U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Motor-Operated Valve Regulatory Activities

Michael F. Farnan

Mechanical Engineering and Inservice Testing Branch
Division of Engineering
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

MOV Users Group
January 2019

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Disclaimer

- This presentation was prepared by staff of the U.S. Nuclear Regulatory Commission (NRC). It may present information that does not currently represent an agreed upon NRC staff position. NRC has neither approved nor disapproved the technical content.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Regulations

- 10 CFR 50.55a(b)(3)(ii) Motor-Operated Valve Testing
  - Licensees shall comply with the provisions for testing motor-operated valves in OM Code ISTC 4.2, 1995 Edition with the 1996 and 1997 Addenda, or ISTC-3500, 1998 Edition through the latest edition and addenda incorporated by reference in paragraph (a)(1)(iv) of this section, and must establish a program to ensure that motor-operated valves continue to be capable of performing their design basis safety functions. Licensees implementing ASME OM Code, Mandatory Appendix III, "Preservice and Inservice Testing of Active Electric Motor Operated Valve Assemblies in Light-Water Reactor Power Plants," of the 2009 Edition, 2011 Addenda, and 2012 Edition shall comply with the following conditions:

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Regulations (cont'd)

A. MOV diagnostic test interval. Licensees shall evaluate the adequacy of the diagnostic test intervals established for MOVs within the scope of ASME OM Code, Appendix III, not later than 5 years or three refueling outages (whichever is longer) from initial implementation of ASME OM Code, Appendix III.

B. MOV testing impact on risk. Licensees shall ensure that the potential increase in core damage frequency and large early release frequency associated with the extension is acceptably small when extending exercise test intervals for high risk MOVs beyond a quarterly frequency. (Regulatory Guide RG-1.174)

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Regulations (cont'd)

C. MOV risk categorization. When applying Appendix III to the ASME OM Code, licensees shall categorize MOVs according to their safety significance using the methodology described in ASME OM Code Case OMN–3, "Requirements for Safety Significance Categorization of Components Using Risk Insights for Inservice Testing of LWR Power Plants," subject to the conditions applicable to OMN–3 which are set forth in Regulatory Guide 1.192, or using an MOV risk ranking methodology accepted by the NRC on a plant-specific or industry-wide basis in accordance with the conditions in the applicable safety NRC evaluation.

D. MOV stroke time. When applying Paragraph III–3600, "MOV Exercising Requirements," of Appendix III to the ASME OM Code, licensees shall verify that the stroke time of MOVs specified in plant technical specifications satisfies the assumptions in the plant's safety analyses.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Current MOV Issues/Activities

- 50.55a Rulemaking
- Regulatory Guide 1.192 Revision 3
- Anchor Darling Double Disk Gate Valve Part 21 Wedge Pin Failure Update
- Regional Inspector Training
- NRC Initiative to Update Reactor Oversight Process (ROP) Engineering Inspections

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

50.55a Rulemaking

- Rulemaking for ASME OM Code 2015 Edition and 2017 Edition completed
- Published in the Federal Register and issued for public comment November 9, 2018
- Public comment period 75 days (last day 1/23/2019)
- NRC staff will address public comments
- Final rule tentatively issued 12 months later

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

50.55a Rulemaking – Items of Interest in Proposed Rulemaking

- Add NRC Inservice Testing (IST) Plan submittal and reporting requirements (replaces ASME requirement)
- Revise 10 CFR 50.55a(f)(4)(i) and (ii) and (g)(4)(i) and (ii) to relax the time schedule for complying with the latest edition and addenda of the ASME OM or BPV Codes for IST and Inservice Inspection (ISI) programs, respectively, from 12 months to 18 months
- Streamline the references to editions of the ASME OM Code in each condition to simplify future 10 CFR 50.55a rulemaking, and to update specific conditions to reflect the latest ASME OM Code editions.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Reg Guide 1.192 Operation and Maintenance Code Case Acceptability, ASME OM Code

