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UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Power-Operated Valve (POV) Focused Engineering Inspection (FEI)

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POV FEI Objectives

- NRC Initiative to Update Reactor Oversight Process (ROP) Engineering Inspections – Focused Engineering Inspections (FEI) for Power Operated Valves (POV)
- POV FEI Inspection Procedure
  - Sample Selection
  - POV Detailed Review
  - Scope
  - Design
  - Testing
  - Maintenance

NRC Initiative to Update ROP Engineering Inspections

NRC Initiative to Update ROP Engineering Inspections

- 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
- SECY-18-0113 “Recommendations for Modifying the Reactor Oversight Process Engineering Inspections” issued 11/13/2018 (ADAMS Accession # ML18441A567)

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

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.

FEI – POVs

- FEI for POVs 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 has developed training for regional inspectors on implementation of FEI process
- Training to be completed by first quarter of 2020

POV Actuators and Valve Types

- POVs include:
  - motor-operated valves (MOVs)
  - pneumatic-operated valves (AOVs)
  - hydraulic-operated valves (HOVs)
  - solenoid-operated valves (SOVs)
  - pyrotechnic-actuated (Squib) valves
- Valve types include gate, globe, butterfly, ball, and plug valves with variations of these valve types.

POV FEI Procedure

ADAMS Accession No. ML19067A240

POV FEI Procedure

- Sample Selection
- POV Detailed Review
- Scope
- Design
- Testing
- Maintenance

Sample Selection

- As pre-inspection activity, about 30 POVs will be selected based on NRR and SRA input:
  - Multiple systems
  - MOVs, AOVs, HOVs, SOVs, and Squib Valves (as applicable)
  - Risk assessment
  - Historical performance
  - Various sizes, types, and manufacturers
- For the 30 valves selected request licensee to make available:
  - Design-basis capability information including function, safety significance, sizing, margin, and setting assumptions

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POV Data Entry Form

POV Data Entry

Docket | PLANT | Date POV Inspection
Valve ID | POV Type
System Description

Valve Information

Valve Type
Valve Manufacturer
Size (inches)
Safety Function
ASME Class
Risk

Actuator Information

Actuator Model
Actuator Manufacturer
Motor Type
Motor Manufacturer
Motor Size ft-lbs
Control Switch Trip Close
Control Switch Trip Open

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POV Data Entry Form

Design Information					
Required Thrust Close		lbs	LSB Assumed (percent)		%
Required Torque Close		ft-lbs	Bearing COF Assumed (AOV)		
Required Thrust Open		lbs	Min Air Begin Stroke (AOV)		psig
Required Torque Open		ft-lbs	Min Air End Stroke (AOV)		psig
Design D/P Close		psig	Max Air Begin Stroke (AOV)		psig
Design D/P Open		psig	Max Air End Stroke (AOV)		psig
Design Flow Close		gpm	Min Spring Preload Begin		psig
Design Flow Open		gpm	Min Spring Preload End		psig
Valve Factor Assumed Close			Max Spring Preload Begin		psig
Valve Factor Assumed Open			Max Spring Preload End		psig
Stem COF Assumed			Least Available		lbs

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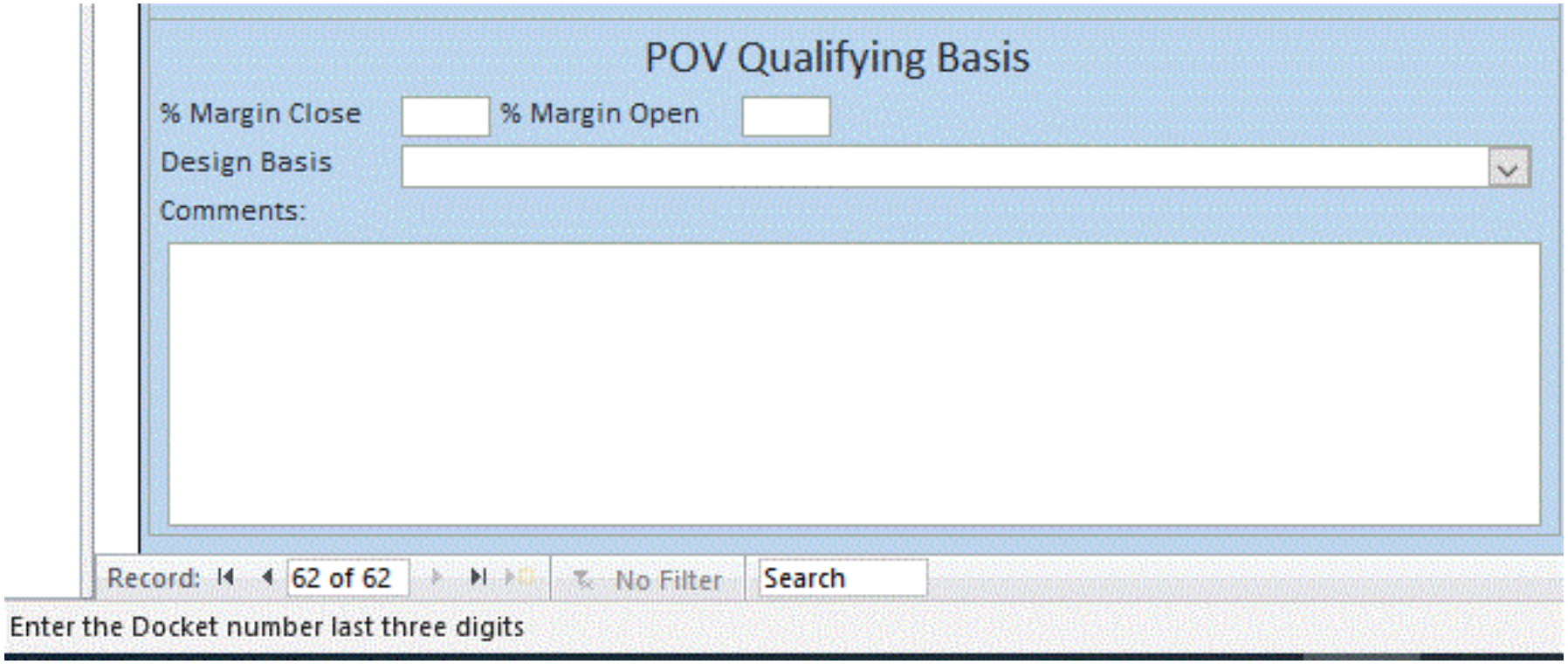
POV Data Entry Form

