Sequoyah Nuclear Plant

Sequoyah Nuclear Plant (SQN)
Pre-submittal Meeting for Inservice Testing (IST) Program Request for Alternative for Pressure Isolation Valve Testing per ISTC-3630(f)

February 16, 2022

TVA TENNESSEE VALLEY AUTHORITY

Agenda

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- Basis for Proposed Alternative
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Introduction

- The purpose of the meeting is to provide information for a planned proposed alternative to the requirements of the American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Subsections ISTC-3630, ISTC-3630(f), and ISTC-5221(a)(1) with regards to pressure isolation valve (PIV) testing in accordance with 10 CFR 50.55a(z)(2).
- PIV testing at SQN is performed during startup from a refueling outage. At present, if one of these PIVs fails and cannot pass at a higher pressure, there is no remedy other than to repair or replace the valve as required in ISTC-3630(f). There is no other corrective action allowed by the ASME OM code.
- Without this alternative, SQN would be required to descend to a lower mode, possibly remove fuel from the reactor vessel, and drain the RCS to a level which would allow the valve to be reworked. This would pose an undue hardship without a compensating increase in quality and safety
- The proposed alternative is needed to support the upcoming SQN Unit 1 Cycle 25 refueling outage (U1R25) scheduled for October 2022 and would apply for the duration of the SQN Units 1 and 2 fourth IST ten-year interval, which ends on June 30, 2026.

Applicable Code Requirement

- The code of record for SQN is the ASME OM Code 2004 Edition through 2006 Addenda.
- ASME OM Code, Subsection ISTC-3630, “Leakage Rate for Other Than Containment Isolation Valves,” states “Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied.”
- ASME OM Code section ISTC-3630(f), “Corrective Action,” states, “Valves or valve combinations with leakage rates exceeding the valves specified by the Owner per ISTC-3630(e) shall be declared inoperable and either repaired or replaced. A retest demonstrating acceptable operation shall be performed following any required corrective action before the valve is returned to service.”
- ASME OM Code, Subsection ISTC 5221(a)(1), “Valve Obturator Movement,” states “Check valves having a safety function in both the open and closed directions shall be exercised by initiating flow and observing that the obturator has traveled to either the full open position or to the position to perform its intended function(s) (see ISTA-1100), and verify on cessation or reversal of flow, the obturator has traveled to the seat”.

Applicable Technical Specification (TS) Requirements

- SQN Units 1 and 2 Technical Specification (TS) 3.4.14, “RCS Pressure Isolation Valve (PIV) Leakage,” states that “Leakage from each RCS PIV shall be within limit.” TS 3.4.14 applies during MODES 1, 2, and 3, and during MODE 4, except valves in the residual heat removal (RHR) flow path when in, or during the transition to or from, the RHR mode of operation.
- TS Surveillance Requirement (SR) 3.4.14.1 states: “Verify leakage from each RCS PIV is equivalent to ≤ 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm at an RCS pressure ≥ 2215 psig and ≤ 2255 psig.”
- The frequency of SR 3.4.14.1 is in accordance with the Inservice Testing (IST) Program and prior to entering Mode 2 whenever the unit has been in Mode 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months, and within 24 hours following valve actuation due to automatic or manual action or flow through the valve.
- If SR 3.4.14.1 is not satisfied then SQN Units 1 and 2 TS 3.4.14 Required Action A.2 requires the Reactor Coolant System (RCS) PIV to be restored within limits within 72 hours, otherwise SQN Units 1 and 2 TS 3.4.14 Required Action B requires the unit be in Mode 3 in six hours and Mode 5 in 36 hours.

ASME OM Code Components Affected

Site/Unit	Component ID	Component Description	Valve Type	OM Code Class	OM Category
SQN Unit 1 and 2	1 & 2-VLV-63-543/545/547/549	Safety Injection System (SIS) Hot Leg Secondary Check Valves	2” Y-Pattern Piston Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-551/553/555/557	Safety Injection System (SIS) Cold Leg Secondary Check Valves	2” Y-Pattern Piston Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-558/559 /641/644	SI/RHR Hot Leg Primary Check Valves	6” Inclined Vertical Seat Swing Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-560/561/562/563	SI Cold Leg Primary Check Valves	10” Vertical Seat Swing Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-622/623/624/625	Safety Injection System (SIS) Cold Leg Accumulator Secondary Check Valves	10” Vertical Seat Swing Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-632/633/634/635	RHR Cold Leg Secondary Check Valves	6” Inclined Vertical Seat Swing Check	1	A/C
SQN Unit 1 and 2	1/2-VLV-63-640/643	RHR Hot Leg Secondary Check Valves	8” Vertical Seat Swing Check	1	A/C

Reason for Request

- PIV testing is performed in accordance with ISTC-3630 and is normally performed during startup from a refueling outage (Modes 5 through 3).
- PIVs have been tested during startup from refueling outages (and certain other non-refueling outages) at lower differential test pressures [starting around 350 pounds per square inch (psi)] in order to complete the required testing as soon as possible thereby eliminating/reducing impact on startup critical path.
- These valves are difficult to test because there are no block valves to allow individual tests using a temporary pressure source as is done for LLRTs. The test is conducted using RCS or CLA pressure and requires system manipulations with multiple entries into LCOs, often on or close to the outage critical path.

