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NRC Staff Presentation on Inservice Testing Activities

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Topics

1. 10 CFR 50.55a Rulemaking
2. Lessons Learned from Power-Operated Valve (POV) Inspections
3. Electric Power Research Institute (EPRI) 10 CFR Part 21 Letter dated August 17, 2022
4. Check Valve Mechanical Agitation Process

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1. 10 CFR 50.55a Rulemaking

10 CFR 50.55a Rulemaking

- ASME Code Case Final Rule (Revision 39)
- ASME *Operation and Maintenance of Nuclear Power Plants* (OM Code), 2020 Edition, and ASME *Boiler and Pressure Vessel Code* (BPV Code), 2019 Edition, Final Rule
- Inservice Inspection (ISI)/Inservice Testing (IST) Program Code of Record (COR) Interval and Code Case Proposed Rule (Revision 40)
- ASME OM Code, 2022 Edition, and ASME BPV Code, 2021 Edition, Proposed Rule
- Streamlining of 10 CFR 50.55a (Embark Project)

ASME Code Case Rule (Revision 39)

- Final Rule issued March 3, 2022, in *Federal Register* (87 FR 11934).
- RG 1.192 (Revision 4), "Operation and Maintenance Code Case Acceptability, ASME OM Code," incorporated by reference in 10 CFR 50.55a with final rule.
- Acceptability of ASME OM Code Cases addressed in RG 1.192 (Revision 4) up to Code Case OMN-27.

ASME OM Code 2020 Edition Final Rule

- Final rule issued on October 27, 2022 (effective 11-28-2022) in 87 FR 65128
- 50.55a changes include:
  - Incorporated by reference 2020 Edition of ASME OM Code.
  - Removed 2011 Addenda and 2015 Edition of OM Code.
  - Accepted Subsection ISTE (2020 Edition) without conditions.
  - Clarified 50.55a(f)(4) and (g)(4) for snubbers.
  - Added 50.55a(f)(7) to require IST Program Plan submittals.
  - Revised 50.55a(b)(3)(xi) to allow increased flexibility for the valve position verification schedule for valves not susceptible to stem-disk separation by directly accepting Code Case OMN-28; and to allow schedule flexibility for initial implementation of ISTC-3700 as supplemented by (b)(3)(xi) where justification available for review.

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ISI/IST Program COR Interval and Code Case Proposed Rule (Revision 40)

SECY-21-0029

- In SECY-21-0029 dated March 15, 2021 (ML20273A286), the NRC staff requested Commission approval to initiate a proposed rulemaking plan that would amend 10 CFR 50.55a to extend the COR interval for IST and ISI programs.
- The proposed rulemaking plan included the following:
  - Prepare a proposed rule to increase from 10-year COR interval to 20-year COR interval for licensees that have updated their IST/ISI Programs to the 2019 Edition of the ASME BPV Code and the 2020 Edition of the ASME OM Code
  - Prepare a proposed rule to extend the COR interval from 20 years to 24 years in the future if ASME increases ISI interval to 12 years
  - Request delegation of signature authority for these rulemakings to the Executive Director for Operations (EDO)
- Provided other information on 10 CFR 50.55a streamlining efforts.

SRM-21-0029

- Commission issued Staff Requirements Memorandum SRM-21-0029 on November 8, 2021 (ML21312A490) approving both proposed rulemakings.
- Commission approved delegation of the signature authority for these two rulemakings to the EDO.
- Commission stated that the NRC staff should move expeditiously to implement the remaining EMBARK 10 CFR 50.55a streamlining recommendations.

Changes to SECY-21-0029 Plan

- NRC staff planned to combine ISI/IST COR interval rulemaking with ASME Code Case Revision 40 rulemaking.
- In 2022, ASME published BPV Code Case N-921 and OM Code Case OMN-31, which allow 12-year ISI and IST program intervals, respectively, as an alternative to the 10-year intervals currently required by the ASME Codes. ASME requested Code Case N-921 be included in the Revision 40 rulemaking (ML22046A112).
- With certain conditions, the inclusion of these code cases would create an option for a licensee to implement either a 10-year or a 12-year ISI/IST program interval. To be consistent and aligned, the same option needs to be in place for the COR interval.
- Therefore, the NRC staff determined the need to inform the Commission of the planned rulemaking changes from the original plan described in SECY-21-0029.

