200, Revision 2.

In response to RAI KNH-025a, where NRC staff requested the applicable peer review Facts and Observations (F&Os), the licensee provided a discussion of the finding, the associated Supporting Requirement from the ASME/ANS PRA standard, the basis of the significance of the F&O, the peer review suggested resolution, and the licensee's response/resolution. The NRC staff reviewed the F&Os to ensure that the licensee assessed the findings adequately for this application. The NRC staff concluded that the resolutions to the F&Os associated with the parameters used to demonstrate the applicability of the generic analysis (i.e., WCAP-15791-P-A, Revision 2) are adequate for supporting the use of the SQN PRA for CIV CT extensions.

Per Section 5.0, Item 9, from the SE for the TR, uncertainty due to plant PRA models is not addressed in TR WCAP-15791-P-A, Revision 2. Sequoyah's use of bounding values in analyses to support the application should limit the impact of model uncertainty (i.e., based on the TR's use of bounding values as well as the use of plant-specific bounding values for input parameters, a sensitivity analysis using an upper bound value should be inherent in the majority of the results). The staff also notes that the conservative assumption of 1.0E-4 for Sequoyah's total CDF, as discussed below, also further addresses model uncertainty.

Per Section 5.0, Item 6, from the SE for the TR, the licensee must demonstrate, by either quantitative or qualitative means, that external event risk will not have an adverse impact on the conclusions of the plant-specific analyses with respect to the TR evaluation. Sequoyah evaluated external event risk in a similar method to the Lead Plant mentioned in WCAP-15791. The total (internal and external) at-power CDF is conservatively assumed to be 1.0E-4/yr consistent with the TR. Per Section 5.0, Item 8, from the SE for the TR, Sequoyah also assessed the cumulative risk impact of the proposed CIV extensions against the risk acceptance criteria in RG 1.174. Sequoyah calculated the increase in CDF and LERF for all of the proposed changes included in the Improved Technical Specification Conversion application to be 1.46E-06/yr and 7.90E-08/yr, respectively, as discussed in Enclosure 2, Volume 11, Discussion of Changes (DOCs), Improved TS (ITS) 3.6.3, "Containment Isolation Valves," DOC L03, Section 3.2.7. The licensee also stated that SQN CDFs for internal events are 1.59E-05/yr (Unit 1) and 1.48E-05/yr (Unit 2) and LERFs for internal events are 2.20E-06/yr (Unit 1) and 2.23E-06 (Unit 2). Based on review of the RG 1.174 acceptance criteria, and conservative treatment of external events consistent with the approved TR, the NRC staff finds that Sequoyah's risk information is acceptable for use in the CIV CT extensions.

3.1.2 Tier 2 – Avoidance of Risk-Significant Configurations

The NRC staff also noted that Tier 2, as presented in TR WCAP-15791-P-A, Revision 2, did not identify generic Tier 2 risk significant configurations as a result of the proposed CIV CTs. In its review of TR WCAP-15791-P-A, Revision 2, the NRC staff identified TS and analysis bases that allow only one CIV to be in maintenance with an extended CT at any given time. In addition, before maintenance or corrective maintenance is performed, other CIVs in the penetration flow path shall be checked for proper position and the licensee will ensure that any inoperable CIVs will not result in a risk significant configuration. The NRC staff SE also noted that, for licensees adopting TR WCAP-15791-P-A, Revision 2, a plant-specific Tier 2 evaluation should be performed to confirm the conclusion of the subject TR (i.e., no additional Tier 2 requirements are needed) is applicable to the licensee's plant. In Enclosure 2, Volume 11, of the application, TVA confirmed "the conclusion in the TR that no Tier 2 requirements are needed other than a requirement to ensure that before maintenance or corrective maintenance (repair) is performed on a CIV, any other CIVs in the penetration flow path have been checked to ensure that they are in their proper position." This addresses the additional information required per Section 5.0, Items 1 and 3, from the SE for the TR.

TVA also proposed the additional LCO 3.6.3 Condition C (which corresponds to Improved Standard Technical Specification LCO 3.6.3 Condition D in TSTF-446, Revision 3) in its plant-specific application as an alternative to confirming only one CIV will be in maintenance with an extended CT at any given time. This added requirement enforces the basis of TR WCAP-15791-P-A, Revision 2, that only one CIV should be in maintenance at a time. This change addresses Section 4.0, "Limitations and Conditions," Items 1 and 2, and Section 5.0, Item 1, in the NRC SE of TR WCAP-15791-P-A, Revision 2, and is, therefore, acceptable.

3.1.3 Tier 3—Risk-Informed Configuration Risk Management Program

TR WCAP-15791-P-A, Revision 2, does not address Tier 3; therefore, licensees need to include an evaluation with respect to Tier 3 in their plant-specific application in accordance with the principles in RG 1.177. (This is also discussed in Section 5.0, Item 4, from the SE for the TR.) Risk assessment of online configurations for Sequoyah Units 1 and 2 CIVs uses the latest approved version of the SQN Units 1 and 2 PRA model. In accordance with the requirements of 10 CFR 50.65(a)(4) SQN assesses and manages the increase in risk that may result from the proposed maintenance activity prior to entering the maintenance configuration. Sequoyah Units 1 and 2 use the Equipment Out Of Service (EOOS) computer code to determine change in CDF and LERF. Per Enclosure 5, Section 4.7.2, of the application and the response to RAI KNH-023, TVA has implemented procedure NPG-SPP-07.1, "On-line Work Management," an on-line work control procedure maintenance tracking and control process that requires a review to identify risk-significant plant configurations. The licensee's online work control procedure is applicable to both planned maintenance activities and emergent conditions during plant operations. This addresses the additional information required per Section 5.0, Item 1, from the SE for the TR.

The licensee's procedure allows for the licensee to analyze the risk prior to implementation to allow for appropriate sequencing of activities as necessary and for other actions determined based on risk insights. Sequoyah will also have work management compensatory measures defined as the risk level increases to limit the likelihood of entering an unplanned configuration (e.g., protected trains/equipment).

In Enclosure 2, Volume 11, DOCs, ITS 3.6.3, "Containment Isolation Valves," DOC L03, Section 3.2.6, the licensee stated "CIV availability is monitored and assessed by SQN TI-4, Attachment 30, 'Containment Isolation System – System 80'" and that the "requirements of this Instruction are in compliance with 10 CFR 50.65, Regulatory Guide (RG) 1.160, RG 1.182, NUMARC 93-01, and NPG-SPP-03.4 [Maintenance Rule Performance Indicator Monitoring, Trending and Reporting – 10 CFR 50.65]." The NRC staff notes that RG 1.182 was withdrawn as noticed in the *Federal Register* on November 27, 2012 (78 FR 70846) because it was determined that RG 1.182 was redundant due to the inclusion of its subject matter in RG 1.160, Revision 3. The withdrawal of RG 1.182 did not alter any prior or existing licensing commitments or conditions based on its use or reference. In response to RAI KNH-025b, Sequoyah confirmed that the current PRA model represents the as-built, as-operated plant. The licensee stated that the PRA model of record is updated based on the cumulative risk impact to the plant configuration. The PRA model is also subject to periodic self-assessments. In response to RAI KNH-026, where the NRC staff requested the licensee describe how CIV availability will be monitored and assessed, the licensee stated that their procedures requires them "to provide the PRA update group all plant-specific unavailability and unreliability data for a specified update window." The response also states that when the PRA is updated (or upgraded) that "the effect of the change on programs and applications must be determined." This discussion addresses the additional information required per Section 3.4 and Section 5.0, Items 4, 5, 7, and 10, from the SE for the TR.

The staff finds that the licensee's program to control risk is capable of adequately monitoring CIV availability and assessing the activities being performed to ensure that high-risk plant configurations that could affect CIV extensions do not occur and/or compensatory actions are implemented if a high-risk plant configuration or condition should occur. As such, the licensee's program provides for the assessment and management of increased risk during maintenance activities as required by 10 CFR 50.65(a)(4) and satisfies the RG 1.177 guidelines for a CRMP for the proposed change.

3.2 Technical Assessment for the Proposed Changes

The licensee's adoption of TSTF-446, Revision 3, would make changes to the TS LCO 3.6.3, "Containment Isolation Valves," as follows:

- TSTF-446 revises LCO 3.6.3, which states "Each containment isolation valve shall be OPERABLE," to read, "Each containment isolation valve (CIV) shall be OPERABLE." Adding the abbreviation "(CIV)" to the LCO statement is editorial in nature and does not change the LCO requirement; therefore, this change is acceptable.

- TSTF-446 revises Condition A's applicability from "for reasons other than Conditions C, D, and E" to "for reasons other than Conditions E, F and G." This change is required by the revision to Condition A and the conversion from Sequoyah's current TS 3.6.3 to improved TS 3.6.3, which results in renumbering the current conditions B, C, D, E, F, and G. This change is editorial and does not result in a technical change; therefore, it is acceptable.

- TSTF-446 revises the existing 4 hour completion time for Condition A to completion times that range from 4 hours up to 7 days, depending upon the category of the applicable CIV (Category 1 through 14). This change has been evaluated and documented in the SE of TR WCAP-15791-P-A, Revision 2. This change proposed by TSTF-446 is consistent with the NRC SE of TR WCAP-15791-P-A, Revision 2, and is, therefore, acceptable.

- TSTF-446 deletes the existing Condition F and the Required Actions, which are applicable to penetration flow paths with only one CIV and a closed system. The existing Condition F entry condition is "One or more penetration flow paths of a closed system design with one containment isolation valve inoperable." With revised Condition A, this covers all CIVs that would have been applicable to existing Condition F. The Required Actions for revised Condition A is identical to the existing

Condition F. The completion times for revised Condition A is changed from the existing Condition F time of 72 hours and have been evaluated and documented in the NRC SE of TR WCAP-15791-P-A, Revision 2. The deletion of existing Condition F is consistent with TR WCAP-15791-P-A, Revision 2, is accounted for by the revision to Condition A and is, therefore, acceptable.

4.0 **SUMMARY AND CONCLUSIONS**

Based on its review of the licensee's submittals, the staff finds that the TS revisions proposed by the licensee are consistent with the methodology for CIV CT extensions evaluated in TR WCAP-15791-P-A, Revision 2. The staff also finds that the TR generic analyses are applicable to SQN Units 1 and 2 and that the licensee uses plant-specific information for the Tier 1 analyses, as necessary. The staff finds the risk impacts for ΔCDF, ΔLERF, and ICLERP to be within the acceptance guidelines of RG 1.174 and RG 1.177. The licensee's use of PRA information was found technically adequate for the purposes of this application. The CDF and LERF information provided by the licensee was consistent with a small change in risk as described in RG 1.174, Revision 2. The licensee's Tier 2 analysis evaluated and confirmed the applicability of the TR analysis and the licensee added the additional LCO condition in accordance with TSTF-446, Revision 3. The licensee's Tier 3 evaluation was found to be consistent with the RG 1.177 CRMP guidelines and 10 CFR 50.65(a)(4) for the implementation of TR WCAP 15791-P-A, Revision 2.

Therefore, the NRC staff finds the licensee's proposed adoption of TSTF-446, Revision 3, to modify the Sequoyah TS requirements for CT for CIVs associated with the implementation of TR WCAP-15791-P-A, Revision 2, to be consistent with the approved TR and meet the associated limitations and conditions for the TR.

7.0 **REFERENCES**

1. Tennessee Valley Authority, Sequoyah Nuclear Plant Units 1 and 2, Technical Specifications Conversion to NUREG-1431, Revision 4.0, November 22, 2013 (ADAMS Accession No. ML13329A881).

2. TSTF-446, Revision 3, "Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times (WCAP-15791)," dated February 19, 2008 (ADAMS Accession No. ML080510164).

3. WCAP-15791-P-A, Revision 2 (Proprietary), "Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times," June 2008 (non-publicly available).

4. WCAP-15791-NP-A, Revision 2 (Non-Proprietary), "Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times," June 2008 (ADAMS Accession No. ML082120239).

5. Final Safety Evaluation of Westinghouse Owners Group Topical Report WCAP-15791-P, Revision 2, "Risk Informed Evaluation of Extensions to Containment Isolation Valve Completion Times," dated February 13, 2008 (ADAMS Accession No. ML080170680).

6. Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis,” Revision 2, May 2011 (ADAMS Accession No. ML100910006).

7. Regulatory Guide 1.177, “An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications,” Revision 1, May 2011 (ADAMS Accession No. ML100910008).

8. Regulatory Guide 1.200, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” Revision 2, March 2009 (ADAMS Accession No. ML090410014).

9. ASME/ANS PRA Standard ASME/ANS RA-Sa-2009, Addenda to ASME RA-S-2008, “Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications.”

10. J. W. Shea, Tennessee Valley Authority to USNRC, “Sequoyah Nuclear Plants, Units 1 and 2 Technical Specifications Conversion to NUREG-1431, Rev 4.0 (SQN-TS-11-10) - Supplement 2” June 19, 2015 (ML15176A678)

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RADIATION PROTECTION AND CONSEQUENCE BRANCH SAFETY EVALUATION INPUT

FOR SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 LICENSE AMENDMENT REQUEST

TO ADOPT TSTF-490-A, REVISION 0, REGARDING DELETION OF E BAR (Ē) DEFINITION

AND REVISION TO REACTOR COOLANT SYSTEM SPECIFIC ACTIVITY

(TAC NOS. MF3128 AND MF3129)

1.0 **INTRODUCTION**

By application dated November 22, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13329A881), as supplemented by letters dated June 19, 2015 (ADAMS Accession No. ML15176A678) and July 24, 2015 (ADAMS Accession No. ML15205A404), Supplements 2 and 3, respectively, Tennessee Valley Authority (TVA, the licensee) proposed changes to the Technical Specifications (TS) for the Sequoyah Nuclear Plant (SQN) Units 1 and 2. The licensee proposes to convert SQN's current TS (CTS) to Improved TS (ITS) consistent with the Improved Standard TS (ISTS) described in NUREG-1431, "Standard Technical Specifications - Westinghouse Plants," Revision 4.0.

One of the requested changes is the adoption of Technical Specification Task Force (TSTF)-490-A, Revision 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec," for pressurized water reactor Standard TS (STS). By letter dated September 13, 2005 (ADAMS Accession No. ML052630462), the TSTF submitted TSTF-490 for Nuclear Regulatory Commission (NRC) staff review. In *Federal Register*, Volume 72, Number 50, dated March 15, 2007, page 12217, the Notice of Availability for TSTF-490-A was published, signifying NRC approval of TSTF-490-A. This TSTF involves changes to NUREG-1430, NUREG-1431, and NUREG-1432 STS Section 3.4.16 reactor coolant system (RCS) gross specific activity limits with the addition of a new limit for noble gas specific activity. The noble gas specific activity limit would be based on a new dose equivalent xenon (Xe)-133 (DEX) definition that replaces the current Ē average disintegration energy definition. In addition, the current dose equivalent iodine (I)-131 (DEI) definition would be revised to be consistent with TSTF-490-A.

2.0 **REGULATORY EVALUATION**

The NRC staff evaluated the impact of the proposed changes as they relate to the radiological consequences of affected design basis accidents (DBAs) that use the RCS inventory as the source term. The source term assumed in radiological analyses should be based on the activity associated with the projected fuel damage or the maximum RCS TS values, whichever maximizes the radiological consequences. The limits on RCS specific activity ensure that the offsite doses are appropriately limited for accidents that are based on releases from the RCS with no significant amount of fuel damage.

The Steam Generator Tube Rupture (SGTR) accident and the Main Steam Line Break (MSLB) accident typically do not result in fuel damage and, therefore, the radiological consequence analyses are generally based on the release of primary coolant activity at maximum TS limits. For accidents that result in fuel damage, the additional dose contribution from the initial activity in the RCS is not normally evaluated and it is considered to be insignificant in relation to the dose consequence resulting from the release of fission products from the damaged fuel.

