

September 1, 2017

MEMORANDUM TO: Dennis C. Morey, Chief
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Office of Nuclear Reactor Regulation

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SUBJECT: SUMMARY OF MEETING WITH INDUSTRY TO DISCUSS ANCHOR
DARLING GATE VALVE PART 21 ISSUES

On June 29, 2017, Nuclear Regulatory Commission (NRC) staff held a meeting with representatives from the Nuclear Energy Institute (NEI), Pressurized Water Owners Group (PWROG), the Boiling Water Owners Group (BWROG), and Flowserve Corporation (Flowserve) (Agencywide Documents Access and Management System (ADAMS) Package Accession Number ML17215A282).

NRC met with industry to discuss its response to the Flowserve Part 21 notification and recent operating experience. The purpose of this meeting was to solicit input from industry on recent actions taken with regard to the Flowserve Part 21 notification as a result of the valve failure at LaSalle County Nuclear Generating Station, Unit 2. A list of meeting participants can be found at ADAMS Accession No. ML17215A342.

The main objective of the meeting was to gain a better understanding of the industry response to the two Part 21 reports related to the Anchor/Darling Double Disc Gate Valves (A/D DDGV) issue.

NRC staff provided an overview of recent A/D DDGV operating experience (ADAMS Accession No. ML17215A291). Of particular note was the failure of the LaSalle Unit 2 HPCS valve in February 2017 and an issue at the Columbia station where a similar valve had a freely rotating stem-disc connection in May 2017. Staff noted the issuance of Information Notice (IN) 2017-003, "Anchor/Darling Double Disc Gate Valve Wedge Pin and Stem-Disc Separation Failures," (ADAMS Accession No. ML17153A053) which covered the LaSalle valve failure and six other events that were related to the same failure mechanism. Staff also noted that two Part 21 notifications were issued in 2013, but the focus of these notifications was on torqueing of the stem-disc connection. In light of recent experience associated with the role of the interference fit stem collar design, Flowserve is re-evaluating the need to update the 2013 Part 21 notification.

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NRC staff also provided a brief overview of the LaSalle Special inspection (SI). The following key points were noted:

- The SI began in April and recently concluded.
- The focus of the SI was to understand the cause of the stem disc separation, understand the extent of condition at LaSalle, and identify any potential generic issues.
- NRC headquarters is evaluating generic implications under LIC-504, "Integrated Risk-Informed Decision-Making Process for Emergent Issues."
- LaSalle had 16 valves that were susceptible to the Part 21 issue.
- The SI team concluded that interference fit collar slippage could result in loss of preload torque. The licensee agreed with that evaluation.
- The SI team exited with an apparent violation associated with design control for the HPCS valve; the Region is evaluating enforcement actions.

NEI

During the NEI presentation (ADAMS Accession No. ML17215A290), the following was noted:

- An Industry team has been formed consisting of NEI, Exelon, BWROG, PWROG, The Electric Power Research Institute (EPRI), The Institute of Nuclear Power Operations (INPO), Flowserve, licensee subject matter experts, and consultants.
- NEI is coordinating a valve survey which is in process.
- The survey requests information on valve size, system, function within system, and active safety function (e.g., open/close, modulate, or just close). The survey also requests information on previous corrective actions. NEI noted that they will provide the survey question list to the NRC.
- Industry intends to inform plant Chief Nuclear Officers (CNO's) formally once the results from the data collection are complete to let licensees know if they have critical valves.
- Industry also intends to inform Flowserve so they can manufacture necessary parts.

Industry stated that it is developing prioritization method for A/D DDGV. At a high level, the approach will:

- i. Evaluate if a valve is "susceptible." A susceptible valve is one where a load analysis demonstrates that the actuator is (or has been) capable of shearing the wedge pin.
- ii. If a valve is "susceptible", then the following actions are taken:
 - High or medium risk valves with safety functions to open and close are to be repaired within one refueling cycle (2 years),
 - High or medium risk valves that are not called upon to cycle are to be repaired within two refueling cycles (4 years) if diagnostic testing is done every refueling cycle,
 - Low risk valves are to be repaired within three refueling cycles (6 years), if diagnostic testing is done every refueling cycle.
- iii. Non susceptible valves do not require corrective action but may need to have an updated weak link analysis.

Industry has not finalized guidance for the performance of the "susceptibility" evaluation. Results of this evaluation could be biased by analysis inputs such as thread friction assumptions, credit for stem collar resistance, etc.

Industry is still evaluating appropriate approaches to secure industry-wide commitment to address A/D DDGV issues in a consistent fashion.