Test Information

Test D/P Close		psig	Test Thrust Close		lbs
Test Pressure Close		psig	Test Torque Close		ft-lbs
Test Flow Close		gpm	Test Thrust Open		lbs
Test System Temp Close		°F	Test Torque Open		ft-lbs
Test Ambient Temp Close		°F	Valve Factor Measured Close		
Test Motor Voltage Close			Valve Factor Measure Open		
Test D/P Open		psig	Valve Factor Available Close		
Test Pressure Open		psig	Valve Factor Available Open		
Test Flow Open		gpm	Stem COF Measured Close		
Test System Temp Open		°F	Stem COF Measured Open		
Test Ambient Temp Open		°F	LSB Measured		%
Test Motor Voltage Open			Bearing COF Measured Close		
% Uncertainty Applied		%	Bearing COF Measured Open		

POV Data Entry Form



Sample Selection
(cont'd)

- Based on POV design-basis capability information, the selection of a POV sample for detailed inspection review shall consider:
  - System Risk
  - POVs with high incidence of corrective maintenance and/or poor performance
  - POVs with low margin
  - POVs with questionable assumptions (e.g., low VF, low friction values, not all uncertainties captured)
  - POVs in systems with untreated water
  - POVs in high energy systems
  - POVs in elevated environments (e.g., high temperature, high radiation area)

POV Detailed Review

- Approximately 10 POVs will be selected for a detailed review and assessment of operational readiness to perform their design-basis functions.
- Selection will be based on performance assumptions (such as valve factor, stem friction coefficient, rate of loading, degraded voltage, bearing torque coefficient, and uncertainties) and margin assessment.
- Sample size may be expanded based on inspection experience with specific types of POVs and their valves.

Scope

- Sampled POVs will be evaluated to be within scope of licensee's activities consistent with NRC regulations.
  - Sampled POVs are being addressed by applicable regulatory requirements, such as 10 CFR 50.55a (IST), 10 CFR 50.49 (environmental qualification), and Appendix B to 10 CFR Part 50 (quality assurance).
  - Licensee is implementing applicable ASME OM Code as incorporated by reference in 10 CFR 50.55a for IST program for sampled POVs.
  - Licensee is implementing applicable commitments to provide reasonable assurance of POV capability, such as GLs 89-10, 95-07 and 96-05.

Design

- Sampled POVs will be evaluated for capability of performing design-basis functions to meet applicable regulatory requirements and commitments.
  - Evaluation of licensee design bases documentation demonstrating that sampled POVs are capable of performing their design-basis functions and meet applicable codes and commitments, including design documents and calculations for POV functional requirements under normal, abnormal, and accident conditions.
  - Confirm adequacy of POV operating requirements and actuator sizing; methods for selecting, setting, and adjusting POVs, as applicable; and modifications to system or valves that could affect POV capability in as-modified configuration.

Testing

- Evaluate whether testing of sampled POVs satisfies regulatory requirements and commitments for POV design-basis capability, and Preservice Test (PST) and Inservice Test (IST)
  - Confirm adequacy of documents for verification of POV design-basis capability.
  - Ensure that PST and IST procedures satisfy ASME OM Code as incorporated by reference in 10 CFR 50.55a.
  - Confirm adequacy of test equipment and instrumentation, including calibration.
  - Verify training of licensee evaluation and test personnel.
  - Confirm proper test acceptance criteria.
  - Evaluate test results for sampled POVs.
  - If testing is conducted during inspection, review ongoing testing activities for sampled POVs and evaluate test results.

Maintenance

- Evaluate maintenance activities including walkdown of sampled POVs.
  - Review available POV monitoring reports, failure analyses, corrective actions, nonconformance reports, or other plant documents that may indicate that a POV is not properly sized, has improper settings, or is not properly maintained, as applicable.
  - Review POV preventive maintenance to determine whether it is appropriate for frequency of operation, working environment, and operational experience.
  - Determine whether licensee is periodically reviewing information related to POV failures and effectiveness of corrective actions.

Maintenance

(cont'd)

- Review sample of POV maintenance packages and determine whether post-maintenance tests and results demonstrate that POVs are capable of performing their design-basis functions.
- Review adequacy of licensee's processing and control of POV operating experience information and vendor notifications.
- Evaluate implementation of licensee's activities to periodically verify POV design-basis capability.
- Review significant changes made in activities affecting sampled POVs since previous NRC reviews or inspections.

Questions?

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