For licensees that incorporate the source term as defined in Technical Information Document (TID) 14844, Atomic Energy Commission (AEC), 1962, “Calculation of Distance Factors for Power and Test Reactors Sites,” in their dose consequence analyses, the NRC staff uses the regulatory guidance provided in NUREG-0800, “Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants,” Section 15.1.5, “Steam System Piping Failures Inside and Outside of Containment (PWR)[Pressurized Water Reactors],” Appendix A, “Radiological Consequences of Main Steam Line Failures Outside Containment,” Revision 2, for the evaluation of MSLB accident analyses and NUREG-0800, SRP Section 15.6.3, “Radiological Consequences of Steam Generator Tube Failure (PWR),” Revision 2, for evaluating SGTR accidents analyses. In addition, the NRC staff uses the guidance from RG 1.195, “Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light Water Nuclear Power Reactors,” May 2003, for those licensees that chose to use its guidance for dose consequence analyses using the TID 14844 source term.

For licensees using the alternative source term (AST) in their dose consequence analyses, the NRC staff uses the regulatory guidance provided in NUREG-0800, SRP Section 15.0.1, “Radiological Consequence Analyses Using Alternative Source Terms,” Revision 0, July 2000, and the methodology and assumptions stated in Regulatory Guide (RG) 1.183, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors,” July 2000.

The applicable dose criteria for the evaluation of DBAs depend on the source term incorporated in the dose consequence analyses. For licensees using the TID 14844 source term, the maximum dose criteria to the whole body and the thyroid that an individual at the exclusion area boundary (EAB) can receive for the first 2 hours following an accident, and at the low population zone (LPZ) outer boundary for the duration of the radiological release, are specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 100.11. These criteria are 25 roentgen equivalent man (rem) total whole body dose and 300 rem thyroid dose from iodine exposure. The accident dose criteria in 10 CFR 100.11 is supplemented by accident specific dose acceptance criteria in SRP 15.1.5, Appendix A, SRP 15.6.3 or Table 4 of RG 1.195, “Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light Water Nuclear Power Reactors,” May 2003.

For control room dose consequence analyses that use the TID 14844 source term, the regulatory requirement for which the NRC staff bases its acceptance is General Design Criterion (GDC) 19 of Appendix A to 10 CFR Part 50, “Control Room.” GDC 19 requires that adequate radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. NUREG-0800, SRP Section 6.4, “Control Room Habitability System,” Revision 2, July 1981, provides guidelines defining the dose equivalency of 5 rem whole body as 30 rem for both the thyroid and skin dose. For licensees adopting the guidance from RG 1.196, “Control Room Habitability at Light Water Nuclear Power Reactors,” May 2003, Section C.4.5 of RG 1.195, May 2003, states that in lieu of the dose equivalency guidelines from Section 6.4 of NUREG-0800, the 10 CFR 20.1201 annual organ dose limit of 50 rem can be used for both the thyroid and skin dose equivalent of 5 rem whole body.

Licensees using the AST are evaluated against the dose criteria specified in 10 CFR 50.67(b)(2). The off-site dose criteria are 25 rem total effective dose equivalent (TEDE) at the EAB for any 2-hour period following the onset of the postulated fission product release and 25 rem TEDE at the outer boundary of the LPZ for the duration of the postulated fission product release. In addition, 10 CFR Part 50.67(b)(2)(iii) requires that adequate radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem TEDE for the duration of the accident.

By letter dated September 30, 2002, the NRC issued Amendment No. 278 to Facility Operating License No. DPR-77 and Amendment No. 269 to Facility Operating License No. DPR-79 for the SQN Units 1 & 2 respectively. These license amendments were issued in response to an application dated September 21, 2001, requesting changes to the SQN Units 1 & 2 plant TS to allow for irradiation of up to 2256 Tritium Producing Burnable Absorber Rods (TPBARs). The licensee's application considered the impact of TPBAR operation on the previously analyzed DBAs including the SGTR and the MSLB accidents. While the licensee evaluated the TEDE to account for the increase in tritium production, the licensee proposed (and the NRC staff agreed) that dose results, expressed in whole body and thyroid dose quantities, would continue to provide bounding estimates of the radiological consequences of accidents concurrent with tritium producing core operations. Therefore, dose results expressed in whole body and thyroid for the SGTR and MSLB accidents remain the current licensing basis for SQN Units 1 & 2.

3.0 **TECHNICAL EVALUATION**

3.1 Technical Evaluation of Custom TS Conversion Changes

3.1.1 Administrative Changes

3.1.1.1 Editorial Changes

In the conversion of the SQN CTS to the plant specific ITS, the licensee proposed certain administrative changes (wording preferences, editorial changes, reformatting, revised numbering, etc.) to ensure consistency with the ISTS. The NRC staff considers these types of proposed changes as administrative changes, in that they do not result in technical changes to the SQN CTS. Therefore, the NRC staff finds these changes acceptable.

3.1.1.2 Isotopic Analysis Requirement for Iodine

The licensee states:

> CTS 3.4.8 (MODES 1, 2, 3, 4, and 5), ACTION a, requires Table 4.4-4 Sampling and Test 4.a, Isotopic Analysis for Iodine, to be performed every 4 hours until the specific activity of the primary coolant system is restored to within limits. This is also restated in CTS Table 4.4-4, Footnote #. ITS 3.4.16 Required Action A.1 essentially requires this same analysis; however the explicit statement to perform

> the isotopic analysis for iodine “until restored to within limits” is not included. This changes the CTS by deleting the explicit statement to perform the isotopic analysis for iodine until the limits are met.
>
> The purpose of the statement ‘until the specific activity of the primary coolant is restored to within its limits,’ in CTS 3.4.8 (MODES 1, 2, 3, 4, and 5), ACTION a and Table 4.4-4 Item Test 4.a and Footnote #, is to ensure the Surveillance is performed until the limit is met. In ITS, stating that the analysis is required until the specific activity is within limits is unnecessary. ITS LCO [limiting condition for operation] 3.0.2 requires the Required Actions of the entered Condition(s) to be performed upon discovery of failure to meet the LCO, until the LCO is met. If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required unless otherwise stated. This proposed change is acceptable since ITS LCO 3.0.2 will require the Required Action to be performed until the LCO is met. This change is designated as administrative because it does not result in technical changes to the CTS.

The proposed change was designated as administrative by the licensee because it does not result in technical changes to CTS. The NRC staff agrees with the licensee’s assessment that this change is administrative and, therefore, the NRC staff finds this change acceptable.

3.1.1.3 CTS Reactor Coolant Sampling Requirement

The licensee states:

> CTS Table 4.4-4 4.item b) Frequency requires, that one sample between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER [RTP] within a one hour period. ITS SR [Surveillance Requirement] 3.4.16.2 Frequency requires, one sample between 2 and 6 hours after a THERMAL POWER change of greater than or equal to 15% RTP within 1 hour. This changes the CTS by requiring one sample to be taken between 2 and 6 hours after a THERMAL POWER change of greater than or equal to 15% RTP within 1 hour.
>
> The purpose of CTS Table 4.4-4 4. b) is to ensure one sample is taken between 2 and 6 hours following a THERMAL POWER change exceeding 15 percent of the RATED THERMAL POWER within a one hour period. This change is acceptable because ITS SR 3.4.16.2 requires essentially the same Frequency, a sample between 2 and 6 hours after a THERMAL POWER change of greater than or equal to 15% RTP within 1 hour. This change is designated as administrative because it does not result in technical changes to CTS.

The proposed change was designated as administrative by the licensee because it does not result in technical changes to CTS. The NRC staff agrees with the licensee’s assessment that this change is administrative and, therefore, the NRC staff finds this change acceptable.

3.1.2 More Restrictive Changes

3.1.2.1 CTS RCS Specific Activity

The licensee states:

> CTS 3.4.8 requires the specific activity of the reactor coolant to be within limit whenever the reactor is in MODES 1, 2, 3, 4 and 5. In addition when a unit shutdown is required in MODES 1, 2 and 3* (Footnote * limits MODE 3 Applicability to $T_{avg} \geq 500°F$) by CTS 3.4.8 ACTION a and CTS 3.4.8 ACTION b, the unit is required to be in HOT STANDBY with T_{avg} less than 500°F within 6 hours. ITS 3.4.16 Applicability, with TSTF-490-A incorporated, requires the RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity to be within limits during MODES 1, 2, 3 and 4. ITS 3.4.16 Required Action B.1 requires the unit to be in MODE 3 within 6 hours and Required Action B.2 requires the unit to be in MODE 5 within 36 hours. This changes the CTS by relaxing the requirement to be "less than 500°F within 6 hours," to "be in MODE 3 in 6 hours," and by adding Required Action B.2 to enter MODE 5 within 36 hours. The change that deletes the E-bar requirement and replaces it with a DEX requirement is discussed in Discussion of Change (DOC) No. L01.
>
> This change is acceptable because the requirement to place the unit in MODE 5 places the unit outside the MODE of Applicability. The Completion Time is based on operating experience and the need to reach the required condition from full power in an orderly manner and without challenging unit systems. This change is designated as more restrictive because it adds a new requirement for the unit to be in MODE 5.

The NRC staff has reviewed the licensee's discussion and concludes that the indicated purpose of SQN CTS 3.4.8 is to ensure that the specific activity of the RCS is consistent with the assumptions of the MSLB accident and SGTR accident analyses. The licensee has asserted that with this proposed change in place, the applicable requirements will continue to ensure that the process variables are maintained in the MODES and other specified conditions assumed in the safety analyses and licensing basis. This change will add a new requirement for the unit to be in MODE 5 and, therefore, outside of the MODES of Applicability when the RCS specific activity limit is not met. The NRC staff concludes that the change described above will be more restrictive and, therefore, is acceptable. The NRC staffs acceptance of the ITS 3.4.16 Applicability is discussed more in detail in Section 3.2.4 below.

3.1.3 Less Restrictive Changes

3.1.3.1 CTS Gross Radioactivity Determination, Ē Deletion, and ITS 3.4.16 REQUIRED ACTION B

The licensee states:

> CTS 3.4.8 requires the specific activity of the primary coolant to be less than or equal to 100/Ē μCi/gram. CTS 3.4.8 ACTION b states that if the limit is not met,

then the unit must be shut down to HOT STANDBY with T_{avg} less than 500°F within 6 hours – no restoration time prior to the shutdown is provided. Furthermore, if the limit is not met, ACTION a (MODES 1, 2, 3, 4 and 5) requires the sample and analysis requirements of Table TS 4.4-4, item 4.a (an isotopic analysis for iodine), to be performed every 4 hours. Table 4.4-4 Item 3, requires a "Radiochemical for E bar Determination" analysis performed every 6 months with a Footnote limitation (Footnote *) that a minimum of 2 EFPD [effective full power days] and 20 days of POWER OPERATION have elapsed since the reactor was last subcritical for 48 hours or longer prior to performance of the analysis. ITS 3.4.16 does not include any requirements related to $\bar{E}$. ITS LCO 3.4.16 required the DOSE EQUIVALENT XE-133 limit to be met. SR 3.4.16.1 states that the DOSE EQUIVALENT XE-133 must be < 1612.6 μCi/gram and only requires the Surveillance to be performed in MODES 1, 2, and 3 with $T_{avg} \geq$ 500°F. If DOSE EQUIVALENT XE-133 is not within the limit, ITS 3.4.16 ACTION B requires a unit shutdown. Furthermore, when DOSE EQUIVALENT XE-133 is not within its limit, the ITS does not require the isotopic analysis for iodine to be performed every 4 hours. This changes the CTS by deleting the $\bar{E}$ requirements on the primary coolant gross specific activity and replacing it with the DOSE EQUIVALENT XE-133 requirements on primary coolant noble gas activity, consistent with Technical Specification Task Force (TSTF) change traveler TSTF-490-A.

CTS 3.4.8 Applicability for DOSE EQUIVALENT I-131 and E bar is required in MODES 1, 2, 3, 4, and 5. ITS 3.4.16 Applicability for DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 is required in MODES 1, 2, 3, and 4. This changes the CTS Applicability for DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 to MODES 1, 2, 3, and 4, consistent with TSTF-490-A.

The NRC staff has reviewed and evaluated the licensee's statements in connection with TSTF-490, and agrees that these proposed changes are consistent with TSTF-490-A, Revision 0. TSTF-490-A, Revision 0, "Deletion of E Bar definition and Revision to RCS Specific Activity Tech Spec" was announced for availability in the *Federal Register* (FR) on March 15, 2007, as part of the consolidated line item improvement process. The changes were approved by the NRC staff Safety Evaluation (SE) dated March 8, 2007 (ADAMS Accession No. ML070250176). TVA has reviewed the NRC staff SE listed above, the FR Notice for comment published November 20, 2006 (including the SE), and the FR Notice for availability published on March 15, 2007. TVA has concluded that the justifications presented in TSTF-490-A, Revision 0 and the model SE prepared by the NRC staff are applicable to SQN and justify this change. The changes incorporating the newly defined quantity DEX are acceptable to the NRC staff from a radiological dose perspective, since they will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analyses that form the bases, and are consistent with the mode that a SGTR and MSLB can occur.

3.2 Technical Evaluation of TSTF-490-A TS Changes

3.2.1 Revision to the Definition of DEI

The list of currently acceptable dose conversion factors (DCFs) for use in the determination of DEI as provided in TSTF-490-A includes the following:

- Table III of TID-14844, Atomic Energy Commission (AEC), 1962, “Calculation of Distance Factors for Power and Test Reactor Sites.”

- Table E-7 of RG 1.109, Revision 1, NRC, 1977.

- International Commission on Radiological Protection (ICRP) 30, 1979, page 192-212, Table titled “Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activity.”

- Committed Dose Equivalent (CDE) or Committed Effective Dose Equivalent (CEDE) dose conversion factors from Table 2.1 of Environmental Protection Agency (EPA) Federal Guidance Report No. 11.

- Table 2.1 of Environmental Protection Agency (EPA) Federal Guidance Report No. 11, 1988, “Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion.”

SQN’s CTS Definition of DEI is:

> DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcurie/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, “Calculation of Distance Factors for Power and Test Reactor Sites.

Proposed change:

> DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using thyroid dose conversion factors from Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites.

<u>Assessment</u>:

The NRC staff confirmed that both the proposed and CTS definition of DOSE EQUIVALENT I-131 use equivalent DCFs.

In request for additional information RPG-013 (in Supplement 2), the NRC staff asked SQN to confirm that the DCFs used for the determination of DEI surveillances are consistent with the DCFs used in SQN current design-basis radiological dose consequence analyses or to provide a justification why the use of different DCFs in the TS definitions from those in the DBA analyses yield conservative RCS radioisotopic concentrations and offsite consequences analyses. SQN stated in the response to RPG-013 that the DCFs used in the DBA analyses to determine the I-131 equivalence were those corresponding to the Thyroid Committed Dose Equivalent per unit intake from Table 2.1 of the EPA Federal Guidance Report (FGR) 11. These DCFs are not consistent with the DCFs in Table III of TID-14844 used in the proposed definition of DEI. SQN asserted and the NRC staff confirmed that the use of the FGR 11 values results in a higher concentration of iodine and doses in the DBA analyses than if the TID-14844 values were used. The higher concentrations used in the DBA analyses would exceed those allowed by TS and, therefore, the use of the EPA FGR 11 values in the DBA analyses instead of those in TID-14844 is conservative. For a given RCS concentration of iodine isotopes the use of the DCFs from TID-14844 will result in a higher value for DEI than the DEI value determined by using the DCFs from FGR 11. As a result, the determination of DEI using the TID-14844 DCFs will result in more restrictive limits on RCS iodine concentrations and, therefore, the proposed change is acceptable.

3.2.2 Deletion of the Definition of Ē and Addition of a New Definition for DE Xe-133

SQN proposes to delete the following current TS Definition of Ē:

> 1.12 Ē shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodine, with half lives greater than 15 minutes, making up at least 95% of the total non-iodine activity in the coolant.

SQN proposes addition of the following Definition for DE Xe-133

> DOSE EQUIVALENT Xe-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."