SECY-22-0075

- On August 1, 2022, the NRC staff sent Informational Paper SECY-22-0075 (ML22124A178) to the Commission.
- In SECY-22-0075, the NRC staff explains the changes to the plan described in SECY-21-0029 and how the staff plans to develop the proposed rule.
- Three major changes are:
  - Combine the two proposed rulemakings into one rulemaking
  - Make conforming changes to 10 CFR Part 50, Appendix J
  - Propose conforming and clarifying changes to address issues encountered during the development of the proposed rule
- The following three slides summarize this information in SECY-22-0075.

Combined Proposed Rulemaking

- Needed to avoid a misalignment, e.g., 20-year COR interval with a 12-year ISI interval
- Condition both code cases to allow their use only by licensees that have updated to the ASME BPV Code, 2019 Edition, and ASME OM Code, 2020 Edition, or later. This is needed to maintain consistency with SECY-21-0029 (only 20- or 24-year COR interval would be acceptable)
- Linking the COR update to the ASME ISI/IST program interval to ensure alignment, e.g., COR interval would be equal to two consecutive ISI or IST program intervals once a licensee has updated to the most recent edition of the code incorporated by reference in 10 CFR 50.55a

Changes to 10 CFR Part 50, Appendix J

- Appendix J contains requirements for containment leak testing (including containment isolation valves).

- Type A tests for Option A requires three leak tests, the third must be performed “when the plant is shutdown for the 10-year plant inservice inspection.” References 10 CFR 50.55a for these tests.

- A proposed revision to Appendix J would conform with the proposed changes to 10 CFR 50.55a consistent with the alternative 12-year ISI/IST program interval.

Other 10 CFR 50.55a Possible Changes

- Current version of 10 CFR 50.55a refers to the current 120-month interval requirement in a variety of ways. NRC staff plans to propose changes to 10 CFR 50.55a to establish consistency in the terminology (e.g., ISI interval, IST interval, and COR interval).

- NRC staff plans to develop a definition section to enhance regulatory clarity and modify the language of 10 CFR 50.55a to be consistent with those definitions.

ASME OM Code (2022 Edition) Proposed Rule

- NRC staff is planning the next 10 CFR 50.55a rulemaking that will follow the rulemaking described in SECY-22-0075
- NRC staff has initiated preparation of a proposed rule to incorporate by reference the 2022 Edition of the ASME OM Code into 10 CFR 50.55a.
- NRC staff is evaluating whether any new or modified conditions are needed when the 2022 Edition of the ASME OM Code is incorporated by reference in 10 CFR 50.55a
- Proposed rule planned to be issued in 2023.

Streamlining 10 CFR 50.55a Rulemaking

- NRC staff working group formed in response to Commission direction to implement remaining EMBARK recommendations to streamline 10 CFR 50.55a rulemaking.
- Goal is to develop a process to provide for annual incorporation by reference of unconditionally-approved Code Cases, and biennial incorporation by reference of ASME Code editions and conditionally-approved Code Cases, in 10 CFR 50.55a.
- NRC staff discussed the working group activities during the NRC Standards Forum on September 28, 2022.
- Working group will reach out to stakeholders when more information is available.

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2. Lessons Learned from Power-Operated Valve (POV) Inspections

POV Inspection Program

- On July 26, 2019, NRC issued Inspection Procedure (IP) 71111.21N.02, “Design-Basis Capability of Power-Operated Valves Under 10 CFR 50.55a Requirements”
- Inspection objective is to assess the reliability, functional capability, and design-basis of risk-important power-operated valves (POVs) at nuclear power plants.
- Training provided for inspectors in NRC Region offices.
- POV inspections began in January 2020 and are scheduled to be completed by the end of 2022.

POV Inspection Approach

- POV inspections focus on sample selection, scope, design, testing, and maintenance and corrective actions.
- POV inspections at each site include a sample of 8 to 12 POVs including:
  - Motor-Operated Valves (MOVs)
  - Air-Operated Valves (AOVs)
  - Hydraulic-Operated Valves (HOVs)
  - Solenoid-Operated Valves (SOVs)
  - Pyrotechnic-Operated (Squib) Valves
- Some inspections relied on partial remote means due to COVID-19 limitations.

