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Protecting People and the Environment

Nuclear Industry Check Valve Regulatory Activities

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Topics

- 10 CFR 50.55a Rulemakings
- Lessons Learned to Improve Check Valve (CV) Condition Monitoring
- Lessons Learned from Recent Power-Operated Valve (POV) Inspections

10 CFR 50.55a IST Rulemakings

- ASME OM Code Cases (Revision 39 rule) with Regulatory Guide (RG) 1.192
- ASME OM Code, 2020 Edition
- ASME OM Code Cases (Revision 40 rule) with RG 1.192, and Inservice Testing and Inservice Inspection (IST/ISI) Program Code of Record Intervals

ASME OM Code Cases (Rev. 39 rule)

- On March 3, 2022, NRC issued 10 CFR 50.55a ASME Code Case rule (87 FR 11934) to incorporate by reference Revision 4 to RG 1.192 in 10 CFR 50.55a.
- RG 1.192 (Rev. 4) accepts OM Code Cases OMN-6, OMN-7, OMN-8, OMN-13 (Rev. 3), OMN-15 (Rev. 3), OMN-16 (Rev. 2), OMN-17 (Rev. 1), OMN-18, OMN-21, OMN-22, OMN-23, OMN-24, OMN-25, OMN-26, and OMN-27 without conditions.
- RG 1.192 (Rev. 4) accepts the same OM Code Cases with conditions as in RG 1.192 (Rev. 3).

ASME OM Code 2020 Edition Proposed Rule

- On March 26, 2021, NRC issued a proposed rule for public comment to update 10 CFR 50.55a (86 FR 16087) to incorporate by reference 2019 Edition of ASME BPV Code and 2020 Edition of OM Code.
- Proposed changes include:
 - Incorporate by reference Subsection ISTE without conditions
 - Allow extension of ISTC-3700 interval for valve position verification
 - Require submittal of IST Program Plans for pumps, valves, and snubbers
 - Clarify 50.55a(f)(4) and (g)(4) for snubber IST programs
 - Streamlining editorial changes
- NRC staff reviewing public comments.
- Final rule issuance planned for summer 2022.

ASME OM Code Edition 2020 Proposed Rulemaking – Impact on Check Valves

- Incorporate by reference Subsection ISTE in the 2020 ASME OM Code Edition without conditions.
- Add 10 CFR 50.55a(f)(7) to require nuclear power plant applicants and licensees to submit IST Plans and interim IST Plan updates related to pumps and valves, and IST Plans and interim IST Plan updates related to snubber examination and testing.
- Proposed extension of interval for position indication testing required in ISTC-3700 for valves not susceptible to stem-disk separation (similar to ASME OM Code Case OMN-28).

ASME OM Code Case (Rev. 40) and IST/ISI Code of Record Interval Rulemaking Effort

- Proposed 10 CFR 50.55a rule being prepared in response to Commission Paper SECY-21-0029 and Staff Requirements Memorandum SRM-SECY-21-0029.
- Proposed rule will address acceptability of most recent ASME Code Cases by updating applicable RGs.
- Rule will propose extension of Code of Record update interval from 10 years to 20 or 24 years depending on IST/ISI intervals for licensees implementing 2019/2020 or later ASME Code editions or addenda.
- Planned to be issued for public comment in early 2023.

Lessons Learned to Improve Check Valve (CV) Condition Monitoring

- ASME OM Code, Appendix II, Check Valve Condition Monitoring Program
- Surry Operating Experience

ASME OM Code, Appendix II

- ASME OM Code, Appendix II, establishes high-level requirements for implementing and maintaining CV condition monitoring (CM) program.
- Owner shall perform Appendix II analysis of test and maintenance history of CVs or groups of CVs in order to establish a basis for specifying IST, examination, and preventive maintenance activities.
- Analysis (II-3000) shall include:
 - Identify any common failure or maintenance patterns
 - Analyze patterns to determine significance and identify potential failure mechanisms
- Appendix II includes requirements for condition monitoring activities (II-4000), corrective maintenance (II-5000), and documentation (II-6000).

Surry Operating Experience

- Surry Unit 2 Turbine Driven Auxiliary Feedwater Pump (TDAFWP) discharge check valve 2-FW-142 failed a leak test in 1987. CV was lapped and returned to service.
- CV lapped again in 1989 and 1991, and replaced in 1993.
- 1995 Preventive Maintenance (PM) established to periodically open and inspect CV as a result of high turbulent flow conditions.
- In 2005, Surry expert panel convened to develop Condition Monitoring Plan:
 - Industry data was reviewed for specific model CV
 - Expert panel recommended that only a leak test was needed for the CM task

Surry Operating Experience

(continued)

- On November 20, 2019, during AFW crosstie capability test, TDAFWP discharge check valve stuck open:
 - Caused TDAFWP to rotate backwards
 - Partially diverted flow rendered all three AFW pumps unable to provide Final Safety Analysis Report (FSAR) minimum required flow to the steam generators.
- TDAFWP discharge check valve had a high plant risk profile.

Surry Operating Experience

(continued)

- Corrective action found:
 - Circular holes in swing arm assembly of TDAFW discharge CV were no longer round but oblong.
 - Shoulders on disk and mating surfaces of TDAFW discharge CV were worn.
 - Oblong holes allowed disk of TDAFW discharge CV to be lower than normal and hang up on valve internals leaving disk partially open instead of closed.
 - TDAFWP rotating backwards caused damage to pump bearings and turbine.

Check Valve CM Lessons Learned

- ASME OM Code, Appendix II, allows significant flexibility in developing a check valve CM program in lieu of specific ASME OM Code IST requirements.
- Safety significance of check valves should be considered when establishing the CM program.
- Operating experience has revealed that the general requirements in Appendix II need to be carefully addressed when developing a check valve CM program that will be effective in assessing the CV operational readiness. For example, CM programs with only seat leakage testing for high-risk CVs might be re-evaluated to determine if additional monitoring is advisable.

Lessons Learned from Recent POV Inspections

POV Inspection Program

- Inspection Procedure (IP) 71111.21N.02, Design-Basis Capability of Power-Operated Valves [POVs] Under 10 CFR 50.55a Requirements, updated on October 9, 2020.
- Inspection objective is to assess reliability, functional capability, and design basis of risk-important POVs as required by 10 CFR 50.55a and 10 CFR Part 50, Appendix A and Appendix B.
- NRC Regions are implementing the POV Inspection Program with technical assistance from HQ staff.
- NRC Information Notice 2021-01 (May 6, 2021) discusses lessons learned from initial POV inspections.

POV Inspection Status

- POV inspections using IP 71111.21N.02 have been performed at over 60 nuclear power plant units since January 2020.
- Inspections focus on 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
- Many inspections rely on partial remote means due to COVID-19.

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.
- NRC staff discussed more recent POV inspection lessons learned at a public meeting with the Boiling Water Reactor Owners Group (BWROG) on December 1, 2021 (ADAMS Accession No. ML21334A168).

Additional POV Inspection Lessons since IN 2021-01

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

Additional POV Inspection Lessons (continued)

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

Additional POV Inspection Lessons (continued)

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

Conclusion

- ASME OM Code, Appendix II, allows flexibility in developing a condition monitoring program for check valves, but care must be taken to provide reasonable assurance of the operational readiness of check valves to perform their safety functions.
- ASME OM Code committee for check valves should review Appendix II for additional condition monitoring provisions where appropriate.
- NRC staff is continuing its POV Inspection Program and plans to develop a summary of the overall lessons learned when the POV Inspection Program is completed at the end of 2022.

QUESTIONS?

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