Assessment:

The NRC staff has reviewed the proposed change and finds that the new definition for DEX proposed in TSTF-490-A and adopted by SQN is similar to the definition for DEI. The determination of DEX will be performed in a similar manner to that currently used in determining DEI, except that the calculation of DEX is based on the acute dose to the whole body and considers the noble gases Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138, which are significant in terms of contribution to whole body dose. Some noble gas isotopes are not included due to low concentration, short half life, or small DCF. The calculation of DEX would use the effective dose conversion factors from Table III.1 of EPA FGR No. 12. Using this approach, the limit on the amount of noble gas activity in the primary coolant would not fluctuate with variations in the calculated values of Ē. If a specified noble gas nuclide is not detected, the new definition states that it should be assumed that the nuclide is present at the minimum detectable activity. This will result in a conservative calculation of DEX.

When Ē is determined using a design basis approach in which it is typically assumed that 1.0% of the power is being generated by fuel rods having cladding defects and it is also assumed that there is no removal of fission gases from the letdown flow, the value of Ē is dominated by Xe-133. The other nuclides have relatively small contributions. However, during normal plant operation there are typically only a small amount of fuel clad defects and the radioactive nuclide inventory can become dominated by tritium and corrosion and/or activation products, resulting in the determination of a value of Ē that is very different than would be calculated using the design basis approach. Because of this difference, the accident dose analyses become disconnected from plant operation and the LCO could become essentially meaningless. It also results in a TS limit that can vary during operation as different values for Ē are determined.

This change will implement an LCO that is consistent with the whole body radiological consequence analyses which are sensitive to the noble gas activity in the primary coolant but not to other non-gaseous activity currently captured in the Ē definition. SQN's CTS LCO 3/4.4.8 (ITS LCO 3.4.16) specifies the limit for primary coolant gross specific activity as 100/Ē μCi/gm. The current Ē definition includes radioisotopes that decay by the emission of both gamma and beta radiation. The CTS ACTION b of LCO 3.4.8 (ITS LCO 3.4.16 CONDITION B) would rarely, if ever, be entered for exceeding 100/Ē since the calculated value is very high (the denominator is very low) if beta emitters such as tritium are included in the determination, as required by the Ē definition.

SQN's proposed deletion of the above stated definition for Ē and addition of a new definition for DEX in TS Section 1.1, is acceptable from a radiological dose perspective since it will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analyses which form their bases.

3.2.3 SQN's CTS LCO 3.4.8 (ITS LCO 3.4.16), "RCS Specific Activity"

CTS LCO 3.4.8 is modified to specify that iodine specific activity in terms of DEI and noble gas specific activity in terms of DEX shall be within limits. Currently the limiting indicators are explicitly identified in CTS LCO 3.4.8 a. and b. and SR 4.4.8, Table 4.4-4, (ITS LCO 3.4.16, CONDITION A and B and SR 3.4.16.1, and SR 3.4.16.2).

The revised LCO states, "RCS DOSE EQUIVALENT 1-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits." The limiting values for DEI and DEX are stated in ITS SR 3.4.16.1 and 3.4.16.2. The NRC staff reviewed the proposed change and found that it follows the format of the ISTS while incorporating the new DEX criteria from TSTF-490-A. Therefore this change is acceptable to the NRC staff from a dose consequence perspective.

3.2.4 SQN's CTS LCO 3.4.8 (ITS LCO 3.4.16), Applicability

CTS 3.4.8 Applicability currently includes all of MODES 1 through 5. SQN's proposed change concerns deletion of MODE 5 from the LCO Applicability.

It is necessary for the LCO to apply during MODES 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these MODES. In MODE 5 with the RCS loops filled, the steam generators are specified as a backup means of decay heat removal via natural circulation. In MODE 5, however, due to the reduced temperature (less than 200 degrees Fahrenheit) of the RCS, the release of significant quantities of RCS inventory is greatly reduced because there is no steam produced and, therefore, doses from either a postulated SGTR or MSLB would not be significant for SQN in MODE 5. In MODE 5, with the RCS loops not filled and in MODE 6, the steam generators are not used for decay heat removal, the RCS and steam generators are depressurized and primary to secondary leakage is minimal. Therefore, monitoring RCS specific activity for MODES 5 and 6 is not required and the exclusion of MODE 5 and 6 is, therefore, acceptable to the NRC staff from a dose consequence perspective.

3.2.5 SQN's CTS LCO 3.4.8 ACTION a (ITS 3.4.16 Condition A)

CTS 3.4.8 Action a which states, "With the specific activity of the primary coolant greater than 0.35 microcuries/gram DOSE EQUIVALENT I-131 for more than 48 hours during one continuous time Interval or exceeding the limit line shown on Figure 3.4-1, be in at least HOT STANDBY with T_{avg} less than 500°F within 6 hours," is revised by replacing the DEI site specific condition of greater than 0.35 µCi/gm with the words "not within limit" to be consistent with the ITS 3.4.16 LCO format. The SQN specific DEI limit of ≤ 0.35 µCi/gm is contained in the proposed SR 3.4.16.2. This proposed format change will not alter current TS requirements and is, therefore, acceptable from a dose consequence perspective.

CTS 3.4.8 Action a is revised to remove the reference to Figure 3.4.-1 "DOSE EQUIVALENT I-131 Primary Coolant Specific Activity Limit Versus Percent of RATED THERMAL POWER with the Primary Coolant Specific Activity > 0.35 µCi/gram Dose Equivalent I-131," and replace it with REQUIRED ACTION A.1, Verify DOSE EQUIVALENT I-131 ≤ 21.0 µCi/gm which is the site specific short term I-131 spiking limit. The curve contained in CTS Figure 3.4-1 was provided by the AEC in a June 12, 1974, letter from the AEC on the subject, "Proposed Standard Technical Specifications for Primary Coolant Activity." Radiological dose consequence analyses for SGTR and MSLB accidents that take into account the pre-accident iodine spike do not consider the elevated RCS iodine specific activities permitted by CTS Figure 3.4-1 for operation at power levels below 80% RTP. Instead, the pre-accident iodine spike analyses assume a DEI concentration of 21.0 µCi/gm, which is 60 times higher than the long term equilibrium value of 0.35 µCi/gm irrespective of power level. TS 3.4.16 Required Action A.1 should be based on the short term site specific DEI spiking limit to be consistent with the assumptions contained in the radiological consequence analyses and, therefore, this change is acceptable to the NRC staff.

The Note in CTS 3.4.8 Action a that states "LCO 3.0.4.c is applicable," is retained in ITS Required Action A.1. This Note allows entry into the applicable Modes from MODE 4 (Hot Shutdown) to MODE 1 (power operation) while the DEI limit is exceeded and the DEI is being restored to within its limit. This Mode change is acceptable to the NRC staff due to the significant conservatism incorporated into the DEI specific activity limit, the low probability of an event occurring that is limiting due to exceeding the DEI specific activity limit, and the ability to restore transient specific excursions while the plant remains at, or proceeds to power operation.

3.2.6 SQN's CTS LCO 3.4.8 ACTION b (ITS 3.4.16 Condition B) Revision to include Action for DEX Limit

CTS 3.4.8, ACTION b is revised to eliminate the reference to the previous primary coolant specific activity limit of 100/Ē. The revised ITS 3.4.16 LCO requires DEX to be within limits as discussed above in Section 3.1.3. The DEX limit is site specific and the numerical value of 1612.6 µCi/gm is contained in proposed SR 3.4.16.1. The site specific limit of DEX in µCi/gm is established based on the maximum accident analysis RCS activity. The primary purpose of the LCO on RCS specific activity and its associated Conditions is to support the dose analyses for DBAs. The whole body dose is primarily dependent on the noble gas activity, not the non-gaseous activity currently captured in the Ē definition.

ITS 3.4.16 Required Action B.1 and B.2 will require the plant to be in MODE 3 in 6 hours and to be in MODE 5 within 36 hours with DEI > 21.0 µCi/gm OR DEX not within limit. These required actions are consistent with the CTS 3.4.8 actions which required an orderly plant shutdown when DEI exceeded the short term spiking limit or whenever the Ē limit was exceeded.

These changes are consistent with TSTF-490-A, and, therefore, these changes are acceptable to the NRC staff from a dose consequence perspective.

3.2.7 CTS Table 4.4-4, item 1 (ITS SR 3.4.16.1 DEX Surveillance)

The change replaces the current CTS Table 4.4-4, item 1. surveillance for RCS gross specific activity with a surveillance contained in ITS SR 3.4.16.1, to verify that the site specific reactor coolant DEX specific activity is ≤ 1612.6 µCi/gm. This change provides a surveillance for the new LCO limit added to ITS 3.4.16 for DEX. The revised SR 3.4.16.1 requires performing a gamma isotopic analysis as a measure of the noble gas specific activity of the reactor coolant in accordance with the Surveillance Frequency Control Program. The surveillance provides an indication of any increase in the noble gas specific activity. The results of the surveillance on DEX allow proper remedial action to be taken before reaching the LCO limit under normal operating conditions. This change is consistent with TSTF-490-A and, therefore, this change is acceptable to the NRC staff from a dose consequence perspective.

3.2.8 SQN CTS SR Table 4.4-4, item 2 (ITS SR 3.4.16.2) DEI Surveillance

CTS SR Table 4.4-4, item 2 requires performing an isotopic analysis for the determination of DEI once per 14 days. ITS SR 3.4.16.2 requires verification of DEI ≤ 0.35 µCi/gm at a frequency in accordance with the Surveillance Frequency Control Program. The surveillance provides an indication of any increase in the iodine specific activity. The results of the surveillance on DEI allow proper remedial action to be taken before reaching the LCO limit under normal operating conditions. This proposed format change will not alter current TS requirements and is, therefore, acceptable to the NRC staff from a dose consequence perspective.

3.2.9 SQN's CTS TS SR Table 4.4-4, item 3

CTS TS SR 4.4-4, item 3 which required the determination of Ē is deleted. SQN's adoption of ITS 3.4.16 LCO on RCS DEX specific activity supports the dose analyses for DBAs, in which the whole body dose is primarily dependent on the noble gas concentration, not the non-gaseous activity currently captured in the Ē definition. With the elimination of the limit for RCS gross specific activity and the addition of the new LCO limit for noble gas specific activity, the CTS SR to determine Ē is no longer required. This change is consistent with TSTF-490-A and, therefore, this change is acceptable to the NRC staff from a dose consequence perspective.

4.0 **CONCLUSION**

The NRC staff has reviewed proposed adoption of TSTF-490-A to: revise the definition of DEI, delete the definition of Ē, add a new definition for DEX, delete CTS Figure 3.4-1, and revise the ITS 3.4.16 Conditions and Required Actions accordingly. In addition, the NRC staff has reviewed the change in the Applicability of LCO 3.4.16 to reflect the MODES during which the SGTR and MSLB accidents could be postulated to occur, the revision of SR 3.4.16.1 to verify DEX is within the prescribed limit, and the deletion of CTS TS SR Table 4.4-4, item 3.

The proposed changes will not impact the dose consequences of the applicable DBAs because the proposed changes will limit the RCS noble gas specific activity to ensure consistency with the values assumed in the site specific DBA radiological consequence analyses. The changes will also limit the potential RCS iodine concentration excursion to the value currently associated with full power operation, which is more restrictive on plant operation than the existing allowable RCS iodine specific activity at lower power levels. Therefore the NRC staff finds that the proposed changes are acceptable from a radiological dose perspective.

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ELECTRICAL ENGINEERING BRANCH SAFETY EVALUATION INPUT

REGARDING LICENSE AMENDMENT REQUEST FOR REVISION OF CURRENT

TECHNICAL SPECIFICATIONS TO IMPROVED TECHNICAL SPECIFICATIONS

ADOPTION OF TSTF-500

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327, AND 50-328

(TAC NOS. MF3128 AND MF3129)

1.0 **INTRODUCTION**

By letter dated November 22, 2013, as supplemented by letters dated December 16, 2014; June 19, 2015; July 24, 2015; August 5, 2015; and August 31, 2015 (Agencywide Documents and Management System (ADAMS) Accession Nos. ML13329A881, ML14350B364, ML15176A678, ML15205A404, ML15218A185, and ML15244A781, respectively), Tennessee Valley Authority (the licensee) proposed conversion of the Current Technical Specifications (CTS) for Sequoyah Nuclear Plant (SQN) Units 1 and 2 to the Improved Technical Specifications (ITS), which is a plant specific modification of the Improved Standard Technical specifications (ISTS) described in NUREG-1431, Revision (Rev.) 4.0. The Technical Specifications Task Force (TSTF)-500, Revision 2, "DC [direct current] Electrical Rewrite – Update to TSTF-360" is incorporated into NUREG-1431 (ISTS), and approved by the U.S. Nuclear Regulatory Commission (NRC) staff. In this safety evaluation (SE), the following DC electrical technical specifications (TS) sections are evaluated: Section 3.8.4, "DC Sources – Operating," Section 3.8.5, "DC Sources – Shutdown," Section 3.8.6, "Battery Parameters," and Section 5.5.15, "Battery Monitoring and Maintenance Program."

In this safety evaluation, the ITS is evaluated with respect to the ISTS and CTS.

During the license amendment request (LAR) review process, the licensee provided draft responses to the NRC staff (hereafter referred to as "the staff") requests for additional information (RAIs). These responses were formalized and submitted in the supplemental letter dated June 19, 2015, which includes updated ITS Section 5.0 changes. The updated proposed ITS Section 3.8 changes were submitted in supplemental letter dated July 24, 2015.

2.0 **REGULATORY EVALUATION**

The staff applied the following NRC regulations and guidance documents for review of the LAR:

The regulation at Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 17, "Electric power systems," states, in part, that:

> An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety…. The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions…. Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

The regulation at 10 CFR Part 50, Appendix A, GDC 18, "Inspection and testing of electric power systems," states, in part, that "electric power systems important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features…."

The regulation at 10 CFR Part 50, Appendix A, GDC 1, "Quality standards and records," requires that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

The regulations at 10 CFR 50.36, "Technical specifications," establish the requirements related to the content of the Technical Specifications (TS). Pursuant to 10 CFR 50.36(c) TS are required to include items in five specific categories related to station operation: (1) Safety limits, limiting safety system settings, and limiting control settings, (2) Limiting conditions for operations (LCOs), (3) Surveillance requirements (SRs), (4) Design features; and (5) Administrative controls. The proposed changes to the SQN TS relate to the LCO, SR, and Administrative control categories.

The regulation at 10 CFR 50.36(c)(3), states that "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operations will be met."

The regulation at 10 CFR 50.65(a)(3), "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," states, in part, that:

> Performance and condition monitoring activities and associated goals and preventive maintenance activities shall be evaluated at least every refueling cycle provided the interval between evaluations does not exceed 24 months.... Adjustments shall be made where necessary to ensure that the objective of preventing failures of structures, systems, and components through maintenance is appropriately balanced against the objective of minimizing unavailability of

structures, systems, and components due to monitoring or preventive maintenance.

Regulatory Guide (RG) 1.129, Revision 2, "Maintenance, Testing, and Replacement of Vented Lead-Acid Storage Batteries for Nuclear Power Plants," provides guidance with respect to the maintenance, testing, and replacement of vented lead-acid storage batteries in nuclear power plants. This RG endorses, in part, the Institute of Electrical and Electronics Engineers (IEEE) Standard (Std.) 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications."

TSTF-500, Revision 2, "DC Electrical Rewrite – Update to TSTF-360," September 22, 2009 (ADAMS Accession No. ML092670242).

TSTF-425, Revision 3, "Relocate Surveillance Frequencies to License Control – RITSTF [risk-informed TSTF] Initiative 5b," March 18, 2009 (ADAMS Accession No. ML090850642).

Model application and safety evaluation (SE) for plant-specific adoption of TSTF-500, Revision 2 (ADAMS Accession No. ML111751792).

NUREG-1431, Revision 4.0, "Standard Technical Specifications – Westinghouse Plants," April 2012 (ADAMS Accession No. ML12100A222). This revision includes incorporation of changes recommended by TSTF-425 and TSTF-500.