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POV Region Panels

- Draft findings from each POV inspection are presented to an NRC staff panel consisting of representatives from each NRC Region office and headquarters.
- POV Region Panel discusses each POV inspection finding in comparison to findings from previous POV inspections.
- Review by POV Region Panel provides confidence in the consistency of NRC staff technical positions during POV inspections across the NRC Regions.

POV Inspection Results

- POV inspections have identified several Green Non-Cited Violations (NCVs) and numerous minor and licensee identified violations.
- At a virtual public meeting on December 8, 2020, NRC staff discussed lessons learned from the POV inspections up to that time.
- 14 categories of lessons learned from POV inspections are presented in NRC Information Notice (IN) 2021-01 (May 6, 2021), “Lessons Learned from U.S. Nuclear Regulatory Commission Inspections of Design-Basis Capability of Power-Operated Valves at Nuclear Power Plants.”

IN 2021-01 POV Inspection Lessons Learned

1. Ensure IST Programs are fully consistent with ASME OM Code, such as addressing all POV safety functions, and maintaining POV risk rankings up to date.
2. Address ASME OM Code, Appendix III, requirement for mix of static and dynamic testing.
3. Follow NRC-accepted commitment change process (e.g., Joint Owners Group (JOG) MOV Periodic Verification Program does not include test interval grace periods).
4. Properly determine POV operating requirements and actuator capability, including parameters used in calculations such as friction values, temperature, pressure, and flow.

IN 2021-01 POV Inspection Lessons Learned

5. JOG Program determined potential for degradation of valve friction coefficients, but did not establish valve friction database.
6. Establish methods to periodically demonstrate design-basis capability of JOG Class D valves.
7. Address conditions for EPRI MOV Performance Prediction Methodology (PPM) applicability, such as maintaining valve in good internal condition. See NUREG-1482 (Revision 3).
8. Properly justify increasing Limitorque actuator thrust ratings. See IN 92-83.

IN 2021-01 POV Inspection Lessons Learned

9. Properly conduct POV testing and adequately evaluate results to demonstrate POV can perform its safety function.
   a) Properly translate test acceptance criteria from design calculations to test procedures
   b) Verify diagnostic equipment installed and operating properly
   c) Evaluate test data for full valve stroke
   d) Verify required parameters are within acceptable range
   e) Determine if test data exceed JOG threshold values
   f) Address potential variation of data from single test
   g) Justify reliance on static diagnostic testing
   h) Periodic evaluation of thermal overload devices
   i) Prepare monitoring reports in accordance with plant procedures

IN 2021-01 POV Inspection Lessons Learned

10. Provide assurance that MOVs set on limit control under static conditions will fully close under dynamic conditions.
11. Provide assurance of qualified life of POVs if extended.
12. Properly implement guidance provided by Boiling Water Reactor Owners Group (BWROG) for assessing susceptibility of separation of stem-disk connection in Anchor/Darling double-disk gate valves (see IN 2017-03).
13. Implement 10 CFR 50.55a(b)(3)(xi) for supplemental valve position indication when conducting testing for ISTC-3700 in ASME OM Code (2012 or later edition).

IN 2021-01 POV Inspection Lessons Learned

14. Justify POV preventive maintenance schedules based on vendor recommendations and plant experience (e.g., MOVs in high temperature areas might need more frequent stem lubrication, and MOVs in non-normal positions might need additional attention, such as limit switch cover facing down might experience grease intrusion).

2021 POV Inspection Lessons Learned

- At a public meeting with the BWROG on December 7, 2021, the NRC staff presented lessons learned from the POV inspections conducted since the preparation of IN 2021-01 up to the fall of 2021.
- The following slides indicate the lessons learned from POV inspections conducted in the 2021 time period as presented at the December 2021 BWROG meeting.

