TENNESSEE VALLEY AUTHORITY
1101 Market Street, Chattanooga, Tennessee 37402

CNL-22-079

July 20, 2022

10 CFR 50.55a

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

Sequoyah Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-77
NRC Docket No. 50-327

Subject: Sequoyah Nuclear Plant (SQN), Unit 1, American Society of Mechanical Engineers Operation and Maintenance Code, Request for Alternative RP-12

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and Standards," paragraphs (z)(2), Tennessee Valley Authority (TVA) requests an alternative to the inservice testing requirements of the American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code, Section ISTB-3310, “Effect of Pump Replacement, Repair, and Maintenance on Reference Values.” This alternative request (RP-12) applies to testing of the Centrifugal Charging Pump (CCP) 1B-B for the Sequoyah Nuclear Plant (SQN), Unit 1.

Due to apparent pump degradation of CCP 1B-B during normal operation during SQN Unit 1 Cycle 25, replacement of the pump rotating element, as a minimum, is necessary. ASME OM Code ISTB-3310 and Code Case OMN-16, “Use of a Pump Curve for Testing,” Revision 2, subsection 16-3310, “Effect of Pump Replacement, Repair, and Maintenance on Reference Values,” require a comprehensive or preservice test to be performed following pump replacement to establish new reference values and acceptance criteria before declaring the pump operable. As discussed in the enclosure to this letter, compliance with ISTB-3310 and Code Case OMN-16, Revision 2, subsection 16-3310, would cause a hardship or unusual difficulty without a compensating increase in the level of quality or safety. Therefore, TVA is submitting this one-time alternative request from ISTB-3310 and Code Case OMN-16, Revision 2, subsection 16-3310, in accordance with 10 CFR 50.55a(z)(2). The enclosure to this letter describes the proposed alternative and the basis for use.

TVA requests Nuclear Regulatory Commission verbal approval of this alternative request within 24 hours from the time and date of this submittal in order to support the timeline for restoring the CCP 1B-B to operable status prior to completion of the 72-hour completion time for SQN Unit 1 Technical Specification (TS) 3.5.2, “EMERGENCY CORE COOLING SYSTEMS (ECCS),” Condition A, which expires on July 21, 2022, at 2230 Eastern Daylight Time. This alternative request is a one-time alternative request until the ISTB-3100 and ISTB-3310 required comprehensive or preservice test is completed for CCP 1B-B during the SQN Unit 1 Cycle 25 refueling outage scheduled to commence in October 2022.

As noted in the enclosure to this submittal, the cause of the failure of the 1B-B CCP is still under investigation, but troubleshooting indicates a pump rotating element degradation, which will necessitate replacement of the pump rotating element, as a minimum. TVA will supplement this proposed alternative, as necessary, to reflect any additional information on the 1B-B CCP failure as it becomes available.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Stuart L. Rymer, Senior Manager, Fleet Licensing, at slrymer@tva.gov.

Respectfully,

Digitally signed by Rymer, Stuart Loveridge
Date: 2022.07.20 20:56:09 -04'00'

Stuart L. Rymer
Director (Acting), Nuclear Regulatory Affairs

Enclosure:

American Society of Mechanical Engineers Operation and Maintenance Code Request for Alternative RP-12

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Sequoyah Nuclear Plant
NRC Project Manager - Sequoyah Nuclear Plant

Enclosure

American Society of Mechanical Engineers Operation and Maintenance Code Request for Alternative RP-12

Centrifugal Charging Pump 1B-B Alternative Test

I. American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code Components Affected

Site/Unit	Pump ID	Pump Description	Pump Type	Code Class	OM Group
Sequoyah Nuclear Plant (SQN) Unit 1	SQN-1-PMP-062-0104	Centrifugal Charging Pump (CCP) 1B-B	Centrifugal Horizontal, Fixed Speed	2	A

II. ASME Code Edition and Addenda

SQN Unit 1

Fourth ten-year interval - September 1, 2016 to June 30, 2026

ASME OM Code 2004 Edition through 2006 Addenda

III. Applicable Code Requirement

ASME OM Code, Subsection ISTB-3310, "Effect of Pump Replacement, Repair, and Maintenance on Reference Values," states:

> *"When a reference value or set of values may have been affected by repair, replacement, or routine servicing of a pump, a new reference value or set of values shall be determined in accordance with ISTB-3300, or the previous value reconfirmed by a comprehensive or Group A test run before declaring the pump operable. The Owner shall determine whether the requirements of ISTB-3100, to reestablish reference values, apply. Deviations between the previous and new set of reference values shall be evaluated, and verification that the new values represent acceptable pump operation shall be placed in the record of tests (see ISTB-9000)."*