3.0 TECHNICAL EVALUATION

In the proposed ITS, the licensee uses the term "train" when referring to the independent and redundant subsystems that make up the Vital DC electrical system. ISTS uses the term "subsystems." The licensee uses the term "subsystem" when referring to the diesel generator (DG) DC electrical power systems.

3.1 Design Features of the SQN Class 1E DC Power System

As described in the proposed SQN ITS Bases 3.8.4, "DC Sources – Operating," the DC electrical power system at SQN consists of the 125 volt direct current (VDC) Vital electrical power subsystems and the DG electrical power subsystem. The 125 volt Vital (Class 1E) DC electrical power subsystem provides control power for the alternating current (AC) emergency power system. It also provides both motive and control power to selected safety-related equipment and preferred AC vital instrument board power (via DC to AC power converters (i.e., inverters)).

The DG DC electrical power subsystem provides the control power and generator field flashing for each DG. SQN is licensed to 10 CFR Part 50, Appendix A, GDC 17, and the licensee states that the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure.

The 125 VDC Vital electrical power subsystem consists of two independent and redundant safety-related Class 1E 125 VDC Vital electrical power trains. Train A is associated with channels I and III and Train B is associated with channel II and IV. Each Train consists of two

125 VDC batteries, two battery chargers (one per battery), and all the associated control equipment and interconnecting cabling, thus constituting two independent channels per train. Each channel has manual access to a fifth vital battery system. The fifth 125 VDC Vital Battery System is intended to serve as a replacement for any one of the four 125 VDC vital batteries during testing, maintenance, and outages with no loss of system reliability under any mode of operation. Additionally, there is one spare battery charger for channels I and II and one spare charger for channels III and IV, which provides backup service in the event that the preferred battery charger is out of service. Thus, the licensee asserts, if the spare battery charger is substituted for one of the preferred battery chargers, then the requirements of independence and redundancy between trains are still maintained.

Control power for the DGs is provided by the four DG battery systems, one per DG. Each DG DC system consists of one 125 VDC battery, one battery charger and the corresponding control equipment (DG 1A-A distribution panel, DG 2A-A distribution panel, DG 1B-B distribution panel, DG 2B-B distribution panel) and interconnecting cabling supply power to the associated DG control circuit.

During normal operation, the 125 VDC Vital load is powered from the battery chargers with the batteries on float-charge mode. In case of loss of normal power to the battery charger, the DC load is automatically powered from the station batteries.

Each 125V Vital DC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each train is located in an area separated physically and electrically from the other train to ensure that a single failure in one train does not cause a failure in a redundant train. There is no sharing of dedicated components between redundant Class 1E trains, such as batteries, battery chargers, or distribution panels.

As described in SQN Updated Final Safety Analysis Report (UFSAR), Section 8.3.2, each vital battery has adequate capacity to independently supply the connected loads for a period of 45 minutes, and to supply a load reduced for Station Blackout (loss of all AC power) for an additional 195 minutes. This capacity is available at the battery's end of qualified life and with the cell electrolyte at the minimum design temperature of 60° F. The manufacturer's ratings adjusted for minimum design cell temperature and battery end-of-life per guidance in IEEE Std. 485-1983, “IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations” is the basis for sizing the battery. The vital batteries are tested periodically to verify that the battery can supply the currents required to meet the loading requirements. The battery is tested per IEEE Std. 450-2002, TS Bases 3.8.6 and the results compared to the vendor capacity ratings.

As described in SQN UFSAR, Section 8.3.2, the normal and spare chargers have the capacity to continuously supply the normal loads and maintain the batteries in the design maximum charged state or to recharge the batteries from the design discharge state within an acceptable time interval, while supplying the normal loads. Each vital battery charger is normally in the float-charge mode, in which the charger is supplying the connected loads and the battery cells are receiving adequate current to charge the battery optimally. According to the licensee, this assures the internal losses of a battery power are overcome because the battery is maintained in a fully charged state.

According to ITS Bases, the vital battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of 123.78 V for a 60 cell battery (i.e., cell voltage of 2.063 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Optimal long term performance however, is obtained by maintaining a minimum float-charge voltage of 129 VDC. According to the licensee, this provides adequate overpotential (the voltage difference between a theoretical or thermodynamically determined voltage and the actual voltage under operating conditions), which limits the formation of lead sulfate and self-discharge.

Each DG battery consists of 58 cells; however, a battery is considered operable with 57 cells if one is strapped out (bypassed). Optimal long term performance is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. According to the licensee, this provides adequate overpotential, which limits the formation of lead sulfate and self-discharge.

3.2 Evaluation of Proposed Changes

The recommendations of TSTF-500, Rev. 2, have been incorporated into Revision 4 of the NUREG-1431 (ISTS). In this SE, the SQN Units 1 and 2 proposed TS (ITS) Sections 3.8.4, 3.8.5, 3.8.6, and 5.5.15 relating to the DC system are compared and evaluated with the corresponding requirements in ISTS and CTS. The SR frequency will be determined and controlled in accordance with the ITS 5.5.15, “Surveillance Frequency Control Program.” The evaluation of the licensee’s adoption of the Surveillance Frequency Control Program is provided separately in Attachment 3 to this SE.

3.2.1 ITS 3.8.4 DC Sources - Operating

3.2.1.1 ITS LCO 3.8.4

ITS LCO 3.8.4 states:

LCO 3.8.4 Two Vital DC electrical power trains and four diesel generator (DG) DC electrical power subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ISTS LCO 3.8.4 states:

LCO 3.8.4 The Train A and Train B electrical power subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

Equivalent CTS LCO 3.8.2.3 and LCO 3.8.1.1.b.5 requires:

LCO 3.8.2.3 The following D.C. vital battery channels shall be energized and OPERABLE:

CHANNEL I Consisting of 125 - volt D.C. board No. I, 125 - volt D.C. battery bank No. I* and a full capacity charger.

CHANNEL II Consisting of 125 - volt D.C. board No. II, 125 - volt D.C. battery bank No. II*, and a full capacity charger.

CHANNEL III Consisting of 125 - volt D.C. board No. III, 125 - volt D.C. battery bank No. III*, and a full capacity charger.

CHANNEL IV Consisting of 125 - volt D.C. board No. IV, 125 - volt D. C. battery bank No. IV*, and a full capacity charger.

* D.C. Battery Bank V may be substituted for any other Battery Bank as needed.

LCO 3.8.1.1.b.5 For each of the four separate and independent diesel generator sets:

A separate 125-volt D.C. distribution panel, 125-volt D.C. battery bank and associated charger shall be OPERABLE.

Evaluation of ITS LCO 3.8.4

SQN CTS LCO 3.8.2.3 requires that all four 125 VDC boards (I, II, III, and IV) be operable. The DC boards I, II, III, and IV directly relate to channels I, II, III, and IV respectively. Channels I and III, and II and IV correspond to Train A and Train B respectively. CTS LCO 3.8.1.1.b.5 requires, in part, that a separate 125 V DC battery bank and associated charger for each of the four DG sets be operable. ITS LCO 3.8.4 would require that two (both) Vital DC electrical power trains (Trains A and B) and four DG DC electrical power subsystems to be operable. CTS LCO 3.8.2.3 and CTS LCO 3.8.1.1.b.5 (DG requirements) are incorporated into the proposed ITS 3.8.4 LCO. The ITS LCO 3.8.4 wording differs from the ISTS LCO language by specifying a plant-specific requirement for the DG DC electrical power subsystems to be operable.

The staff finds that ITS LCO 3.8.4 is acceptable because it meets the intent of CTS LCOs 3.8.1.1.b.5 and 3.8.2.3 and is consistent with ISTS LCO 3.8.4, specifically, the two DC electrical power subsystems are operable and plant-specific changes are included to satisfy the operability of the DG DC power subsystems. The staff finds that the proposed ITS LCO 3.8.4 meets the requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.1.2 ITS 3.8.4; Condition 3.8.4.A

ITS 3.8.4.A states:

CONDITION: A. One or two vital battery chargers on one train inoperable

REQUIRED ACTION: A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.

COMPLETION TIME: 2 hours

AND

A.2 Verify battery float current ≤ 2 amps.
COMPLETION TIME: Once per 12 hours

AND

A.3 Restore vital battery chargers to OPERABLE status.
COMPLETION TIME: 7 days

This Condition is regarding the vital battery charger(s) being inoperable. The corresponding Conditions in CTS and ISTS are as follows:

ISTS 3.8.4.A states:

CONDITION: A. One [or two] battery charger[s] on one subsystem inoperable.

REQUIRED ACTION: A.1 Restore battery terminal voltage to greater than or equal to the minimum established float voltage.
COMPLETION TIME: [2 hours]

AND

A.2 Verify battery float current ≤ [2] amps.
COMPLETION TIME: Once per [12] hours

AND

A.3 Restore vital battery chargers to OPERABLE status.
COMPLETION TIME: [72] hours

Equivalent CTS Actions 3.8.2.3.a and 3.8.2.3.b require:

Restoration of inoperable 125-volt D.C. board/battery bank/charger to OPERABLE status within 2 hours.

Evaluation of ITS Condition 3.8.4.A

ITS 3.8.4 Required A would apply when one or two battery chargers on one train are inoperable. There are two battery chargers for each train. There are three associated Required Actions for Condition A. The Required Actions provide a tiered response that focuses on returning the battery and battery chargers to operable status in a specific time period. A vital battery is determined to be inoperable if its battery charger is inoperable.

ITS 3.8.4 Required Action A.1 would require that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. The battery charger, in addition to maintaining the battery operable, provides DC control power to AC circuit breakers and thus supports the recovery of AC power following events such as loss-of-offsite power or station blackout. ITS 3.8.4 Required Action A.1 meets the intent of CTS as both require the battery to be operable (terminal voltage to be restored greater than or equal to the minimum established float voltage) within 2 hours. ITS 3.8.4 Required Action A.1 and the associated Completion Time are the same as ISTS 3.8.4, Required Action A.1. Therefore, the staff finds ITS 3.8.4, Required Action A.1 acceptable.

ITS Required Action 3.8.4.A.2 would require that once per 12 hours, the battery float current be verified to be less than or equal to 2 amps. This would confirm that if the battery has been discharged as a result of an inoperable battery charger, it had been fully recharged. If, at the expiration of a12-hour period, the battery float current is greater than 2 amps, then the battery subsystem is considered inoperable. This verification provides assurance that the battery has sufficient capacity to perform its safety function. There is no similar requirement in the CTS for the completion of the battery float current verification once per 12 hours. However, ITS 3.8.4.A.2 including the completion time are the same as ISTS 3.8.4.A.2 (which is based on the NRC approved TSTF-500, Rev. 2). Therefore, the staff finds ITS 3.8.4, Required Action A.2 acceptable.

ITS 3.8.4 Require Action A.3 would require restoring inoperable the vital battery charger to operable status within 7 days. The CTS requires the vital battery charger to be restored to operable status within 2 hours. This Completion Time deviates from 72 hours of ISTS Required Action 3.8.4.A.3. The licensee states in ITS Bases 3.8.4.A.3 that the licensee has a fifth vital battery charger which can be substituted for an inoperable battery charger. Therefore, the restoration of the vital battery charger within 7 days is acceptable, as a separate charging source is available to justify the extended Completion Time to restore the original battery charger.

The staff finds that ITS 3.8.4 Condition A meets the requirements of CTS and ISTS; meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.1.3 <u>ITS 3.8.4; New Condition B</u>

<u>ITS Condition 3.8.4.B states</u>:

CONDITION:	B. One vital DC electrical power train inoperable for reasons other than Condition A.
REQUIRED ACTION:	B.1 Restore vital DC electrical power train to OPERABLE status. COMPLETION TIME: 2 hours

<u>ISTS Condition 3.8.4.B states</u>:

CONDITION:	B. One [or two] batter[y][ies on one subsystem] inoperable.
REQUIRED ACTION:	B.1 Restore batter[y][ies] to OPERABLE status.

COMPLETION TIME: [2] hours

ISTS Condition 3.8.4.C states:

CONDITION:	C. One DC electrical power subsystem inoperable for reasons other than Condition A [or B].
REQUIRED ACTION:	C.1 Restore DC electrical power subsystems to OPERABLE status. COMPLETION TIME: [2] hours

Equivalent CTS 3.8.2.3 Actions require:

Restoration of inoperable 125-volt D.C. board (Action a) and Battery bank/charger (Action b) to OPERABLE status within 2 hours.

Evaluation of ITS 3.8.4 Condition B

The proposed ITS 3.8.4 Condition has the combined requirements of ISTS 3.8.4 Conditions B and C. Revised Required Action B.1 would require that the vital DC electrical power train (other than battery charges, addressed in Condition A) be restored to operable status within 2 hours. New Required Action 3.8.4.B.1, including the Completion Time meets the intent of ISTS and CTS. The exception is that ISTS 3.8.4 uses the term “subsystem” while the proposed ITS 3.8.4 Action uses the plant specific term “train” which is a plant-specific editorial change.

The staff finds that ITS 3.8.4, Condition B provides acceptable Required Actions and Completion Times, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.1.4 ITS 3.8.4; Condition C

ITS Condition 3.8.4.C states:

CONDITION:	C. Required Action and Associated Completion Time of Condition A or B not met.
REQUIRED ACTION:	C.1 Be in MODE 3. COMPLETION TIME: 6 hours AND C.2 Be in MODE 5 COMPLETION TIME: 36 hours

ISTS Condition 3.8.4.D states:

CONDITION:	D. Required Action and Associated Completion Time not met.
REQUIRED ACTION:	D.1 Be in MODE 3.

COMPLETION TIME: 6 hours

AND

D.2 Be in MODE 5
COMPLETION TIME: 36 hours

Equivalent Action CTS 3.8.2.3.a and 3.8.2.3.b requires:

Restoration of inoperable 125-volt D.C. board/battery bank/charger to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

Evaluation of ITS 3.8.4.C

ITS Condition 3.8.4.C provides similar actions and Completion Times as corresponding actions and Completion Times in ISTS and CTS, if the components belonging to one of the vital trains are not restored within the times stated in Condition A or B.

The staff finds that ITS 3.8.4.C provides acceptable Required Actions and Ccompletion Times; meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.1.5 ITS 3.8.4; Condition D

ITS Condition 3.8.4.D states:

CONDITION: D. One or more DG DC electrical power subsystem(s) inoperable

REQUIRED ACTION: D.1 Declare associated DG(s) inoperable.
COMPLETION TIME: Immediately

There is no equivalent condition in ISTS.

Equivalent CTS LCO 3.8.1.1.b.5 requires:

A separate 125-volt D.C. distribution panel, 125-volt D.C. battery bank and associated charger with each DG.

Evaluation of ITS Condition 3.8.4.D

ITS Condition 3.8.4.D is equivalent to CTS LCO 3.8.1.1.b.5 that requires a separate 125 volt DC battery bank and associated charger for each DG as a condition for operability. ITS 3.8.4 LCO requires four DG DC electrical power subsystems to be operable. Required Action 3.8.4.D.1 requires that if one DG DC electrical power subsystem is inoperable, then declare the associated DG inoperable immediately. Since the requirement of CTS LCO 3.8.1.1.b.5 is to specify the operability association between each DG set and its supporting battery and battery charger, Required Action D.1 preserves this intent by requiring each DG to be declared inoperable if its associated DC electrical subsystem is inoperable. For most plants, the DC requirements for the DG system are provided by the main vital DC electrical power trains. Therefore, there is no separate requirement for the DG DC electrical power subsystems in the ISTS. ITS Condition 3.8.4.D meets the intent of CTS 3.8.1.1.b.5.

The staff finds that ITS 3.8.4.D provides acceptable Required Actions and Completion Times; meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.1.6 ITS SR 3.8.4.1

ITS SR 3.8.4.1 states:

SR 3.8.4.1: Verify battery terminal voltage is greater than or equal to the minimum established float voltage.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.4.1 states:

SR 3.8.4.1: Verify battery terminal voltage is greater than or equal to the minimum established float voltage.

