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Industry Response to Flowserve Part 21 on Anchor Darling Double Disk Gate Valves and NRC Staff Next Steps

Public Meeting

10/10/2018

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Overview

- Operating Experience has 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
- The NRC staff continues to assess the need for a Generic Communication, but does not plan one at this time

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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

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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

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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
  - Public Data Compilations are in ML18053A023 and ML18053A904
- NRC staff held public meeting February 15, 2018
  - Staff discussed guidance document, licensee corrective actions, and future plant inspections. Staff has concerns on credit for thread friction and limited effectiveness of diagnostic testing

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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

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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

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Staff Assessment of Data (cont.)

- NRC staff assessment of the industry repair and test 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

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Next Steps

- Discuss the feasibility of forming a working group consisting of NRC staff and industry MOV experts 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)
- Discuss path forward
  - NRC staff concur on final acceptance criteria and updated industry guidance document?
  - NRC update temporary instruction and conduct inspection?

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Milestones

- Working group formed – Fall 2018
- Plant participation identified – Fall 2018
- Working group kickoff meeting to discuss necessary data and objectives – Fall 2018
- Data collection – Fall 2018?
- Review data and develop criteria – Fall 2018?
- Next steps

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Assumptions

- Actuator capability based on industry standard equations
- Stem/wedge thread shear capability based on ASME B1.1 Unified Inch Screw Threads (Class 2 unless other specified)
- Wedge pin shear capability based on basic equation for pin shear torque (as detailed in BWROG revision 4 guidance document)
- Assume 0.08 stem to stem nut coefficient of friction if data does not exist

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Discussion

Future Questions

Stewart.Bailey@nrc.gov
301-415-1321

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