ASME OM Code, Code Case OMN-16, "Use of a Pump Curve for Testing," Revision 2, subsection 16-3310, "Effect of Pump Replacement, Repair, and Maintenance on Reference Values," states:

> *"When a reference curve(s) may have been affected by repair, replacement, or routine servicing of a pump, a new reference curve shall be determined in accordance with para. 16-3300, or the previous curve(s) reconfirmed by a comprehensive or Group A test run before declaring the pump operable. The Owner shall determine whether the requirements of ISTB-3100, to reestablish reference curves, apply. Deviations between the previous and new set of*

reference curves shall be identified, and verification that the new curves represent acceptable pump operation shall be placed in the record of tests (see section ISTB-9000).”

IV. Reason for Request

On July 18, 2022, operators in the main control room (MCR) noticed that the SQN Unit 1 pressurizer level was slowly declining with the downstream flow control valve near 100 percent open. Thereafter, operators received an unexpected alarm for low flow to the number 1 reactor coolant pump (RCP) seal. Operators dispatched auxiliary unit operators to the field to validate MCR indications. Subsequently, operators received an alarm indicating a lowering pressurizer level with level indicating 54 percent and declining. Operators placed the 1 A-A centrifugal charging pump (CCP) in service and pressurizer level began to recover. The 1B-B CCP was declared inoperable due to reduced pump capacity and on July 18, 2022, at 2230 Eastern Daylight Time (EDT), SQN Unit 1 entered Technical Specification (TS) 3.5.2, “EMERGENCY CORE COOLING SYSTEMS (ECCS),” Condition A, which requires that with one or more ECCS trains inoperable in Modes 1, 2, and 3, then the ECCS train(s) must be restored to operable status within 72 hours. The 72-hour completion time currently expires at 2230 EDT on July 21, 2022. The cause of the failure of the 1B-B CCP is still under investigation, but troubleshooting indicates a pump rotating element degradation, which will necessitate replacement of the pump element, as a minimum. The new rotating element comes with a balance drum and the remaining components have been inspected and are satisfactory.

To obtain additional information about the condition of the 1B CCP, the pump was placed back into service on July 19, 2022 at 1304 EDT. The pump experienced excessive internal recirculation flow at 70 gallons per minute (gpm) versus 25 gpm normal. A vibration measure of the inboard bearing showed an abnormal vibration as high as 0.89 inches per second (in/s) which is above the action required range of greater than 0.70 in/s.

The 1B-B CCP pump element is being replaced and TVA has determined that the requirements of ISTB-3100, “Preservice Testing,” and subsequently ISTB-5110, “Preservice Testing,” are applicable, and a preservice test is required to establish new reference values and acceptance criteria before declaring the 1B-B CCP operable. Currently, SQN Unit 1 is in Mode 1 operating at 100 percent power. Performing the ISTB-3100 required preservice test is not possible in Mode 1 and would require a unit shutdown, with the reactor head off in Mode 6 to perform the test. Maneuvering the plant from Mode 1 to lower modes of operation introduces additional shutdown risks, infrequent field and control room operations, and an increase in the volume of critical parameter monitoring. Cycling plant temperature and pressure from Mode 1 to Mode 6, and subsequently back to Mode 1 would introduce the potential to challenge both primary and secondary systems, such as safety valves simmering.

Operability of the 1B-B CCP is also verified by SQN Unit 1 TS Surveillance Requirement (SR) 3.5.2.4 which states “Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.” The Frequency of this SR is “in accordance with the Surveillance Frequency Control Program.” If the 1B-B CCP is not able to be restored to operable status within the 72-hour Completion Time of SQN Unit 1 TS 3.5.2, Condition A, then SQN Unit 1 TS 3.5.2, Condition B would require the unit to transition from Mode 1 to Mode 3 within six hours and transition to Mode 4 within 12 hours. Performing a mid-cycle outage in July 2022 simply to perform the required comprehensive

or preservice tests is not desirable due to high peak electrical load demands and would result in unnecessary plant transients and unnecessary radiological dose to plant personnel.

Furthermore, SQN Unit 1 is scheduled to commence a refueling outage in October 2022 (U1R25) at which time the ISTB-3100 required preservice test would be performed. Accordingly, commencing a shutdown of SQN Unit 1 to perform the ISTB-3100 required comprehensive or preservice tests, prior to U1R25, would result in undue increase in risk with no corresponding benefit to public health and safety.