FREQUENCY: [7 days OR In accordance with the Surveillance Frequency Control Program]

Equivalent CTS SRs 4.8.1.1.3.a.2 and 4.8.2.3.2.a.2 requires:

Verification that the terminal voltage of the battery associated with each DG is greater than or equal to 124-volts on float charge, every 7 days (SR 4.8.1.1.3.a.2); and Verification that the terminal voltage of the 125 V vital battery is greater than or equal to 129-volts on float charge, every 7 days (SR 4.8.2.3.2.a.2).

Evaluation of ITS SR 3.8.4.1

The purpose of SR 3.8.4.1 is to verify battery terminal voltage while the system is on a float charge to ensure that the effectiveness of the battery chargers is not degraded. The proposed SQN ITS Bases, SR 3.8.4.1, states in part that the voltage requirements are based on the nominal design voltage of the battery, and are consistent with the minimum float voltage established by the manufacturer (129 V for the vital batteries and 124 V for the DG batteries). Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state while supplying the continuous steady state loads of the associated DC train or subsystem. Proposed SR 3.8.4.1 removes the minimum float voltage values for vital and DG batteries as specified by CTS SR 4.8.1.1.3.a.2 and 4.8.2.3.2.a.2 and places these values in the ITS Bases in accordance with ISTS, which includes incorporation of TSTF-500. Changes to the Bases are controlled by the TS Bases Control Program in Chapter 5 of ITS.

During the LAR review process (RAI VKG019), the staff requested the licensee to provide the basis for selecting 124 V minimum float voltage for DG batteries. In the response submitted in Supplement 2, dated June 19, 2015, the licensee provided the following information regarding the basis for selecting 124 V as the minimum float voltage for the DG batteries:

> The minimum float voltage requirements for the DG batteries, as discussed in ITS 3.8.4 Bases Surveillance Requirements Section 3.8.4.1, reflects CTS 4.8.1.1.3.a.2 that requires verifying, "the total battery terminal voltage is greater than or equal to 124 volts on float charge," for the DG batteries. By letter dated September 17, 1982 (ADAMS Legacy Accession Number 8209220277), SQN requested a license amendment to change the minimum float voltage requirement specified in surveillance requirement 4.8.1.1.3.a.2 for the DG batteries from 129 volts to 124 volts. The change was necessary because SQN replaced the DG batteries with lead calcium batteries with 57 cells with a manufacturer's recommended minimum float voltage of 2.17 volts/cell. The original minimum float voltage requirement of 129 volts exceeded the manufacturer's recommended maximum of 128.25 volts and could contribute to shorter battery life. Therefore, 124 volts should be the minimum total float voltage requirement. By letter dated December 23, 1982 (Accession Number 8301060001), the Commission issued Amendments 17 and 8 for SQN, Units 1 and 2, respectively. The Safety Evaluation related to Amendments 17 and 8 stated that, "from this justification, the staff agrees that surveillance requirement 4.8.1.1.3.a.2 should be changed from 129 volts to 124 volts."

The staff finds the licensee's response is acceptable because a justification was provided for selecting the 124 V minimum float voltage for the DG batteries.

ITS SR 3.8.4.1 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds ITS SR 3.8.4.1 acceptable since it meets the intent of CTS and ISTS, and meets the 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.1.7 ITS SR 3.8.4.2

ITS SR 3.8.4.2 states:

SR 3.8.4.2: Verify each battery charger supplies ≥ 150 amps at greater than or equal to the minimum established float voltage for ≥ 4 hours

OR

Verify each battery charger can recharge the battery to the fully charged state within 36 hours while supplying the largest combined demands of various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.4.2 states:

SR 3.8.4.2: Verify each vital battery charger supplies ≥ [400] amps at greater than or equal to the minimum established float voltage for ≥ [8] hours

OR

Verify each vital battery charger can recharge the battery to the fully charged state within [24] hours while supplying the largest combined demands of various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.

FREQUENCY: [18 months OR In accordance with the Surveillance Frequency Control Program]

Equivalent CTS SR 4.8.2.3.2.c.4 requires:

The battery charger supplies at least 150 amperes at 125 volts for at least 4 hours; verify at least once per 18 months.

Evaluation of ITS SR 3.8.4.2

The purpose of ITS SR 3.8.4.2 is to verify the design capacity of the vital battery chargers. The design capacity of a vital battery charger is based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design basis event discharge state to the fully charged state within a given time. The first option of ITS SR 3.8.4.2 requires that each battery charger be capable of supplying 150 amps at the minimum established float voltage (129 VDC) for 4 hours. The second option of ITS SR 3.8.4.2 requires that each vital battery charger be capable of recharging the battery within 36 hours after a bounding design basis event discharge state coincident with supplying the largest combined demands of the various continuous steady state loads.

CTS SR 4.8.2.3.2.c.4 requires that the battery charger supply at least 150 amps at 125 V for at least 4 hours. The ITS SR 3.8.4.2 includes the same requirement as the CTS in requiring that the charger supply at least 150 amps, but requires charging at the minimum established float voltage (129 V discussed in evaluation of ITS SR 3.8.4.1 above) for 4 hours, and provides another surveillance option that verifies that the battery charger can recharge the battery to its fully charged state within 36 hours. The 150 amps and 4 hours values used in ITS SR 3.8.4.2 are plant-specific values based on SQN current licensing basis. The 36 hours value used in ITS SR 3.8.4.2 is also a plant-specific value based on SQN current licensing basis. In SQN UFSAR Section 8.3.2.1.1, the following is stated: "The charger supplies normal load demand on the battery board and maintains the battery in a charged state. Normal recharging of the battery from the design discharged condition can be accomplished in 12 hours (with accident loads being supplied) following a 30-minute AC power outage and in approximately 36 hours (with normal loads being supplied) following a 4-hour ac power outage."

During the LAR review process (RAI VKG020), the staff requested that the licensee provide a summary calculation that shows that the battery can be recharged to the fully charged state within 36 hours. In response to VKG020 submitted in Supplement 2, dated June 19, 2015, the licensee stated that the SQN Vital Battery Charger sizing analysis is performed in accordance with IEEE Std. 946-1985, “Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations” and provided a summary of charger sizing calculation.

The staff reviewed the summary of charger sizing calculation. Based on its review, the staff finds that charger can recharge the battery within 36 hours after a bounding design basis event discharge state coincident with supplying the largest combined demands of the various continuous steady state loads. Therefore, the response is acceptable.

During the LAR review process (RAI VKG021), the staff noted that ITS SR 3.8.4.2 pertains to surveillance of the vital battery charger only. The staff requested that the licensee explain why the DG battery charger did not have a similar SR as the vital batteries. In response to VKG021 submitted in Supplement 2, dated June 19, 2015, the licensee stated that ITS 3.8.4 does not have a DG battery charger testing requirement because the purpose of the DG batteries is to provide power to initially start the DG. Once the DG is running, the safety function is met and there is not a recharge time or extended load profile required to be tested. The staff determined that the SQN CTS does not have a surveillance requirement to verify the DG battery charger’s design basis capability to carry the normal required DG system loads and maintain the battery in a fully charged condition from a fully discharged battery condition. The adequacy of the existing CTS SR for the DG battery charger is beyond the scope of this review and is consistent with the current licensing basis.

ITS SR 3.8.4.2 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds proposed ITS SR 3.8.4.2 acceptable since it meets the intent of CTS and ISTS, and meets the 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.1.8 <u>ITS SR 3.8.4.3</u>

<u>ITS SR 3.8.4.3 states</u>:

SR 3.8.4.3: ------------------------------NOTES----------------------------

1. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3 for the vital batteries.

2. The modified performance discharge test in SR 3.8.6.7 may be performed in lieu of SR 3.8.4.3 for the DG batteries.

3. This Surveillance shall not be performed on in-service vital batteries in MODE 1, 2, 3, or 4. Credit may be taken for unplanned events that satisfy this SR.

Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required actual or simulated emergency loads for the design cycle when subjected to a battery service test.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.4.3 states:

SR 3.8.4.3: -----------------------------NOTES----------------------------

1. The modified performance discharge test in SR 3.8.6.6 may be performed in lieu of SR 3.8.4.3.

2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained and enhanced. Credit may be taken for unplanned events that satisfy this SR.

Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.

FREQUENCY: [18 months OR In accordance with the Surveillance Frequency Control Program]

Equivalent CTS SRs 4.8.2.3.2.d and 4.8.2.3.2.e requires:

Each 125-volt battery bank and charger to be demonstrated OPERABLE by performing a battery service test to verify that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for 2 hours, at least once per 18 months (SR 4.8.3.2.d); and performing battery discharge test to verify that the battery capacity is at least 82% of the manufacturer’s rating, once per 60 month interval (SR 4.8.2.3.2.e).

Evaluation of ITS SR 3.8.4.3

The purpose of battery service test is to verify the battery capability, as found, to satisfy the design requirements. ITS SR 3.8.4.3 is consistent with CTS SR 4.8.2.3.2.d in regard to verification of battery capacity to supply loads (actual or simulated emergency loads) during a battery service test. In regard to CTS SR 4.8.2.3.2.e, as allowed by Notes 1 and 2 in ITS SR 3.8.4.3, the requirements are covered by ITS SRs 3.8.6.6 and SR 3.8.6.7.

ITS SR 3.8.4.3, Note 3 specifies that the surveillance shall not be performed on in-service vital batteries in MODE 1, 2, 3, or 4. This is consistent with Note 2 of ISTS SR 3.8.4.3.

ITS SR 3.8.4.3 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds the proposed ITS SR 3.8.4.3 acceptable since it meets the intent of CTS and ISTS, and meets the 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.2 TS 3.8.5 DC Sources - Shutdown

3.2.2.1 ITS LCO 3.8.5

ITS LCO 3.8.5 states:

LCO 3.8.5 One Vital DC electrical power train and the diesel generator (DG) DC electrical power subsystems required to support one train of DGs shall be OPERABLE.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies

ISTS LCO 3.8.5 states:

LCO 3.8.5 [DC electrical power subsystem shall be OPERABLE to support the DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems - Shutdown."]

[One DC electrical power subsystem shall be OPERABLE.]

APPLICABILITY: MODES 5 and 6,
During movement of [recently] irradiated fuel assemblies

Equivalent CTS LCOs 3.8.1.2.b.5 and 3.8.2.4 require:

A separate 125-volt D.C. distribution panel, 125-volt D.C. battery bank and associated charger for each diesel generator sets 1A-A and 2A-A or 1B-B and 2B-B to be OPERABLE (LCO 3.8.1.2.b.5); and 125-volt battery banks and chargers, one associated with 125-volt D.C. Boards either I and III or II and IV to be OPERABLE (LCO 3.8.2.4).

APPLICABILITY: MODES 5 and 6.

Evaluation of ITS LCO 3.8.5

ITS LCO 3.8.5 requires one vital DC electrical power train (Train A consists of channels I and III and Train B consists of channels II and IV) to be operable. One required train consists of two batteries, one battery charger per battery, and the corresponding control equipment and interconnecting cabling. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents). Control power for the DGs is provided by four DG DC electrical power subsystems, one per DG. Each DG DC electrical power subsystem is comprised of one 125 VDC battery, an associated charger, and associated control equipment and interconnecting cabling. One DG DC electrical power subsystem is required to be operable for each required DG. ITS 3.8.5 is applicable in MODE 5 and 6 and during movement of irradiated fuel assemblies. Typically, ISTS has been written for a one-unit plant that has two DC subsystems. SQN is a two-unit plant in which each train consists of two subsystems. Since ITS LCO 3.8.5 is identical for SQN Unit 1 and Unit 2, the use of term "train" in ITS is considered acceptable, which functionally requires two trains for a two unit plant.

CTS LCO 3.8.1.2.b.5 requires a separate 125 VDC battery bank and associated charger for each required DG. CTS LCO 3.8.2.4 requires, in part, two 125 VDC DC boards either I and III or II and IV, and associated 125 VDC battery banks and chargers. ITS LCO 3.8.5 requires one vital DC electrical power train to be operable and the DG DC electrical power subsystems required to support one train of DGs to be operable. Therefore, ITS LCO 3.8.5 contains the applicable requirements of CTS LCOs 3.8.1.2.b.5 and 3.8.2.4.

ITS LCO 3.8.5 modifies the second option [One DC electrical power subsystem shall be OPERABLE] of ISTS LCO 3.8.5 by incorporating the CTS requirements. This option is appropriate because it applies to plants where the CTS only require one DC electrical Power subsystem to be operable.

The ITS require LCO 3.8.5 to be applicable during movement of irradiated fuel assemblies. This ensures the availability of sufficient DC electrical power sources to mitigate the consequences of postulated events even during shutdown (e.g., fuel handing accidents). LCO 3.0.3 is not applicable while in action statements of LCO 3.8.5. This requirement is consistent with ISTS.

The staff finds that ITS 3.8.5 LCO meets the intent of corresponding LCO requirements of CTS and ISTS, and meets the requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.2.2 ISTS Condition 3.8.5.A (Not Adopted)

ITS does not adopt ISTS Condition 3.8.5.A.

ISTS Condition 3.8.5.A states:

CONDITION: [A. One [or two] battery charger[s on one subsystem] inoperable.
AND
The redundant battery and charger[s] OPERABLE.

REQUIRED ACTION: A.1 Restore battery terminal voltage to greater than equal to the minimum established float voltage.
COMPLETION TIME: 2 hours

AND

A.2 Verify battery float current ≤ [2] amps.
COMPLETION TIME: Once per [12] hours

AND

A.3 Restore battery charger[s] to OPERABLE status.
COMPLETION TIME: [72] hours]

Evaluation of ISTS 3.8.5.A (Not Adopted)

As stated in the ISTS LCO 3.8.5 Reviewer's Note, Action A is applicable only when a plant-specific implementation of ISTS LCO 3.8.5 requires both subsystems/trains of DC system to be OPERABLE. The licensee stated that it did not adopt ISTS Action 3.8.5.A because the Current Licensing Basis only requires one DC electrical power subsystem. The NRC staff finds this acceptable since this is consistent with CTS.

3.2.2.3 ITS 3.8.5; Condition A

ITS Condition 3.8.5.A states:

CONDITION: A. One required vital DC electrical power train inoperable.

REQUIRED ACTION: A.1 Suspend movement of irradiated fuel assemblies
COMPLETION TIME: Immediately

AND

A.2 Suspend operations involving positive reactivity additions that could result in loss of required SDM [shutdown margin] or boron concentration.
COMPLETION TIME: Immediately

AND

A.3 Initiate action to restore required DC electrical power train to OPERABLE status.
COMPLETION TIME: Immediately

Equivalent ISTS Condition 3.8.5.B states:

CONDITION: B. One or more required DC electrical power subsystem[s] inoperable [for reasons other than Condition A. OR Required Actions and associated Completion Time of Condition A not met].

REQUIRED ACTION: B.1 Declare affected required feature(s) inoperable.
COMPLETION TIME: Immediately

OR

B.2.1 Suspend movement of [recently] irradiated fuel assemblies.
COMPLETION TIME: Immediately

AND

B.2.2 Suspend operations involving positive reactivity additions that could result in loss of required SDM or boron concentration.
COMPLETION TIME: Immediately

AND

B.2.3 Initiate action to restore required DC electrical power train to OPERABLE status.
COMPLETION TIME: Immediately

Equivalent CTS 3.8.2.4 Action requires:

With less than the required complement of D.C. equipment and board (125-volt D.C. boards either I and III or II and IV) OPERABLE, establish CONTAINMENT INTEGRITY within 8 hours.

Evaluation of ITS 3.8.5 Condition A

ITS Condition 3.8.5.A would apply if the one required vital DC electrical power train were inoperable. ITS Condition 3.8.5.A is consistent with ISTS Condition 3.8.5.B in regards to inoperability, since both are functionally similar.

ISTS Required Action 3.8.5.B.1 is applicable only when redundant subsystems/trains are required for the LCO. ITS 3.8.5 requires one train of DC system and so it is consistent with the CTS. Therefore, elimination of Action B.1 of ISTS is considered acceptable.