- Regulatory Guide (RG) lists OM Code Cases that are acceptable to the NRC for implementation in the Inservice Test (IST) of light-water-cooled nuclear power plants
- RG 1.192 Revision 2 is currently applicable to Code Cases published in the 2009 Edition through the 2012 Edition of the ASME OM Code
- RG1.192 Revision 3 is applicable to Code Cases published in the 2015 Edition and 2017 Edition of the ASME OM Code

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Reg Guide 1.192 Operation and Maintenance Code Case Acceptability, ASME OM Code

- RG1.192 Revision 3 was published for public comment on August 16, 2018 with a 75 day comment period
- NRC staff is currently addressing all comments
- Final approval of these code cases is currently scheduled for the fall of 2019

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Anchor/Darling Update - Background

- Failure of A/D DDGV at Browns Ferry in 2013 revealed that threaded stem-to-wedge connection had not been properly torqued
- Flowserve Part 21 notification February 25, 2013
  - Recommended assessing wedge pin susceptibility to shear and rework the valve if needed
- BWROG developed guidance to address Part 21 to include:
  - Prioritization and Screening Criteria
  - Evaluation Methods
  - Inspection and Diagnostics
  - Repair Methods

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Background (cont.)

- NRC staff evaluated 2013 Part 21 and determined the issue would be monitored with no generic communication
- Additional failures occurred at LaSalle Unit 2 and Columbia
- LaSalle event elevated to NRC special inspection
- Information Notice (June 2017)
- Flowserve updated Part 21 (July 2017)
- BWROG updated guidance to Rev. 4 (August 2017)
- NRC staff considered need for generic communication due to larger population of failures and limited information readily available to the staff

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Progress to Date

- NRC staff held public meetings on guidance and licensee corrective actions
  - Staff requested clarification of guidance (October 2017)
  - NEI provided clarification (November 2017)
- All licensees submitted information (December 2017)
  - Valve population
  - Valve characteristics (susceptible, non susceptible, risk category)
  - Rework status and commitments for future repairs
  - Data Compilation – ADAMS # ML18053A023 & ML18053A904
- NRC staff held public meeting February 15, 2018
  - Staff discussed guidance document, licensee corrective actions, and future plant inspections. Staff has concerns with credit for thread friction and limited effectiveness of diagnostic testing

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Progress to Date (cont.)

- NRC staff held public meeting May 16, 2018
  - Staff discussed draft Temporary Instruction (TI)
  - Industry representatives expressed concerns that the draft TI goes above and beyond the regulatory requirements
- NRC staff explained the TI serves two purposes:
  - Evaluate industry progress on addressing Part 21 issue
  - Allow NRC staff to assess the need for further regulatory action
- Industry representative agreed to send NRC staff data from the repairs made to date. Data was received July 13, 2018

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Staff Assessment of Data

- NRC staff has reviewed the submitted industry data and observed the following:
  - 78 valves reported reworked with 2 valves having sheared pins and 1 valve with pin degraded. Remainder reported no pin damage
  - 22 valves reported stem/wedge joint was found tight and 56 valves reported stem/wedge joint was found loose
  - Collar reported damaged in 5 valves with 2 of 5 having pin sheared
  - 47 valves reworked were size 3 inch (5 total) and 4 inch (42 total). Almost all of the 47 valves had pin margins less than -100%. All 47 valves were found with no pin damage.
  - Valves 6 inch and larger with a valve class greater than 150 tend to have much larger negative pin margins (-300% and greater)
  - 3 valves reported as found diagnostic test anomalies. 1 had a sheared pin while the other 2 valves had loose stem/wedge joint

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Staff Assessment of Data (cont.)