2021 POV Inspection Lessons Learned

- Evaluation of possible consequences of drilling a hole in valve disk when preventing pressure locking
- JOG program schedule does not include grace periods so commitment change process needed
- Monitoring torque limits when operating a valve by its manual handwheel
- Ensuring leak rate requirements met for MOVs with long closing torque switch bypass
- Improper reliance on one-time stall torque limits for actuator margin calculations
- Determination of stem lube degradation factor for ball-screw stem nut

2021 POV Inspection Lessons Learned

- Identification and correction of degraded magnesium MOV motor rotors
- Consideration of gate valve unwedging force
- Modification of JOG program schedule commitments
- 10 CFR 50.59 evaluations for valve pressure locking modifications
- Evaluation of MOVs with design-basis safety functions to throttle flow
- Potential for improper stroke time calculations that rely on computer data
- Updating POV surveillance program following Probabilistic Risk Assessment (PRA) update

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2021 POV Inspection Lessons Learned

- Response to EPRI MOV PPM Type 1 warnings
- Verification that installed POVs match calculation assumptions
- Maintaining EPRI MOV PPM long-term applicability
- Monitoring of industry data for valves that EPRI MOV PPM is best available information
- Verification and Validation of POV software
- Removal of valves from 10 CFR Part 50, Appendix J Program without adequate technical justification

2022 POV Inspection Lessons Learned

- The NRC staff has been collecting lessons learned from the POV inspections conducted since the BWROG public meeting in December 2021.
- The following slides indicate the lessons learned from POV inspections conducted in the 2022 time period following the December 2021 BWROG meeting.

2022 POV Inspection Lessons Learned

- Conduct detailed evaluation (including appropriate inspection) of effects of backseating on valve bonnet and stem to verify structural integrity.
- Consider need to prepare a license amendment to revise technical specifications when making changes to POV parameters (such as main steam isolation valve accumulator pressure).
- Ensure all normal operating loads that act simultaneously with seismic load are addressed where POV must perform its safety-related function during such conditions.

2022 POV Inspection Lessons Learned

- Ensure that calculation methodologies for thrust and stroke time undergo verification and validation with appropriate assumptions and data points.
- Ensure that a cause evaluation is performed if the POV leak rate limit is exceeded during a containment isolation valve test.
- Re-justify the JOG qualifying basis for an MOV following extensive maintenance (such as disassembly) where the JOG Program is implemented to satisfy 10 CFR 50.55a(b)(3)(ii) or Generic Letter 96-05.

2022 POV Inspection Lessons Learned

- When implementing the EPRI MOV PPM for butterfly valves, ensure that the calculated maximum transmitted torque is applied when evaluating the acceptability of the valve weak link and actuator ratings.
- Ensure that the impact of high ambient temperature on MOV motor output is properly evaluated, such as described in Limitorque Technical Update 93-03.
- When applying the EPRI MOV PPM as part of implementing the JOG MOV Program, ensure that the conditions in the JOG MOV Program and EPRI MOV PPM Topical Report as accepted in the applicable NRC safety evaluations are implemented.

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2022 POV Inspection Lessons Learned

- Ensure that adverse impact from throttling operation of MOVs on the actuator motor caused by thermal effects is evaluated.
- When applying the EPRI MOV PPM for globe valve calculations, ensure that the provisions in the EPRI MOV PPM globe valve model are implemented, such as use of outside seat diameter for calculating required operating thrust.
- Ensure that appropriate corrective action in accordance with plant procedures is implemented when (a) POV test results fall outside of the acceptance criteria; (b) POV performance anomalies (such as abnormal AOV diagnostic traces or MOV valve factor degradation) are observed; or (c) a mechanical problem with a POV is identified, such as a manual declutch lever malfunction.

2022 POV Inspection Lessons Learned

- Ensure that the MOV diagnostic test frequency is consistent with the JOG Program commitments specified in plant procedures, such as when the design-basis capability margin is determined to be low, or when the MOV testing can only be performed with the plant in a certain status.
- Ensure that unwedging forces are properly considered in determining the minimum required thrust for opening a POV.
- Ensure that leakage requirements specified in the Final Safety Analysis Report (FSAR) are satisfied for containment isolation valves even if exempt from 10 CFR Part 50, Appendix J, testing requirements because of a water seal.