ITS Required Action 3.8.5.A.1 would require immediate suspension of movement of irradiated fuel assemblies if one required vital DC electrical power train is inoperable. ISTS Required Action 3.8.5.B.2.1 is the same as ITS 3.8.5.A.1.

ITS Required Action 3.8.5.A.2 would require immediate suspension of operations involving positive reactivity additions that could result in the loss of required SDM or boron concentration when one required vital DC electrical power train is inoperable. ISTS Required Action 3.8.5.B.2.2 is consistent with ITS 3.8.5.A.2.

ITS Required Action 3.8.5.A.3 would require immediate action to restore the required DC electrical power train to operable status. ISTS Required Action 3.8.5.B.2.3 is consistent with ITS 3.8.5.A.3.

ITS Required Actions 3.8.5.A.1, 3.8.5.A.2, and 3.8.5.A.3 are needed to ensure the required Safe Shutdown Margin (SDM) (MODE 5) or boron concentration (MODE 6) is maintained. The Completion Time of immediately is consistent with the required times for Actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

The proposed ITS Action 3.8.5.A does not require the establishment of containment integrity within 8 hours as required by CTS. The change is considered acceptable as immediate initiation of actions to restore required DC electrical power source to OPERABLE status, suspend the movement of irradiated fuel assemblies to prevent fuel handling accidents from occurring and suspend of positive reactivity additions that could result in failure to meet the minimum SDM or boron concentration limit will ensure the reactor remains subcritical.

Based on the above, the NRC staff finds that ITS Action 3.8.5.A provides acceptable Required Actions and Completion Times, consistent with CTS and ISTS, and is, therefore, acceptable.

3.2.2.4 ITS 3.8.5, Action B

ITS Condition 3.8.5.B states:

CONDITION: B. One or more required DG DC electrical power subsystem(s) inoperable.

REQUIRED ACTION: B.1 Declare associated DG(s) inoperable.
COMPLETION TIME: Immediately

There is no corresponding ISTS Condition, since ISTS does not discuss separate DC subsystems for DGs.

Equivalent CTS 3.8.1.2 Action requires:

With less than the required AC electrical power sources (including when a DG is rendered inoperable due to the inoperable associated DC system), suspend all operations involving CORE ALTERATIONS and suspend operations involving positive reactivity additions that could result in loss of required shutdown margin or boron concentration.

Evaluation of ITS Condition 3.8.5.B

ITS Condition 3.8.5.B.1 associated with ITS Condition 3.8.5.B requires the associated DGs to be declared inoperable immediately since the DGs will be incapable of performing their function. This declaration will also require entry into applicable Conditions and Required Actions for inoperable DGs, ITS LCO 3.8.2, “AC Sources – Shutdown,” and which require actions similar to those in the CTS.

The staff finds ITS Condition 3.8.5.B acceptable because it provides Required Actions and Completion Times that are consistent with the CTS.

3.2.2.5 ITS SR 3.8.5.1

ITS SR 3.8.5.1 states:

SR 3.8.5.1: For DC sources required to be OPERABLE, the following SRs are applicable:
SR 3.8.4.1
SR 3.8.4.2
SR 3.8.4.3

FREQUENCY: In accordance with applicable SRs

<u>ISTS SR 3.8.5.1 states</u>:

SR 3.8.5.1: -------------------NOTE---
The following SRs are not required to be performed: SR 3.8.4.2, and SR 3.8.4.3.

For DC sources required to be OPERABLE, the following SRs are applicable:

SR 3.8.4.1
SR 3.8.4.2
SR 3.8.4.3

FREQUENCY: In accordance with applicable SRs

<u>Equivalent CTS Requirements</u>:

CTS SR 4.8.1.2 refers to CTS SR 4.8.1.1.3 regarding certain DC System SRs required to be performed in Mode 5 and 6. The CTS SR 4.8.1.1.3 requirements (which are related to the battery systems) are discussed under ITS 3.8.6 SRs.

<u>Evaluation of ITS SR 3.8.5.1</u>

The purpose of ITS SR 3.8.5.1 is to assure operability of the required DC sources during shutdown mode by the performance of SR 3.8.4.1, SR 3.8.4.2, and SR 3.8.4.3, which are discussed above (SE Sections 3.2.1.6, 3.2.1.7, and 3.2.1.8).

ISTS 3.8.5 SRs are similar to ISTS 3.8.4 SRs except the ISTS SRs are preceded by a Note. The Note requires that SR 3.8.4.2 and SR 3.8.4.3 should still be capable of being met, but actual performance is not required. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged or rendered inoperable while the unit is in shutdown mode. ITS 3.8.5 SRs do not have this note. The licensee stated that ITS 3.8.5 SRs (same as ITS 3.8.4 SRs) can be performed in any mode because a spare vital battery and battery charger will allow SR 3.8.4.2 and SR 3.8.4.3 to be performed without making a train inoperable during the entire test. The Frequency of ITS SR 3.8.5.1 is the same as that of ITS 3.8.4 SRs.

The staff finds ITS SR 3.8.5.1 acceptable since it meets the intent of CTS and ISTS. Thus, it meets the 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3 <u>ITS 3.8.6 (Battery Parameters)</u>

Battery parameter limits are conservatively established, allowing continued DC electrical system function even with limits not met for a limited time. Preventive maintenance, testing, and monitoring are performed in accordance with the Battery Monitoring and Maintenance Program specified in ITS 5.5.15.

ITS 3.8.6 Bases, Background, states: "The Vital battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 123.78 V for 60 cell battery (i.e., cell voltage of 2.063 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Optimal long term performance however, is obtained by maintaining a float voltage 2.17 Vpc. This provides adequate overpotential which limits the formation of lead sulfate and self-discharge." The staff asked the licensee (RAI VKG023) to provide a similar discussion for the DG batteries consisting of 58 cells.

In response to VKG023 submitted in Supplement 2, dated June 19, 2015, the licensee provided the following additional information in the ITS 3.8.6 Bases Background Section to include a description of the DG batteries. The ITS 3.8.6 Bases now include: "The DG battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. Each DG battery consists of 58 cells; however, a battery is considered operable with 57 cells if one is strapped out. Optimal long term performance is obtained by maintaining a float voltage of 2.20 to 2.25 Vpc. This provides adequate overpotential which limits the formation of lead sulfate and self-discharges." The NRC staff reviewed the licensee's submittals and finds the additional information relating to DG batteries in ITS 3.8.6 Bases, reasonable and acceptable.

3.2.3.1 ITS LCO 3.8.6

ITS LCO 3.8.6 requires that Battery (Vital DC and DG batteries) parameters remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated design-basis accident. ITS LCO 3.8.6 incorporates the requirements of CTS 3.8.1.1, 3.8.1.2, and 3.8.2.3 by combining the requirements for the Vital Battery and DG battery parameters and changing applicable modes (MODES 1, 2, 3 and 4) with "When associated Vital DC and DG DC electrical power subsystems are required to be operable."

Proposed ITS LCO 3.8.6 states:

LCO 3.8.6 Battery parameters for Train A and Train B Vital batteries and diesel generator (DG) batteries shall be within limits.

APPLICABILITY: When associated Vital DC and DG DC electrical power subsystems are required to be OPERABLE.

ISTS LCO 3.8.6 states:

LCO 3.8.6 Battery parameters for Train A and Train B batteries electrical power subsystem shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

<u>CTS LCOs 3.8.1.1, 3.8.1.2, 3.8.2.3 and 3.8.2.4 require</u>:

125-volt D.C. battery bank associated with each DG (CTS LCO 3.8.1.1, and CTS LCO 3.8.1.2); and 125-volt D.C. battery bank No. I, II, II, IV (CTS LCO 3.8.2.3 and 3.8.2.4) are required to be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4 (for LCO 3.8.1.1 and LCO 3.8.2.3); MODES 5 and 6 (for LCO 3.8.1.2 and LCO 3.8.2.4)

<u>Evaluation of ITS LCO 3.8.6</u>

ITS 3.8.6 LCO requires that battery parameters (float voltage and current, electrolyte temperature and level) be within limits for both Trains A and B Vital batteries and DG batteries. The battery parameters that are required to be within limits specified in Condition statements and SRs. ITS LCO 3.8.6 is applicable when the associated Vital DC and DG DC electrical power subsystems are required to be operable. ITS LCO 3.8.6 is for both the plant and DG batteries, whereas ISTS LCO 3.8.6 is for plant batteries that support the combined DC power requirements of the plant and DGs (i.e., there are no separate DG batteries).

In the CTS, for a battery to be operable, the battery parameters are specified in CTS SRs 4.8.1.1.3 and 4.8.2.3.2.

Based on the above, the staff finds that ITS LCO 3.8.6 is acceptable because it satisfies the intent of CTS LCOs 3.8.1.1, 3.8.1.2, 3.8.2.3, and 3.8.2.4 in ensuring that the batteries remain operable.

3.2.3.2 <u>ITS 3.8.6; New Condition A</u>

<u>ITS Condition 3.8.6.A states</u>:

CONDITION: A. One or more batteries with one or more battery cells float voltage < 2.07 V.

REQUIRED ACTION: A.1 Perform SR 3.8.4.1.
COMPLETION TIME: 2 hours

<u>AND</u>

A.2 Perform SR 3.8.6.1.
COMPLETION TIME: 2 hours

<u>AND</u>

A.3 Restore affected cell voltage ≥ 2.07 V.
COMPLETION TIME: 24 hours

ISTS Condition 3.8.6.A states:

CONDITION: A. One [or two] batter[y]ies on one subsystem] with one or more battery cells float voltage < [2.07] V.

REQUIRED ACTION: A.1 Perform SR 3.8.4.1.
COMPLETION TIME: 2 hours

AND

A.2 Perform SR 3.8.6.1.
COMPLETION TIME: 2 hours

AND

A.3 Restore affected cell voltage ≥ [2.07] V.
COMPLETION TIME: 24 hours

CTS Requirements: There are no equivalent action statements. However, CTS SR 4.8.1.1.3.b.1 for DG batteries and CTS SR 4.8.2.3.2.b.1 for Vital batteries requires each connected cell to have a voltage of >2.07 volts at least once per 92 days.

Evaluation of ITS Condition 3.8.6.A

ITS Condition 3.8.6.A would apply when one or more batteries with one or more battery cells float voltage less than 2.07 V. ITS 3.8.6.A is similar to ISTS 3.8.6.A except for editorial, non-technical differences. There are three associated Required Actions for ITS 3.8.1.A. The Required Actions require performance of SRs and restoration of cell voltage of the affected cells.

ITS Required Action 3.8.6.A.1 would require performance of SR 3.8.4.1 within 2 hours of entrance into Condition A. SR 3.8.4.1 requires verifying battery terminal voltage while on float charge to ensure the effectiveness of the battery chargers, so that they can perform their intended function. ITS 3.8.6.A.1 and the Completion Time is the same as ISTS.

ITS Required Action 3.8.6.A.2 would require performance of SR 3.8.6.1 within 2 hours. SR 3.8.6.1 requires verification of each battery float current to ensure sufficient battery capacity, so that they can perform their intended function. ITS Required Action 3.8.6.A.2 and the completion time are the same as ISTS.

ITS Required Action 3.8.6.A.3 would require restoring affected battery cell voltage within 24 hours. ITS Required Action 3.8.6.A.3 and the Completion Time are similar to ISTS.

The main difference between the ITS and CTS is that ITS allows a certain Completion Time to restore the battery cell voltage whereas the CTS does not specify the Completion Ttime. ITS Condition 3.8.6.A Required Actions are considered acceptable as loads can be supplied by the associated battery charger while the battery cell voltage is restored to ≥ 2.07 volts. In ITS, the battery cell voltage is checked when performing SR 3.8.6.5 in accordance with Surveillance Frequency Control Program.

The staff finds that the proposed ITS 3.8.6 Condition A provides acceptable Required Actions and Completion Times, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.3 ITS 3.8.6; Condition B

Proposed ITS Condition 3.8.6.B states:

CONDITION: B. One or more Vital batteries with float current > 2 amps. OR One or more DG batteries with float current >1 amp.

REQUIRED ACTION: B.1 Perform SR 3.8.4.1.
COMPLETION TIME: 2 hours

AND

B.2.1 Restore Vital battery float current to ≤ 2 amps
COMPLETION TIME: 12 hours

OR

B.2.2 Restore DG battery float current to ≤ 1 amp
COMPLETION TIME: 12 hours

ISTS 3.8.6, Condition B states:

CONDITION: B. One [or two] batter[y][ies on one subsystem] with float current > [2] amps.

REQUIRED ACTION: B.1 Perform SR 3.8.4.1.
COMPLETION TIME: 2 hours

AND

B.2 Restore battery float Current to ≤ [2] amps.
COMPLETION TIME: [12] hours

CTS Requirements: There are no equivalent action statements. However, CTS SR 4.8.1.1.3.a.1 for DG batteries and CTS SR 4.8.2.3.2.a.1 for Vital batteries requires each pilot cell to meet either a specific gravity requirement or the battery charging current requirement of < 2 amp at least once per 7 days.

Evaluation of ITS 3.8.6.B

The proposed ITS 3.8.6, Condition B would apply when one or more vital batteries have a float current greater than 2 amps or one or more DG batteries have a float current greater than 1 amp. There are three Required Actions: B.1, B.2.1, and B.2.2, associated with ITS 3.8.6 Condition B. ITS 3.8.6, Condition B would verify the battery cells float current and revises ISTS Condition 3.8.6.B with changes creating two separate Required Actions to distinguish between vital and DG batteries.

ITS Required Action 3.8.6.B.1 would require performance of SR 3.8.4.1 within 2 hours of the occurrence of Condition B. SR 3.8.4.1 requires verifying battery terminal voltage while on float charge to ensure the effectiveness of the battery chargers, so they can perform their intended function. ITS Required Action 3.8.6.B.1, including the Completion Time, is the same as ISTS Required Action 3.8.6.B.1.

ITS 3.8.6 Required Actions B.2.1 or B.2.2 are required if the float current is found to be less than the minimum established float current. ITS 3.8.6 Required Action B.2.1 would require restoration of the vital battery float current to less than or equal to 2 amps within 12 hours of the occurrence of Condition B. ITS Required Action 3.8.6.B.2.2 would require restoration of the DG battery float current to less than or equal to 1 amp within 12 hours of the occurrence of Condition B. If the Vital and DG battery float currents are not restored to minimum requirements, then the batteries are declared inoperable. ITS Required Actions 3.8.6.B.1, 3.8.6.B.2.1, and 3.8.6.B.2.2, including the completion time, are similar to the ISTS Required Actions 3.8.6.B.1 and 3.8.6.B.2.

The main difference between the ITS and CTS is that ITS specifies a Completion Ttime to restore the battery float charge within limits whereas the CTS does not specify the Completion Time. ITS Condition B actions are considered acceptable as loads can be supplied by the associated battery charger while the battery float charge is restored to within the limits. In the ITS, the battery float charge is checked when performing SR 3.8.6.1 in accordance with the Surveillance Frequency Control Program.

The staff finds that ITS Condition 3.8.6.B provides acceptable required actions and Completion Times, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.4 ITS 3.8.6; Condition C

ITS Condition 3.8.6.C states:

CONDITION:	NOTE: Required Action C.2 shall be completed if electrolyte level was below the top of plates -- C. One or more batteries with one or more cells electrolyte level less than minimum established design limits.

REQUIRED ACTION:

NOTE:
Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates
----
C.1 Restore electrolyte level to above top of plates.
COMPLETION TIME: 8 hours

AND

C.2 Verify no evidence of leakage.
COMPLETION TIME: 12 hours

AND

C.3 Restore electrolyte level to greater than or equal to minimum established design limits.
COMPLETION TIME: 31 days

ISTS Condition 3.8.6.C states:

CONDITION:

NOTE:
Required Action C.2 shall be completed if electrolyte level was below the top of plates
----
C. One [or two] batter[y][ies on one subsystem] with one or more cells electrolyte level less than minimum established design limits.