- NRC staff preliminary assessment of the industry data:
  - Appears that valves 4 inch and smaller make up the majority of the valve population and do not present a problem. Additional data is needed to complete the assessment
  - Appears that stem/wedge thread friction does play a part in assisting the pin with resisting the force being applied. Additional data is needed to support developing acceptance criteria for crediting stem/wedge thread friction.
  - Data needed to support - actuator capability (motor size, motor curve stall value, overall actuator ratio, motor speed), stem diameter, stem thread diameter, stem thread half angle, stem/wedge material, stem/wedge pitch and lead, wedge pin size, wedge pin material, stem/wedge/wedge pin yield & ultimate stress values, stem/stemnut coefficient of friction, stem/wedge coefficient of friction, shear factor applied, and tested torque & or thrust values

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Next Steps

- Public meeting held on 10/10/2018 to discuss the feasibility of forming a working group consisting of NRC staff and industry MOV engineers to evaluate the data and establish acceptance criteria for crediting stem/wedge thread friction, material margins based on component attributes (size, service, material strength, etc.)
  - Criteria could be used for addressing the remainder of the valve population. (e.g., rework/repair, monitor, no rework needed)
- Path forward
  - NRC staff concur on final acceptance criteria and updated industry guidance document?
  - NRC update temporary instruction and conduct inspection?

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Anchor/Darling Update - Summary

- Operating Experience identified failures of Anchor/Darling (A/D) Double Disk Gate Valves (DDGVs)
- Significant progress has been made
  - Industry has developed guidance
  - All licensees have submitted information on the affected valves, including commitments for valve repairs
  - Industry provided information on valves repaired through end of spring 2018 refueling outages
  - The NRC staff has drafted an inspection procedure
  - NRC staff and industry MOV engineers are performing more intensive review of the valve repair and test data
  - The NRC staff continues to assess the need for a Generic Communication, but does not plan one at this time

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Regional Inspector Training

- At the request of regional inspectors, Motor-Operated Valve 3 day training seminar was developed
- The 3 day seminar consists of:
  - History
  - Actuator and Valve design
  - Performance, Design Analysis, and Lessons Learned
  - MOV actuator design and typical control circuitry
  - MOV Diagnostics and Test Systems
  - Preservice and Inservice Testing
  - Operating Experience and Inspection Issues
  - Case Studies, NRC inspection procedures, and recommendations

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Regional Inspector Training

- As of October 2018, all four regions have completed the training
- Training for headquarter staff is currently planned for the first quarter of 2019

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Initiative to Update ROP Engineering Inspections

- SECY-18-0113 “Recommendations for Modifying the Reactor Oversight Process Engineering Inspections” issued 11/13/2018
- Initiative is to improve effectiveness and efficiency of engineering inspections
- Primary focus of inspections remains unchanged
- Inspection sample selection has shifted since the 1990s from verifying compliance with the original plant design bases to inspecting licensee performance in maintaining risk significant equipment

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC Initiative to Update ROP Engineering Inspections

- Recommended changes include:
  - Perform inspections on a 4 year cycle instead of current 3 year
  - Inspection consolidation and two new types of inspections to be performed during the 4 year cycle, Comprehensive Engineering Team Inspection (CETI) and the Focused Engineering Inspection (FEI)
  - Focusing inspection towards operating experience, aging management, facility changes, and risk
  - NRC staff is evaluating an industry proposal to allow plants to perform a licensee self-assessment in lieu of one FEI during each 4 year cycle

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

NRC ROP Initiative Summary

- Propose quadrennial inspection cycle, with a CETI or FEI inspection every year at each site. (1 CETI and 3 FEI)
- CETI to incorporate aspects of modifications, 10 CFR 50.59, and design bases assurance inspection with a focus on operating experience, aging management, and changes to the design basis and PRA model
- Development and implementation of new FEIs
- FEIs are intended to verify the licensee's implementation of NRC approved engineering programs (e.g., MOV, AOV, EQ). Topics chosen based on risk, operating experience and potential for engineering challenges.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

FEI – MOV

- FEI for MOVs will evaluate capability
  - Valve/Actuator design and safety function
  - Design basis conditions
  - Uncertainty assumptions applied
  - Diagnostic equipment
  - Weak link evaluations
  - Design basis capability tests
  - Design basis capability basis
- NRC staff is developing training for regional inspectors on implementation of FEI for MOVs

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

QUESTIONS?

Future Questions

Michael.Farnan@nrc.gov
301-415-1486