Exelon

Exelon's presentation (ADAMS Accession No. ML17215A288), provided an overview of the A/D DDGV timeline, including mention that Exelon first entered the issue onto their corrective action system in March of 2013. The failure analysis for the Unit 2 HPCS valve indicated insufficient load carrying capability of the shrink fit collar combined with multiple high load cycles. This led to wedge pin failure and subsequent wear of wedge and stem thread connection. Exelon offered the following insights from their experience: (1) the need to include consequence of valve failure into repair plans, (2) stem rotation checks should use instruments with sufficient accuracy and support trending, (3) diagnostic trace differences should be thoroughly analyzed, (4) structural assessment should consider highest torque applied (i.e., consider historical loadings vice current set up), (5) weak link analyses should include stem collar, and (6) stem collar should be replaced with integral one piece collar design.

Exelon also provided an informative discussion of the various revisions to the BWROG topical report guidance intended to address the Part 21 issues.

Exelon has taken the following fleet actions in response to the A/D issue:

- Working with BWROG to revise topical report guidance
- Revised Exelon MOV governance procedures to address revised BWROG guidance
- Re-evaluated the Flowserve Part 21 and providing input to Flowserve
- Scheduling repairs of susceptible critical valves
- Expediting delivery of stem and disc replacement parts
- Developing plans for non-critical MOVs

The importance of industry coordination was highlighted since there may be challenges for Flowserve in meeting industry wide part demands.

The BWROG

In its presentation (ADAMS Accession No. ML17215A287), the BWROG covered the timeline for A/D DDGV issues, including the 2013 issuance of the Flowserve Part 21 and the BWROG Valve Technical Review Group (VTRG) development of BWROG-TP-13-006 in April 2013 to provide recommended industry response to Part 21. The BWROG topical report was revised in December 2016 (Revision 1) based on operating experience which indicated that there was not a need for aggressive corrective actions (e.g., inspections of 26 valves indicated that although 24 had loosened stems, none had broken wedge pins). The BWROG topical report provided two options to address the Part 21 notification: (1) analyze loading and show all anticipated loads are acceptable, or (2) repair valve internal within 3 refueling outages or 6 years.

The topical report was revised in May 2017 (Revision 2) to incorporate the LaSalle event. This update included more aggressive corrective actions and provided diagnostic test anomalies found during LaSalle motor-operated valve (MOV) failure. A June 2017 update (Revision 3) made some additional changes to facilitate Flowserve concurrence and revised the stem rotation checks to use three valve strokes to support the measurement. There are plans to further update the guidance in August 2017 to address press fit collar and additional testing recommendations.

BWROG expects to issue Revision 4 to BWROG TP-16-1-112, Revision 4 in August 2017. This update will provide guidance for wedge pin evaluations and will include insights developed from recent operating experience and failure evaluations.

Flowserve

Key discussion points in Flowserve's presentation (ADAMS Accession No. ML17215A289) included the following:

- The A/D DDGV is an on-off valve (no flow modulation)
- The stem-wedge connection is threaded and pinned. The stem collar is either pressed on or integral.
- For valves manufactured in Williamsport, Pennsylvania, the stem collars were pressed on. After Flowserve moved to Raleigh, North Carolina, the collar was integral made from the same stock piece. Operations moved to Raleigh in the 1996 time frame.
- Valve sizes 2" and larger are susceptible.
- In the LaSalle failure, stem threads had no limited pre-load. Pressed on stem collar could not support the stem thrust.
- Flowserve is starting to look at what the allowable loading of the valves should be based on pressed on stem collar.

Flowserve expects to update the 2013 Part 21 notification by July 2017. This update will address recent issues associated with stem collar slippage.

Action Items

- Industry will evaluate appropriate methods for providing NRC access to latest version of BWROG A/D DDGV guidance (Revision 3).
- NEI will complete data analysis and notify CNO's that have high/medium risk valves which require near term corrective action.
- The Industry Executive sponsor will provide NRC with additional information on the process that will be used to formalize industry commitment to corrective actions for A/D DDGV issue.
- NEI will provide NRC with the list of questions that were provided to industry by July 10, 2017.
- Industry Executive Sponsor to evaluate the appropriate methods to provide NRC results of NEI data gathering/collection effort.
- Industry Executive sponsor to provide an update as to when the extent of condition analysis will be completed by July 14, 2017.
- Industry to evaluate if additional guidance is needed for performance of operability evaluations for susceptible valves (e.g., enhancement to next revision of BWROG topical report).
- Industry to evaluate if more transparent linkage needed between risk prioritization and BWROG topical report guidance (e.g., potential enhancement for next revision to BWROG topical report).
- Industry Executive Sponsor to provide a status update on the above action items to NRC by July 14, 2017.

SUBJECT: SUMMARY OF CLOSED MEETING WITH THE PRESSURIZED WATER OWNERS GROUP AND THE BOILING WATER OWNERS GROUP TO DISCUSS ANCHOR DARLING GATE VALVE PART 21 ISSUES
DATED: SEPTEMBER 1, 2017

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ADAMS Accession Nos.: Package: ML17215A282; Summary: ML17215A971; *via email NRC-001

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