REQUIRED ACTION:

NOTE:
Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates
----
C.1 Restore electrolyte level to above top of plates.
COMPLETION TIME: 8 hours

AND

C.2 Verify no evidence of leakage.
COMPLETION TIME: 12 hours

AND

C.3 Restore electrolyte level to greater than or equal to minimum established design limits.
COMPLETION TIME: 31 days

CTS Requirements:

There are no equivalent action statements. However, CTS SR 4.8.1.1.3 for DG batteries and CTS SR 4.8.2.3.2 for Vital batteries requires that each pilot cell and each connected cell meet the specific electrolyte level requirements, at least once per 7 days for each plot cell and at least once per 92 days for each connected cell.

Evaluation of ITS Condition 3.8.6.C

ITS 3.8.6.C would apply when one or more batteries are found with one or more cells electrolyte level less than the minimum established design limits. ITS Required Action 3.8.6.C.1 would restore electrolyte levels to above the top of the plate if levels fall below design limit within 8 hours of entry into Condition C. ITS Required Action 3.8.6.C.2 would verify whether there is leakage causing a drop in electrolyte levels within 12 hours of entry into Condition C. ITS Required Action 3.8.6.C.3 would restore the electrolyte level to greater than or equal to the minimum established design limits within 31 days. Required Actions C.3 is needed if the electrolyte level is above the top of the battery plates, but below the minimum limit. In this scenario, the battery should still have sufficient capacity to perform its intended safety function. The affected battery is not required to be considered inoperable solely as a result of the electrolyte level not being met. Therefore, the Completion Time for Required Action C.3 is significantly more than for Required Actions C.1 and C2 because the battery still has the capacity to perform its safety function.

ITS 3.8.6 Required Actions C.1, C.2, and C.3 including the Completion Times are the same as ISTS 3.8.6 Required Actions C.1, C.2, and C.3.

The main difference between the ITS and CTS is that the ITS allow certain Completion Time to restore the battery electrolyte level within limits, whereas the CTS do not specify a Completion Time. ITS Condition C actions are considered acceptable as loads can be supplied by the associated battery charger while the battery electrolyte level is restored to within limits. In the ITS, the battery electrolyte level is checked when performing SR 3.8.6.3 in accordance with the Surveillance Frequency Control Program.

The staff finds that ITS 3.8.6, Condition C provides acceptable Required Actions and Completion Times, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.5 ITS 3.8.6; Condition D

TS 3.8.6, Condition D states:

CONDITION: D. One or more batteries with pilot cell electrolyte temperature less than minimum established design limits.

REQUIRED ACTION: D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.
COMPLETION TIME: 12 hours

ISTS 3.8.6, Condition D states:

CONDITION: D. One [or two] batter[y][ies on one subsystem] with pilot cell electrolyte temperature less than minimum established design limits.

REQUIRED ACTION: D.1 Restore battery pilot cell temperature to greater than or equal to minimum established design limits.
COMPLETION TIME: 12 hours

CTS Requirements: There are no equivalent action statements.

Evaluation of ITS 3.8.6; Condition D

The proposed revised ITS 3.8.6 Condition D would apply when one or more batteries are found with a pilot cell electrolyte temperature less than the minimum established design limit. A low electrolyte temperature limits the current and power available from the battery. However, even with a degraded battery capacity, the batteries can perform their intended function because of additional margin built into the design. The 12 hour Completion Time allocated is adequate for restoration of battery cell temperature, since the batteries can still perform their intended function. In the ITS, the battery float charge is checked when performing SR 3.8.6.4 in accordance with the Surveillance Frequency Control Program.

ITS 3.8.6 Condition D Required Actions D.1 including the Completion Time is the same as ISTS 3.8.6, Required Action D.1.

The staff finds that ITS 3.8.6 Condition D provides acceptable required actions and completion time; meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.6 ITS 3.8.6; New Condition E

ITS 3.8.6, Condition E states:

CONDITION: E. One or more batteries in redundant trains with battery parameters not within limits.

REQUIRED ACTION: E.1 Restore battery parameters for batteries in one train to within limits.
COMPLETION TIME: 2 hours

ISTS 3.8.6, Condition E states:

CONDITION: E. One or more batteries in redundant subsystems with battery parameters not within limits.

REQUIRED ACTION: E.1 Restore battery parameters for batteries in one subsystem to within limits.
COMPLETION TIME: 2 hours

CTS Requirements: There are no equivalent action statements.

Evaluation of ITS 3.8.6; New Condition E

The proposed revised ITS 3.8.6 Condition E would apply when battery parameters in one or more batteries in redundant trains are not within design limits. Therefore, Required Action E.1 would require restoration of battery parameters in at least one train within 2 hours. When the battery parameters are not within design limits, there is no assurance that the affected batteries can perform their required function. In this scenario, multiple systems that rely on these batteries may not be able to function. This situation is important enough, so that the battery parameters need to be restored in a short period of time as specified by the 2 hour Completion Time. Revised ITS 3.8.6 Condition E Required Action E.1, including the Completion Time, is consistent with ISTS 3.8.6 Required Action E.1.

The staff finds that ITS 3.8.6 Condition E provides acceptable Required Actions and Completion Time, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.7 ITS 3.8.6; New Condition F

ITS 3.8.6, Condition F states:

CONDITION: F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met.

OR

One or more Vital batteries with one or more battery cells float voltage < 2.07 V and float current > 2 amps.

OR

One or more DG batteries with one or more battery cells float voltage < 2.07 V and float current > 1 amp.

OR

SR 3.8.6.6 not met

OR

SR 3.8.6.7 not met

REQUIRED ACTION: F.1 Declare associated battery inoperable.
COMPLETION TIME: Immediately

ISTS 3.8.6, Condition F, states:

CONDITION: F. Required Action and associated Completion Time of Condition A, B, C, D, or E not met.

OR

One [or two] batter[y][ies on one subsystems] with one or more battery cells float voltage < [2.07] V and float current > [2] amps.

REQUIRED ACTION: F.1 Declare associated battery inoperable.
COMPLETION TIME: Immediately

CTS Requirements: If any of the battery parameters during CTS SRs are not within limits, the battery is declared inoperable immediately.

Evaluation of ITS Condition 3.8.6.F

The proposed revised ITS 3.8.6.F is needed when Required Action and associated Completion Time of TS 3.8.6 Condition A, B, C, D, or E are not met. If any of the scenarios of Condition F happens, Required Action F.1 is applicable. Under these scenarios, there may not be sufficient battery capacity in terms of float voltage and/or float current to supply the expected load requirements. Therefore, the battery must be declared inoperable immediately because of insufficient capacity to perform its intended function.

ITS 3.8.6 Required Action F.1 including the Completion Time is similar to ISTS 3.8.6 Required Action F.1.

The staff finds that ITS 3.8.6 Condition F provides acceptable Required Actions and Completion Time, meets the LCO requirements of 10 CFR 50.36, and is, therefore, acceptable.

3.2.3.8 ITS SR 3.8.6.1

ITS SR 3.8.6.1 states:

SR 3.8.6.1: NOTE:
Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1.

Verify each vital battery float current is ≤ 2 amps and each DG battery float current is ≤ 1 amp.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.6.1 states:

SR 3.8.6.1: NOTE:

Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1.

Verify each battery float current is ≤ [2] amps.

FREQUENCY: [7 days
<u>OR</u>
In accordance with the Surveillance Frequency Control Program]

<u>Equivalent CTS Requirements</u>:

CTS SR 4.8.1.1.3.a.1 for DG batteries and CTS SR 4.8.2.3.2.a.1 for Vital batteries require each pilot cell to meet either a specific gravity requirement or the battery charging current requirement of < 2 amp at least once per 7 days.

<u>Evaluation of ITS SR 3.8.6.1</u>

The purpose of ITS SR 3.8.6.1 is to determine the state of charge of the battery by verifying the vital and DG battery float currents. The float charge is the condition in which the battery charger is supplying the continuous small amount of current required to overcome the internal losses of a battery to maintain the battery in a fully charged state. As stated in the ITS SR 3.8.6.1, the NOTE is consistent with ISTS.

The equivalent CTS SRs require either the specific gravity or the battery charging current measurement. TSTF-500, Rev. 2 explained that according to IEEE Std. 450-2002, the verification of the battery float current is a more accurate measure of the battery charge.

ITS SR 3.8.6.1 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds that the proposed changes are acceptable because the SR verifies the battery float current in accordance with IEEE Std. 450-2002 and is consistent with ISTS, SR 3.8.6.1.

In response to VKG022 submitted in Supplement 2, dated June 19, 2015, the licensee incorporated the following into the SR 3.8.6.1, Bases: "The minimum required procedural time to measure battery float current will be 30 seconds or as recommended by the float current measurement instrument manufacturer. The minimum float current measurement time is required to provide a more accurate battery float current reading." The staff finds the procedural time to measure battery float current reasonable.

The staff finds that ITS SR 3.8.6.1 is acceptable since it meets the intent of CTS and ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components are maintained.

3.2.3.9 ITS SR 3.8.6.2

ITS SR 3.8.6.2 states:

SR 3.8.6.2 Verify each battery pilot cell float voltage is ≥ 2.07 V.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.6.2 states:

SR 3.8.6.2 Verify each battery pilot cell float voltage is ≥ [2.07] V.

FREQUENCY: [31 days
OR
In accordance with the Surveillance Frequency Control Program]

Equivalent CTS requirements:

CTS SR 4.8.1.1.3.a.1 for DG batteries and CTS SR 4.8.2.3.2.a.1 for Vital batteries require each pilot cell to meet the float voltage requirement of ≥ 2.13 volts at least once per 7 days.

Evaluation of ITS SR 3.8.6.2

The purpose of ITS SR 3.8.6.2 is to verify that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V to make sure that the formation of lead sulfate and self-discharge is limited.

CTS 4.8.1.1.3.a and 4.8.2.3.2.a require verification that the pilot cell voltage is greater than or equal to 2.13 V every 7 days. This is considered acceptable since “Battery Monitoring and Maintenance Program” has been added which requires actions to be taken to restore battery cells with float voltage < 2.13 V. This program will help ensure the cell voltage will not approach the ISTS SR 3.8.6.2 limit of 2.07 V.

ITS SR 3.8.6.2 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The NRC staff finds ITS SR 3.8.6.2 assures that the battery pilot cell voltage will be maintained at an acceptable level through the SR and Battery Monitoring and Maintenance Program. The NRC staff finds ITS SR 3.8.6.2 is acceptable since it meets the intent of CTS and ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3.10 ITS SR 3.8.6.3

ITS SR 3.8.6.3 states:

SR 3.8.6.3 Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.6.3 states:

SR 3.8.6.3 Verify each battery connected cell electrolyte level is greater than or equal to minimum established design limits.

FREQUENCY: [31 days
OR
In accordance with the Surveillance Frequency Control Program]

Equivalent CTS Requirements:

CTS SR 4.8.1.1.3 for DG batteries and CTS SR 4.8.2.3.2 for Vital batteries require that each pilot cell meet the specific electrolyte level requirements (> Minimum level indication mark, and ≤ ¼" above maximum level indication mark), at least once per 7 days, and each connected cell meet the specific electrolyte level requirements (Above top of plates, and not overflowing) at least once per 92 days for each connected cell.

Evaluation of ITS SR 3.8.6.3

The purpose of revised ITS SR 3.8.6.3 is to verify that each battery connected cell electrolyte level is greater than or equal to the minimum established design limits. SR 3.8.6.3 will be conducted in accordance with the Surveillance Frequency Control Program. The design limit specified for the electrolyte level ensures that the plates suffer no physical damage and maintain adequate electron transfer capability.

The purpose of the CTS limit on pilot cell electrolyte level and its related Frequency is to represent appropriate monitoring levels and appropriate preventive maintenance levels for long-term battery quality and extended battery life. The purpose of the CTS allowable value on each connected cell for electrolyte level and its related Frequency is to ensure that the plates suffer no physical damage and maintain adequate electron transfer capability to ensure the battery can perform its intended function and maintain a margin of safety. ITS 5.5.15, “Battery Monitoring and Maintenance Program,” requires a program providing controls for battery restoration and maintenance that shall be in accordance with IEEE Std. 450-2002 as endorsed by RG 1.129, Revision 2, with exceptions and other provisions. IEEE Std. 450-2002 contains, in part, guidance on monitoring electrolyte level with the intention of providing recommended maintenance, test schedules, and testing procedures that can be used to optimize the life and performance of permanently installed, vented lead-acid storage batteries used for standby power applications. Based on its review of the licensee-controlled program, "Battery Monitoring and Maintenance Program,” that staff finds that the program will provide adequate assurance that necessary battery parameter values will continue to be controlled and actions will be implemented if the battery parameter values are not met.

The staff finds ITS SR 3.8.6.3 acceptable because each battery cell electrolyte level will be maintained at an acceptable level through the Battery Monitoring and Maintenance Program, and is consistent with ISTS.

ITS SR 3.8.6.3 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds that ITS SR 3.8.6.3 is acceptable since it meets the intent of CTS/ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3.11 ITS SR 3.8.6.4

ITS SR 3.8.6.4 states:

SR 3.8.6.4 Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS SR 3.8.6.4 states:

SR 3.8.6.4 Verify each battery pilot cell temperature is greater than or equal to minimum established design limits.

FREQUENCY: [31 days
OR
In accordance with the Surveillance Frequency Control Program]

Equivalent CTS Requirements:

Although there is no exactly equivalent CTS SR, CTS SR 4.8.1.1.3 for DG batteries and CTS SR 4.8.2.3.2 for Vital batteries require that when performing SRs related to the specific gravity and float voltage, the specific gravity value of each pilot cell and float voltage of each connected cell shall be corrected based on the electrolyte temperature; and the specific gravity value and float voltage of each connected cell shall be corrected based on the average electrolyte temperature.

Evaluation of ITS SR 3.8.6.4

The purpose of ITS SR 3.8.6.4 is to verify that the battery pilot cell temperature is greater than or equal to minimum established design limits. Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. The SR is needed to ensure that battery capacity is not reduced due to temperature beyond design limits.

The proposed ITS 5.5.15, "Battery Monitoring and Maintenance Program," will include provisions for limits on average electrolyte temperature. ITS SR 3.8.6.4 requirements are the same as ISTS.

ITS SR 3.8.6.4 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

Based on the above, the staff finds that ITS SR 3.8.6.4 is acceptable since it meets the intent of CTS and ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3.12 ITS SR 3.8.6.5

ITS SR 3.8.6.5 states:

SR 3.8.6.5 Verify each battery connected cell float voltage is ≥ 2.07 V.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

ISTS TS SR 3.8.6.5 states:

SR 3.8.6.5 Verify each battery connected cell float voltage is [≥ 2.07] V.

FREQUENCY: [92 days
OR
In accordance with the Surveillance Frequency Control Program]

Equivalent CTS requirements:

CTS SR 4.8.1.1.3.b.1 for DG batteries and CTS SR 4.8.2.3.2.b.1 for Vital batteries requires that each connected cell float voltage is >2.07 volts, at least once per 92 days.

Evaluation of ITS SR 3.8.6.5

The purpose of proposed SR 3.8.6.5 is to verify that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 V. The purpose of CTS 4.8.1.1.3.b.1 and 4.8.2.3.2.b.1 is to verify each connected cell voltage is > 2.07 V at least every 92 days, thereby establishing a minimum value for battery OPERABILITY. ITS SR 3.8.6.5 requires verification that each connected cell voltage is ≥ 2.07 V. This changes the CTS by changing the acceptance criteria for each connected cell voltage limit from > 2.07 V to ≥ 2.07 V, thereby establishing new acceptance criteria for battery connected cell float voltage for OPERABILITY. Optimal long-term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 2.063 V per cell. This provides adequate overpotential, which limits the formation of lead sulfate and self-discharge, which could eventually render the battery inoperable. Furthermore, the Battery Monitoring and Maintenance Program includes actions to restore battery cells with float voltage less than 2.13 V and actions to verify that the remaining cells are greater than or equal to 2.13 V when a cell voltage has been found to be less than 2.13 V. The 2.07 V per individual cell limit reflects the OPERABILITY limit for the batteries. With all battery cells at or above 2.07 V, there is adequate assurance that the terminal voltage is at an acceptable threshold for establishing battery OPERABILITY.