Reason for Request (cont'd)

- In some cases, mechanical agitation has been necessary to get the valve to seat well enough to achieve an acceptable leakage rate.
  - TVA recognizes that mechanical agitation is a troubleshooting tool rather than a repair method. It is also recognized that OM Code, ISTC-3630(f) requires valves with leakage rates that exceed acceptance criteria to be declared inoperable and then, repaired or replaced followed with a re-test showing acceptable operation before return to service.
- Therefore, if one of the affected PIVs fails and cannot pass at a higher pressure, there is no remedy other than to repair or replace the valve as required in ISTC-3630(f). There is no other corrective action allowed by the ASME OM code.

Basis for Hardship

- The TS leakage criteria is the same as the ASME OM Code general criteria for PIVs, and the ASME OM Code does not allow use of analysis to declare a valve acceptable (non-conforming but operable).
- If the PIV fails the SR 3.4.14.1 and OM Code leakage acceptance criteria, then TS 3.14.14, Required Action A.1 requires isolation of the high pressure portion of the affected system from the low pressure portion by use of one closed manual, deactivated automatic, or check valve within four hours and Required Action A.2 requires restoration of the RCS PIV to within limits within 72 hours.
- In order to repair or replace a failed PIV, the plant would have to reverse startup activities by lowering pressure, possibly remove fuel from the reactor vessel, and RCS water level as required to perform repair or replacement of the failed PIV.
- This would have a significant impact on startup and outage duration and require emergent plant maneuvering to achieve the required configuration necessary for repair or replacement.

Basis for Hardship (cont'd)

- Attempting to repair or replace a PIV would also subject plant personnel to increased dose rates in a heat stress environment for an extended period of time just to perform the actual repair or replacement. Work for one of these PIVs would also require emergent support activities [work order planning and issue, scaffolds, insulation removal, radiological control surveys and coverage, Operations tag outs and system alignments, Engineering (various) inspections and support, QC and ISI support].
- As an example, PIV 1-VLV-63-559 was disassembled and inspected (D&I) during the U1R24 RFO in spring 2021. After initial inspections, it was determined the valve had to be cut out and a new one welded in. The entire duration of the D&I and replacement activities was approximately five days during the core empty period. This was for a planned activity with contingencies for replacement already staged. For an emergent replacement during startup activities (in Mode 5 or higher), the impact would be much more significant.

Basis for Hardship (cont’d)

- Because mechanical agitation is not a repair or replacement activity, this alternative is needed to avoid potential unnecessary emergent demands on plant equipment, resources, and personnel.
- Therefore, compliance with Subsections ISTC-3630, ISTC-3630(f), and ISTC-5221(a)(1) for the PIVs previously listed, would cause a hardship or unusual difficulty without a compensating increase in the level of quality or safety in order to perform the repair or replacement activity required by ISTC-3630(f).

Proposed Alternative

- TVA may perform initial PIV leakage testing at lower test pressures to optimize startup activities. If leakage rate is unacceptable at a lower test pressure, then test pressure will be raised, and leak testing will be repeated.
- If PIV leakage rate testing is not acceptable at the highest possible test pressure (using only RCS or cold leg accumulator pressure), the PIV will be declared inoperable.
- PIVs declared inoperable due to unacceptable seat leakage may be mechanically agitated to help the valve disc seat.
- PIVs that are mechanically agitated will be retested. If the seat leakage rate is acceptable, then the valve will be declared operable for one operating cycle or until the next time flow is passed through the valve, whichever comes first.

Proposed Alternative (cont'd)

- If mechanical agitation of the PIV failed to restore the seat leakage safety function of the PIV, then the PIV would be repaired or replaced, followed by a seat leakage test using normal test procedures.
- Any PIVs which had mechanical agitation applied to restore the PIV safety function and which have flow through them during a subsequent shutdown outside a refuel outage, regardless of time since the last test, will be seat leakage tested using normal test procedures.
- Any PIV that has been mechanically agitated will be either repaired or replaced in the following refuel outage and must pass all normal operability tests as post maintenance testing following the repair or replacement.
- This alternative may be used for multiple PIVs in series or in parallel.

Basis for Proposed Alternative

- A review of SQN PIV test and maintenance history showed that some valves have undergone corrective maintenance, but the majority have been good performers.
- There are two possible causes for the PIVs to fail leakage rate acceptance criteria and require mechanical agitation to achieve better disc seating.
  - System conditions do not provide adequate closing force of the disc upon cessation or reversal of flow.
  - Minor degradation of the valve internals.
- There are two mitigating factors that reduce concern of valve degradation.
  - Once the valve is seated well enough to meet the PIV leakage acceptance criteria it will remain in that position for the entire fuel cycle unless there is an emergency core cooling system injection due to a loss of coolant accident (LOCA). If a PIV opens due to a LOCA, then it will not be required to re-close to perform a PIV seat leakage function. SQN has never experienced a PIV failure to meet open exercise testing.
  - System parameter monitoring by operations and engineering during the operating cycle provides a detection method for PIV leakage rate issues.

Duration of Proposed Alternative and Precedents

- The duration of the proposed alternative request will be through the remainder of the fourth ten-year IST interval, which ends on June 30, 2026.
- There are no known precedents for this alternative request.

Schedule for Submittal

- TVA to submit request for alternative to NRC by mid-March 2022.
- TVA requests NRC approval by October 15, 2022 to support SQN U1R25, scheduled to commence October 22, 2022.


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