TVA will be challenged from a reliability perspective if it loses a unit, or any portion of a unit, at SQN, anytime within the next eight days. TVA is already in a Conservative Operations Alert (COA) in preparation for high temperatures and record-setting load forecasts that are expected to continue for at least the next eight days, and potentially longer. TVA will need to make use of all available generation to meet this peak during this time, and even with all available generation in service, TVA anticipates that it will need to make non-firm spot market energy replacements to meet its forecast system load. Given the high loads forecast in TVA and neighboring systems alike, it is likely that TVA will be challenged in its ability to make these energy replacements and, if they are not available, TVA will be at risk of shedding firm load. Thus, it is critical that TVA maintain its native generation resources throughout the duration of the system challenges it is currently facing.

Therefore, compliance with ISTB-3310 under the circumstances described above represents a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, this request for alternative is being submitted in accordance with 10 CFR 50.55a(z)(2).

V. Proposed Alternative and Basis for Use

Proposed Alternative

1. Following repair of the 1B-B CCP, initial pump operability for compliance with SQN Unit 1 TS Limiting Condition for Operation (LCO) 3.5.2 and Surveillance Requirement (SR) 3.5.2.4 will be established by performance of a Group A pump test. The Group A pump test will be performed in accordance with Code Case OMN-16, Revision 2. The reference curve will be established in accordance with OMN-16, subsection 16-3300, for the range of flow rates achievable during Mode 1 operation. Differential pressure, flow rate and vibration shall be determined and compared with the associated reference values from the reference curve. Deviations from the associated reference values will be compared with the limits given in ASME OM Code Table ISTB-5121-1 and corrective action taken as specified in OMN-16, subsection 16-6200. This acceptance criterion is truncated, if necessary, to ensure the pump minimum design limits are met.
2. The ISTB-3310 required comprehensive or preservice test will be performed during U1R25. Testing will be performed in accordance with ISTB 3100, ISTB-3300, ISTB-5110, and Table ISTB-5121-1, as applicable. In the event SQN Unit 1 experienced an unplanned outage before U1R25, then TVA would evaluate whether plant conditions would be favorable to performing the ISTB-3310 required comprehensive or preservice test. As previously noted, this test is currently required to be performed in Mode 6 with the reactor vessel head removed. The basis for performing this test in Mode 6 is provided in the section of this enclosure titled “Operations.”

3. In accordance with ISTB-3100, the preservice test method is in accordance with ISTB-5110, which requires flow and differential pressure to be measured at a minimum of five points. If practicable, these points shall be from pump minimum flow to at least pump design flow. The Group A reference value for flow and differential pressure will be essentially the same point as the minimum flow and differential pressure used as the minimum flow point for the preservice test. Acceptance criteria will be established in accordance with Table ISTB-5121-1.

Basis for Use

Centrifugal Charging Pump

These pumps, as a function of ECCS, deliver water from the refueling water storage tank through an injection tank to the Reactor Coolant System (RCS) at the prevailing RCS pressure during accident conditions. As a normal operating function of the Chemical and Volume Control System, these pumps are normally aligned for RCP seal injection and charging service to the RCS.

During normal plant operations, the charging pumps take suction from the volume control tank and return the cooled, purified reactor coolant to the RCS through the charging line. Normal charging flow is handled by one of the two charging pumps. The bulk of the charging flow is pumped back to the RCS through the tube side of the regenerative heat exchanger. The flow is then injected into a cold leg of the RCS. A portion of the charging flow is directed to the reactor coolant pumps (normally eight gpm per pump) through a seal water injection filter.

TS Bases

The SQN Unit 1 TS Bases for SR 3.5.2.4 notes that the ASME OM Code provides the activities and frequencies necessary to satisfy the TS requirements. The TS Bases demonstrate the inservice test performed at the nominal charging flow point on the pump design curve is adequate to confirm component operability. The TS SR and Bases do not place additional requirements on the CCPs that have undergone repair, replacement, or routine servicing.

The performance of SR 3.5.2.4 is adequate to identify any significant issues resulting from a repair, replacement, or routine servicing and provides reasonable assurance the CCP is capable of performing its safety-related function until the performance of the ISTB-3310 required comprehensive or preservice test.