2022 POV Inspection Lessons Learned

- Ensure that sufficient information and test data are developed to validate assumptions for rate-of-loading effects and load sensitive behavior for plant-specific applications.
- Ensure that valves are properly included and categorized within the scope of the IST program, such as valves with leakage limitations, POVs with remote-operated safety functions, and POVs with manual-operated safety functions.
- Ensure that inspections of POVs verify appropriate external and internal parts for the motor and actuator, with corrective action implemented to determine whether any missing or damaged parts impact operational readiness or qualification of the POV.

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2022 POV Inspection Lessons Learned

- For POV diagnostic testing, ensure:
  - (a) acceptance criteria apply correct assumptions (such as actuator thrust limits);
  - (b) proper evaluations of test data are conducted; and
  - (c) records of evaluations are maintained per plant procedures.
- Ensure appropriate values are input into software when conducting diagnostic testing for determination of accurate thrust and torque values (such as proper stem material properties).

2022 POV Inspection Lessons Learned

- Ensure that environmental effects are addressed for POVs, including squib valves, that must remain functional for long periods of time following a loss of coolant accident, or other adverse conditions.
- Ensure procedures at applicable plants include instructions and acceptance criteria to verify valve supplemental position indication (SPI) meets 10 CFR 50.55a(b)(3)(xi), including specifying actions to meet SPI requirements such as leakage testing, flow measurement, or diagnostic trace analysis.

POV Inspection Summary

- Implementation of IP 71111.21N.02 for POV inspections has been successful in meeting the inspection objectives and maintaining consistency across NRC Region offices.
- POV inspections identified many lessons learned that licensees should address in providing reasonable assurance of the design-basis capability of POVs to perform their safety functions.
- NRC staff plans to complete the POV inspection program using IP 71111.21N.02 by the end of 2022.
- NRC staff will prepare a summary of all POV inspection lessons learned in 2023.

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3. EPRI 10 CFR Part 21 Letter dated August 17, 2022

EPRI Part 21 Letter dated August 17, 2022

- EPRI Transfer of Information notification under 10 CFR 21.21(b) of a deviation in a basic component supplied by EPRI.
- EPRI states that it has insufficient information as to the basic component's actual use to determine if the condition represents a defect reportable under 10 CFR Part 21.
- Recipients should evaluate the condition pursuant to 10 CFR 21.21(a) to determine if it could represent a substantial safety hazard, were it to remain uncorrected.

EPRI Part 21 Letter dated August 17, 2022

- EPRI Report 3002008055 (2021), “Evaluation Guide for Valve Thrust and Torque Requirements,” provides a method for assessing flow rate effects on gate valve stem thrust predictions.
- Simplified methods are provided to calculate required thrust under low flow conditions.
- EPRI has determined that the equations providing a limiting value for mass flow rate for steam are incorrect for both US and SI (metric) units.
- The erroneous mass flow limit for steam applications might allow some gate valves to be evaluated by the simplified method when a more detailed evaluation is needed.

EPRI Part 21 Letter dated August 17, 2022

- EPRI indicated that it removed EPRI Report 3002008055 (2021) from its website.
- EPRI stated that it is preparing a correction to EPRI Report 3002008055.
- Nuclear industry personnel should review the EPRI letter for any appropriate action regarding gate valve thrust calculations.

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4. Check Valve Mechanical Agitation Process

Background

- On March 15, 2022 (ML22074A315), Tennessee Valley Authority (TVA) submitted Alternative Request RV-02 for use of a Mechanical Agitation Process for Pressure Isolation Valves (PIVs) at Sequoyah Nuclear Plant, Units 1 and 2 (SQN) under 10 CFR 50.55a(z)(2).
- In response to NRC staff questions, TVA submitted a supplement on June 28, 2022 (ML22179A357).
- TVA submitted an editorial correction on October 31, 2022 (ML22304A146).
- TVA stated that the alternative request will not affect the Technical Specifications (TS) or Surveillance Requirements (SR).

Reason for Sequoyah Alternative Request RV-02

- Repair or replacement of a PIV that fails its leak test requires reversal of startup activities, including cool down, depressurization, reduction of reactor coolant system (RCS) water level, and removal of reactor fuel, as applicable.
- TVA provided justification that compliance with the applicable ASME OM Code requirements would result in hardship or unusual difficulty without compensating increase in the level of quality or safety as required by 10 CFR 50.55a(z)(2).