ITS SR 3.8.6.5 requirements are similar to ISTS SR 3.8.6.5. ITS SR 3.8.6.5 Frequency will be controlled in accordance with the Surveillance Frequency Control Program.

The staff finds that ITS SR 3.8.6.5 is acceptable since it meets the intent of CTS and ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3.13 ITS SR 3.8.6.6

ITS SR 3.8.6.6 states:

SR 3.8.6.6:

---NOTE------------------------
This Surveillance shall not be performed on in-service Vital batteries in MODE 1, 2, 3, or 4. Credit may be taken for unplanned events that satisfy this SR.

Verify vital battery capacity is ≥ 82% of the manufacturer’s rating when subjected to a performance discharge test or a modified performance discharge test.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

AND

12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of manufacturer’s rating

AND

24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer’s rating

ISTS SR 3.8.6.6 states:

SR 3.8.6.6: ---NOTE-----------------
This Surveillance shall not be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR.

Verify battery capacity is ≥ [80%] of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.

FREQUENCY: [60 months
OR
In accordance with the Surveillance Frequency Control Program]

AND

12 months when battery shows degradation, or has reached [85] % of the expected life with capacity < 100% of manufacturer's rating

AND

24 months when battery has reached [85] % of the expected life with capacity ≥ 100% of manufacturer's rating

Equivalent CTS requirements:

CTS SR 4.8.2.3.2.e and SR 4.8.2.3.2.f for Vital batteries require verification of the battery capacity to be at least 82% of the manufacturer’s rating when subjected to a performance discharge test, at least once per 60 months. The performance test will be performed annually if the battery shows signs of degradation or has reached 85% of the service life expected for the application.

Evaluation of ITS SR 3.8.6.6

The purpose of ITS SR 3.8.6.6 is to verify that the vital battery capacity is ≥ 82% of the manufacturer’s rating when subjected to a performance discharge test or a modified performance discharge test. The battery performance discharge test is intended to determine overall battery degradation due to age and usage. This is a test of the constant current capacity of a battery, normally done in the as found condition, after having been in service. A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This test is designed to confirm whether the battery is able to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. ITS SR 3.8.6.6 meets the requirements of IEEE Std. 450-2002, which require replacement when its capacity falls below 80% of the manufacturer’s rating. In the ITS 3.8.6 Bases, the licensee stated that the minimum requirement for the vital battery was raised from the recommended 80% to 82% because of possible discharge during the 5-minute delay associated with the DG start and load shed timer.

The ITS SR 3.8.6.6 Frequency will be controlled in accordance with the Surveillance Frequency Control Program. This frequency will be changed to once per 12 months for higher than normal degradation or if the capacity has reached 85% of the expected life with capacity less than 100%, and the frequency will be changed to 24 months if the capacity has reached 85% of the expected life with capacity ≥ 100% of the manufacturer's rating.

The requirements of CTS 4.8.2.3.2.e, and CTS 4.8.2.3.2.f are similar to the ITS and ISTS, except that CTS does not discuss a modified performance test. According to IEEE Std. 450-2002 and ISTS, both the standard performance test and a modified performance test can be used to determine battery capacity. Therefore, the staff finds the ITS SR 3.8.6.6 to verify battery capacity to be acceptable.

ITS SR 3.8.6.6 is consistent with ISTS SR 3.8.6.6.

The staff finds that ITS SR 3.8.6.6 is acceptable since it meets the intent of CTS and ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.3.14 ITS SR 3.8.6.7

SR 3.8.6.7 is in addition to the SRs listed in ISTS Section 3.8.6 and is related to the DG battery capacity.

ITS SR 3.8.6.7 states:

SR 3.8.6.7: ---NOTE--------------------
Credit may be taken for unplanned events that satisfy this SR.

Verify DG battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.

FREQUENCY: In accordance with the Surveillance Frequency Control Program

AND

12 months when battery shows degradation, or has reached 85% of the expected life with capacity < 100% of manufacturer's rating

AND

24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

Evaluation of ITS SR 3.8.6.7

The purpose of ITS SR 3.8.6.7 is to test the DG battery to detect any change in the capacity, and/or to determine the battery's as-found capacity and ability to meet the duty cycle. IEEE Std. 450-2002 recommends replacing the battery if its capacity is below 80% of the manufacturer's rating and if a battery cannot meet its duty cycle. CTS 4.8.1.1.3 specify the Surveillances for the DG batteries while the unit is in MODE 1, 2, 3, or 4. CTS 4.8.1.2 refer to these Surveillances for DG batteries while in MODE 5 or 6. These Surveillances are related to the DG batteries cell parameters and do not include verification of the DG batteries capacity. ITS 3.8.6 adds a new Surveillance, ITS SR 3.8.6.7 requiring verification that the DG battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test in accordance with the Surveillance Frequency Control Program or at a conditional Frequency based on specific battery conditions. All of the other requirements are similar to those required for the vital battery Surveillance discussed in ITS SR 3.8.6.6 above.

The NRC staff finds that ITS SR 3.8.6.7 is consistent with IEEE Std. 450-2002 and is necessary to monitor the battery for degradation and/or battery capacity. The staff finds ITS SR 3.8.6.7 is acceptable since it meets the intent of ISTS, and meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained.

3.2.4 ITS 5.5.15, Battery Monitoring and Maintenance Program

ITS 5.5.15 adds a new Battery Monitoring and Maintenance Program as TS Section 5.5.15 as follows:

<u>ITS 5.5.15; New Battery Monitoring and Maintenance Program</u>

This Program provides controls for battery restoration and maintenance. The program shall be in accordance with IEEE Std. 450-2002, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications," as endorsed by RG 1.129, Revision 2, with RG exceptions and program provisions as identified below:

a. The program allows the following RG 1.129, Revision 2 exceptions:

    1. Battery temperature correction may be performed before or after conducting discharge tests.

    2. RG 1.129, Regulatory Position 1, Subsection 2, "References," is not applicable to this program.

    3. In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, "Inspections," the following shall be used: "Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery."

    4. In RG 1.129, Regulatory Position 3, Subsection 5.4.1, "State of Charge Indicator," the following statements in Paragraph (d) may

be omitted: "When it has been recorded that the charging current has stabilized at the charging voltage for three consecutive hourly measurements, the battery is near full charge. These measurements shall be made after the initially high charging current decreases sharply and the battery voltage rises to approach the charger output voltage."

5. In lieu of RG 1.129, Regulatory Position 7, Subsection 7.6, "Restoration," the following may be used: "Following the test, record the float voltage of each cell of the string."

b. The program shall include the following provisions:

1. Actions to restore battery cells with float voltage < 2.13 V;

2. Actions to determine whether the float voltage of the remaining battery cells is ≥ 2.13 V when the float voltage of a battery cell has been found to be < 2.13 V;

3. Actions to equalize and test battery cells that had been discovered with electrolyte level below the top of the plates;

4. Limits on average electrolyte temperature, battery connection resistance, and battery terminal voltage; and

5. A requirement to obtain specific gravity readings of all cells at each discharge test, consistent with manufacturer recommendations.

<u>Evaluation of ITS 5.5.15, New Battery Monitoring and Maintenance Program</u>

The staff finds that the Battery Monitoring and Maintenance Program is consistent with the ISTS. As required by the Reviewer Note in the ISTS Bases, the licensee, in its letter dated June 19, 2015 (in response to RAI GMW-002), provided the following information and verifications required as part of adoption of TSTF-500, Revision 2 into the ISTS:

1. A letter from the manufacturer of the batteries used at SQN, Units 1 and 2. For the Vital batteries, it states, "after a discharge, when the float current drops to less than or equal to 2 amps, the battery should be at least 98% charged." For the DG batteries, it states, "after a discharge, when the float current drops to less than or equal to 1 amp, the battery should be at least 98% charged." Additionally, the letter states, "This relationship will not change as the batteries age." Therefore, monitoring float current as a reliable and accurate indication of the state-of-the-charge of the battery is acceptable for the life of the battery.

   SQN CTS allow the use of battery charging current as a determination of battery operability. For Vital batteries, CTS 4.8.2.3.2.a.1 requires verification that the 125-volt battery parameters are within Category A limits of Table 4.8-2. CTS Table 4.8-2 includes Category A limits for specific gravity, modified by footnote (b), which provides an alternative method of verifying the battery state of charge by ensuring a battery charging current of less than 2 amps. SQN DG batteries are allowed the same alternative method of verifying the battery state of charge as demonstrated in CTS Table 4.8-1a, footnote (b).

2. SQN verifies that the equipment that will be used to monitor float current under SR 3.8.6.1 will have the necessary accuracy and capability to measure electrical currents in the expected range. Additionally, SQN will verify that the minimum required procedural time to measure battery float current will be 30 seconds or as recommended by the float current measurement instrument manufacturer. This minimum float current measurement time is required to provide a more accurate battery float current reading.

   SQN will incorporate the minimum float current measurement time into the Bases for SR 3.8.6.1. The following sentences will be added to the SR, “The minimum required procedural time to measure battery float current will be 30 seconds or as recommended by the float current measurement instrument manufacturer. The minimum float current measurement time is required to provide a more accurate battery float current reading.”

3. SQN verifies that Vital battery room temperature is routinely monitored such that a room temperature excursion could reasonably be detected and corrected prior to the average battery electrolyte temperature dropping below the minimum required electrolyte temperature.

   The SQN procedure for main control room operator rounds requires Vital battery room temperature monitoring at a minimum of once per 24 hours. The procedure contains temperature limits and instructions for actions should any temperatures deviate from the specified limits.

   Each set of DG batteries is located in a room with the associated DG. The SQN procedure for outside operator rounds requires temperature monitoring in the 2B-B DG room at a minimum of once per 12 hours. This temperature monitoring is considered to be a representative sample of all DG rooms. The procedure contains temperature limits and instructions for action should any temperatures deviate from the specified limits.

4. SQN is proposing a CT [completion time] longer than 72 hours for ITS 3.8.4, Required Action A.3, using the alternative justification method as allowed by TSTF-500, Section 4.7.1. The CT is consistent with SQN’s UFSAR description of a means to charge the batteries available and that this capability includes power supplied from a source that is independent of the offsite power supply. A description of the power source follows:

   The normal supply of DC current to the 125-volt vital battery boards is from the battery charger in each channel. There are six qualified, 125-volt battery chargers (one per battery and two spares). Each normally aligned 125-volt battery charger can be replaced by a spare charger. One spare charger is provided for every two normal chargers. Each charger supplies normal load demand on the battery board and maintains the associated battery in a charged state. Each charger is provided with manual transfer facilities to connect either a normal or an alternate AC input source. The normal and alternate sources are so arranged such that a loss of a single emergency AC onsite power supply does not leave a charger without an AC input source. Each charger is equipped with a DC voltmeter, DC ammeter, and charger failure alarm. Malfunction of a charger is annunciated in the main control room. Each charger is powered from the 480V shutdown boards (normal and alternate) which upon loss of normal power are energized from the standby power system (standby power is from the associated diesel generator through the 480-volt shutdown board). Each battery is normally required to supply loads only during the time interval between loss of normal feed to its charger and the receipt of emergency power to the charger from the standby diesel generator.

5. SQN is not proposing a CT greater than two hours for TS 3.8.4, Required Action B.1 or C.1.

6. The cell resistance limits in CTS 4.8.1.1.3.b.2 (DG batteries) and CTS 4.8.2.3.2.b.2 (Vital batteries) will be relocated to the Battery Monitoring and Maintenance Program required and described in proposed TS Section 5.5, Programs and Manuals. The connection resistance limit is 150 μOhms based on SQN battery calculations. The calculations illustrate that the minimum DC voltage is maintained for all required loads assuming a resistance of 150 μOhms per connection. For the DG batteries, the 150 μOhms connection resistance limit is for each connection, including each inter-cell, inter-tier, and terminal connection. For the Vital batteries, the 150 μOhms connection resistance limit is for each connection, including each inter-cell, inter-tier, and terminal connection.

7. SQN is proposing to adopt an allowance to perform the modified performance discharge test instead of the service test. For the Vital batteries, SQN verifies that the modified performance discharge test completely encompasses the load profile of the battery service test and that it adequately confirms the intent of the service test to verify the battery capacity to supply the design basis load profile.

   For the DG batteries, SR 3.8.4.3 and associated SR 3.8.6.7 will be new surveillance requirements. SQN will verify the procedures developed for the DG modified performance discharge test completely encompass the load profile of the battery service test and that it adequately confirms the intent of the service test to verify the battery capacity to supply the design basis load profile.

8. Monitoring of battery parameters (i.e., specific gravity, electrolyte level, cell temperature, float voltage, connection resistance, and physical condition) will be relocated to the licensee-controlled program, required and described in TS Section 5.5, Programs and Manuals, and titled the Battery Monitoring and Maintenance Program.

9. SQN verifies that plant procedures will require verification of the selection of the pilot cell or cells when performing SR 3.8.6.2.

   ITS Section 5.5.15, Battery Monitoring and Maintenance Program, a.3. states, “In lieu of RG 1.129, Regulatory Position 2, Subsection 5.2, ’Inspections,’ the following shall be used: 'Where reference is made to the pilot cell, pilot cell selection shall be based on the lowest voltage cell in the battery.'" Therefore, in order to comply with technical specifications, procedures will reflect this requirement.

The ITS 5.5.15 Battery Monitoring and Maintenance Program provides assurance that the battery parameters will be monitored and controlled in accordance with the program, and that actions to restore deficient parameters will be implemented in accordance with the licensee's corrective action program. Furthermore, the battery and its preventive maintenance and monitoring program continue to be subject to the regulatory requirements of 10 CFR 50.65.

Based on the above the staff finds that the proposed ITS 5.5.15 Battery Monitoring and Maintenance Program meets 10 CFR 50.36 requirements for surveillances by ensuring that the necessary quality of systems and components is maintained and that the LCOs will be met and is, therefore, acceptable.

3.3 Regulatory Commitments

In the LAR, Enclosure 9, "List of Final Safety Analysis Report (FSAR) Descriptions for TSTF-500 and TSTF-400," the licensee identified FSAR descriptions for the Diesel Generator Batteries and Vital Batteries, as part of the adoption of TSTF-500. The licensee committed to change or verify the following ten (10) SQN FSAR descriptions:

1. Describes how a 5 percent design margin for the 125V Vital batteries corresponds to a 2 amp float current value indicating that the battery is 98 percent charged.

2. Describes how a 5 percent design margin for the Diesel Generator batteries corresponds to a 1 amp float current value indicating that the battery is 98 percent charged.

3. States that long term battery performance is supported by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 2.13 V per connected cell and that there are 60 connected cells in the battery, which corresponds to 127.8 V at the battery terminals.

4. Describe how the batteries are sized with correction margins that include temperature and aging and how these margins are maintained.

5. States the minimum established design limit for battery terminal float voltage.

6. States the minimum established design limit for electrolyte level.

7. States the minimum established design limit for electrolyte temperature.

8. Describes how each battery is designed with additional capacity above that required by the design duty cycles to allow for temperature variations and other factors.

9. Describes normal DC system operation (i.e., powered from the battery chargers) with the batteries floating on the system, and a loss of normal power to the battery charger describing how the DC load is automatically powered from the station batteries.

10. Describes the availability of a means to charge the Vital Batteries and a description that the battery charger is capable of being supplied power from a power source that is independent of the offsite power supply. Specification 3.8.4, Required Action A.3.

3.4 Summary and Conclusions

Based on the above evaluation, the staff finds the proposed ITS Sections 3.8.4, 3.8.5, 3.8.6, and 5.5.15 provide assurance of the continued availability of the required DC power to shut down the reactor and to maintain the reactor in a safe condition after an anticipated operational occurrence or a postulated design-basis accident. The staff also concludes that the proposed CTS changes are in accordance with 10 CFR 50.36 and do not impact the licensee's current compliance with GDC 1, 17 and 18. Therefore, the staff finds the proposed changes acceptable.

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