Updated Final Safety Analysis Report

SQN Updated Final Safety Analysis Report (UFSAR) Chapter 6, Section 6.3, “Emergency Core Cooling System,” discusses the ECCS. UFSAR Section 6.3.1.1, “Range of Coolant Ruptures and Leaks,” describes the various range of reactor coolant system ruptures and leaks that ECCS is designed for cooling the reactor core as well as to provide additional shutdown capability following initiation of the following accident conditions:

1. A pipe break or spurious valve lifting in the (RCS) which cause a discharge larger than that which can be made up by the normal makeup system, up to and including the instantaneous circumferential rupture of the largest pipe in the RCS.

2. Rupture of a control rod drive mechanism causing a rod cluster control assembly ejection accident.

3. A pipe break or spurious valve lifting in the secondary system, up to and including the instantaneous circumferential rupture of the largest pipe in the secondary system.

4. A steam generator tube rupture.

Per UFSAR Section 6.3.1.2, “Fission Product Decay Heat,” the primary function of the ECCS following a loss of coolant accident is to remove the stored and fission product decay heat from the reactor core such that fuel rod damage, to the extent that it would impair effective cooling of the core, is prevented.

Per UFSAR Section 6.3.1.3, “Reactivity Required for Cold Shutdown,” the ECCS also provides shutdown capability for the accidents listed above by means of chemical poison (boron) injection. The most critical accident for shutdown capability is the steam line break.

To ensure that the ECCS will perform its desired function during these accidents, the system is designed to tolerate a single active failure during the short term immediately following an accident, or to tolerate a single active or passive failure during the long term following an accident.

Maintenance

The maintenance performed determines the extent of testing required by ISTB-3310. If maintenance is performed which could significantly affect the pump hydraulic performance (e.g., impeller, rotating element, casing) then a pre-service test is required. Maintenance without the potential to significantly affect hydraulic performance (such as shaft maintenance or shim adjustments) could be verified against the existing pump hydraulic limits utilizing a Group A test.

For major maintenance which includes replacement of the impeller [rotating element(s)], the post maintenance test (PMT) would be performed in two phases due to the lack of a full flow testing loop.

The immediate PMT will prove a part of the pump curve which can be compared with the previous baseline curve which established reference values and the vendor curve for the pump design. Any significant abnormalities should be detectable by the deviation from expected hydraulic performance. The known curve for the pump design will provide reasonable assurance that the Group A test results will correlate with the necessary hydraulic performance to demonstrate required design flow rates. This curve will be established and monitored, and ASME OM Code limits for deviation from the reference value will provide an adequate bases for operational functionality. This monitoring will include quarterly Group A testing with vibration monitoring in accordance with the SQN IST Program. Additionally, this pump has performance parameters which can detect degradation or eminent failure when the pump is in normal service. The degraded flow of the 1B-B Centrifugal Charging Pump was identified during normal plant operations by control room monitoring. This combination of monitoring provides assurance that pump hydraulic degradation or failure will be

detected and addressed at the first available opportunity.

For normal pump maintenance (e.g., shaft maintenance or shim adjustments), verification that the pump remains within the expected acceptance criteria for hydraulic parameters during the Group A test will demonstrate that the reference values are valid for continued pump operability. As described above, normal monitoring of plant parameters from the MCR would provide identification of significant hydraulic degradation.

Operations

The reason the comprehensive test is performed in Mode 6 with the head off is due to the following.

- Mode of applicability of SQN TS 3.4.12, “Low Temperature Overpressure Protection (LTOP) System,” is Mode 4 when any reactor coolant system (RCS) cold leg temperature is ≤ 350°F, Mode 5, and Mode 6 when the reactor vessel head is on.
- The reactor water storage tank (RWST) has sufficient room to act as a letdown path.
- The operator has sufficient time to react to level changes due to the increased volume because the reactor cavity is flooded.
- Less risk and easier to schedule.

SQN TS LCO 3.4.12 states that the LTOP System shall be OPERABLE with a maximum of one charging pump and no safety injection pump capable of injecting into the RCS and the accumulators isolated and one of the following pressure relief capabilities:

a. Two power operated relief valves (PORV) with lift settings within the limits specified in the PTLR; or

b. The RCS depressurized and an RCS vent of ≥ 3.0 square inches.

The mass input pressure transient, which would occur most frequently during the course of normal plant operation with LTOP armed, would involve letdown isolation with the charging pumps delivering an input less than or equal to 180 gpm (maximum cleanup flow). However, the mass input analysis was performed assuming letdown isolation with one charging pump operating in the configuration producing the maximum possible delivery rates for the RCS pressure (40 gpm to 500 gpm). This more unlikely event and more severe configuration was chosen to provide additional system flexibility for pressure control. Mass injection events, which could potentially produce higher injection rates than the overpressure mitigation system is capable of mitigating, are prevented from occurring by locking out the required valves and pumps.