NRC Regulations and ASME OM Code Requirements

- SQN IST Program implements 2004 Edition with 2006 Addenda of ASME OM Code per SQN TS 5.5.6, “Inservice Testing Program,” and 10 CFR 50.55a(f).
- ASME OM Code specifies:
  - ISTC-3630 requires PIV testing to verify seat leakage within acceptable limits, and states “Valve closure before seat leakage testing shall be by using the valve operator with no additional closing force applied.”
  - ISTC-3630(a) requires PIV leakage rate testing to be conducted at least once every 2 years.
  - ISTC-3630(f) in part states “Valves or valve combinations with leakage rates exceeding the values specified by the Owner per ISTC-3630(e) shall be declared inoperable and either repaired or replaced.”

Alternative Request RV-02

- If PIV seat leakage does not meet the acceptance criteria at maximum possible pressure and temperature during startup of the plant, TVA will take the following actions:
  - PIV will be declared inoperable in accordance with the affected TS, and the failed PIV will be entered into the TVA corrective action program.
  - In lieu of implementing an ASME Code repair or replacement, the PIV may be mechanically agitated in accordance with Alternative Request RV-02 and TVA guidance and procedures.

Alternative Request RV-02 (continued)

- After PIV is mechanically agitated, it will be seat leakage tested using the normal test procedures. The incremental mechanical agitation and testing process may be repeated until seat leakage rate acceptance criteria are met, or it is determined that corrective maintenance is required.
  - If the seat leakage test meets the acceptance criteria, then the PIV will be declared operable.
  - If the seat leakage test does not meet the acceptance criteria, then the PIV will be repaired or replaced during the outage of discovery.
- PIVs that have been mechanically agitated, and subsequently passed seat leakage testing, will be repaired or replaced during the next refueling outage.
- PIVs that are repaired or replaced must pass post-maintenance tests (including seat leakage tests) before being declared operable.

NRC Evaluation

- NRC staff conducted a detailed evaluation of the mechanical agitation process proposed in SQN Alternative Request RV-02 for PIVs within the scope of the request.
- NRC staff performed an audit review of the TVA engineering evaluation for the specific valve sizes, mechanical agitators, and methods applicable to the request to provide assurance that the loads will not damage the PIVs.
- NRC staff reviewed the TVA condition monitoring activities for check valves within the scope of the request.
- NRC staff reviewed the past leakage history of the applicable PIVs provided by TVA to support the request.

NRC Evaluation
(continued)

- Preconditioning Assessment: Mechanical agitation of a PIV in accordance with SQN Alternative Request RV-02 will only be used after the PIV has been declared inoperable.
- The licensee will only use mechanical agitation of PIVs as specified in SQN Alternative Request RV-02 as part of plant startup.
- Prior to applying mechanical agitation to a PIV, the licensee will evaluate the as-found test results of the PIV, and will use other measures, such as varying pressure or venting, in an effort to seat the check valve such that the seat leakage acceptance criteria can be met.

NRC Evaluation
(continued)

- For a PIV within the scope of SQN Alternative Request RV-02 that does not meet the seat leakage acceptance criteria, the following action will be taken in accordance with the request:
  - The PIV will be declared inoperable per the applicable TS, and the failed PIV will be entered into the TVA Corrective Action Program.
  - Mechanical agitation of the PIV will be performed using the method detailed in the request (as supplemented) and the TVA engineering evaluation.
  - The PIV will be visibly inspected prior to and after mechanical agitation to confirm no physical external damage to the PIV.

Sequoyah RV-02 Conclusion

- Based on its evaluation, the NRC staff found acceptable the process proposed by TVA in SQN Alternative Request RV-02 (as supplemented) for mechanical agitation of the specified PIVs.
- NRC issued Audit Summary dated September 28, 2022 (ML22263A008) describing the NRC staff audit of the TVA technical evaluation with stress calculations supporting the request.
- NRC issued Safety Evaluation (SE) dated September 29, 2022 (ML22263A375) authorizing SQN Alternative Request RV-02 in accordance with 10 CFR 50.55a(z)(2) for the current OM Code of record interval for the SQN IST Program.
- NRC preparing a revised SE and Audit Summary in response to the TVA editorial correction (ML22304A186 and ML22312A352).

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QUESTIONS?