The heat input transient analysis is performed over the entire RCS shutdown temperature range. This analysis assumes an inadvertent start of a reactor coolant pump with a 50°F mismatch between the RCS and the temperature of the hotter secondary side of the steam generators with the RCS in a water solid condition. Both heat input and mass input analyses took into account the single failure of one PORV; therefore, only one PORV was assumed to be available for pressure relief. The evaluation of the transient results concludes that the allowable limits will not be

exceeded and, therefore, will not constitute an impairment to vessel integrity and plant safety.

While it is preferable to perform the comprehensive test in Mode 6 with the reactor vessel head removed, which provides the ideal conditions for performing the test, based on the accident analysis, the test could be performed in Mode 5 with or without the pressurizer manway removed; however, it would be difficult to manage decay heat and perform the test. The Bases for TS LCO 3.4.12 would allow the performance of the CCP comprehensive test on the CCP that is not made incapable of injecting to comply with LCO 3.4.12. The problems become risk and procedure development. If the safety injection test is used as a guideline and aligning the suction of the CCP to the residual heat removal (RHR) pump, inventory could be controlled without having to drain the RWST to provide some margin before it is overfilled. Also, this would allow the operator to control pressurizer level instead of reactor cavity level. Based on the performance of the comprehensive safety injection pump test, the operator can stop and start flow from the MCR and will have the ability to quickly respond to any transient events that could occur. LTOPS could be left in service to provide the overpressure protection and direct the reactor coolant, in the event a PORV was to lift, to the pressurizer relief tank (PRT). This would prevent Reactor coolant from exiting the RCS through the pressurizer manway if it were removed.

VI. Risk Insights

The following information provides risk insight while the 1B-B CCP is being repaired.

The incremental conditional core damage probability (ICCDP) for SQN Unit 1 associated with 120 hours of unavailability is 2.15E-07. The incremental conditional large early release probability (ICLERP) for SQN Unit 1 is 3.05E-09. These values are below acceptable thresholds and indicate that the requested extension should be acceptable from a risk perspective.

The dominant contributors remain those present in the baseline models including several internal flooding scenarios in the auxiliary building and plant transients resulting in a reactor coolant pump seal loss of coolant accident.

Contributions from common-cause failures (CCFs) need special attention when calculating the increased risk level R1. If the component is down because of a failure, the common-cause contributions involving the component should be divided by the probability of the component being down because of failure since the component is given to be down. If the component is down because it is being brought down for maintenance (but not failed), the CCF contributions involving the component should be modified to remove the component and to only include failures of the remaining components. The common cause associated with the CCPs were increased by dividing the probability of the common cause factor with the probability of the 1B CCP. The common cause includes the 1A and 1B CCPs.

VII. Duration of Proposed Alternative

This alternative request is a one-time alternative request until the ISTB-3100 and ISTB-3310 required preservice test is completed for the CCP 1B-B during U1R25.

VIII. Precedents

The following precedents are similar to the proposed alternative request in that they approved deferring the comprehensive or preservice test until suitable plant conditions existed to perform the test.

- In Reference 1, the Nuclear Regulatory Commission (NRC) approved a similar one-time alternative request for the SQN Unit 1 Motor Driven Auxiliary Feedwater pump 1B-B.
- In Reference 2, the NRC approved a similar alternative request for the SQN Units 1 and 2, and the WBN Units 1 and 2 Turbine Driven Auxiliary Feedwater pumps.
- A similar alternative (RR-4-12) was approved by the NRC for Virgil C. Summer Nuclear Station, Unit 1 for the Turbine Driven Emergency Feedwater Pump on April 28, 2017 (ML17088A256 and ML17103A533).

IX. References

1. NRC letter to TVA, “Sequoyah Nuclear Plant, Unit 1 – Authorization of Alternative Request RP-10 for the 1B-B Motor Driven Auxiliary Feedwater Pump (EPID L-2021-LLR-0039),” dated October 1, 2021 (ML21266A389)
2. NRC letter to TVA, “Sequoyah Nuclear Plant, Units 1 And 2, and Watts Bar Nuclear Plant, Units 1 and 2 – Alternative Request for the Turbine Driven Auxiliary Feedwater Pumps 10-Year Interval Inservice Testing Program (EPID L-2019-LLR-0005),” dated August 26, 2019 (ML19227A110)