

May 25, 2017

MEMORANDUM TO: Kevin Hsueh, Chief  
Licensing Processes Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

FROM: Lynnea Wilkins, Project Manager /RA/  
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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

On May 16, 2017, the Nuclear Regulatory Commission (NRC) staff held a closed meeting with representatives from the 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 ML17131A336). The purpose of this meeting was to discuss Anchor Darling Gate Valve Part 21 issues. A list of meeting participants can be found in Attachment 3.

The following documents were shared with the participants in advance of the meeting to help facilitate the discussion:

- Agenda (Attachment 1)
- Talking points (Attachment 2)
- Licensee Event Report (LER) 50-374/2017-003-00, "High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation" (ADAMS Accession No. ML17102B424).
- LER 50-260/2012-002-00, "High Pressure Coolant Injection System Rendered Inoperable Due to an Inoperable Primary Containment Isolation Valve" (ADAMS Accession No. ML12227A688)
- LER 50-281/2011-001-00, "Auto Reactor Trip on Low Coolant Flow Due to Loop Stop Valve Failure" (ADAMS Accession No. ML11105A032)
- Tennessee Valley Authority (TVA) – Part 21 # 2013-02-00, Anti-Rotation Pin Failure in 10-inch Anchor Darling (Flowserve) double Disc Gate Valve (ADAMS Accession No. ML13008A321)
- Flowserve – Part 21 # 2013-09-00, Wedge Pin Failure in Anchor Darling Motor Operated Double Disc Gate Valve (ADAMS Accession No. ML13064A012).

CONTACT: Lynnea E. Wilkins, NRR/DPR

## 301-415-1377

- TVA – Part 21 # 2013-02-00, Anti-Rotation Pin Failure in 10-inch Anchor Darling (Flowserve) double Disc Gate Valve (ADAMS ML13008A321)
- Flowserve – Part 21 # 2013-09-00, Wedge Pin Failure in Anchor Darling Motor Operated Double Disc Gate Valve (ADAMS ML13064A012).

The main objective of the meeting was to provide the industry with information related to recent observations related to Anchor/Darling Double Disc Gate Valves and gain a better understanding of the industry response to the two Part 21 reports related to the issue. The following points were highlighted:

- The NRC continues to gather information to support developing a path forward. No final decisions have been made with regard to this issue.
- This meeting provided the PWROG/BWROG/Flowserve with an opportunity to describe activities related to the Part 21 reports and related valve issues.
- Although issues found during the LaSalle County Station, Unit 2 (LaSalle) inspection were mentioned, the focus of the discussion was on the generic industry questions related to this issue.

The meeting then focused on addressing the following questions which were included on the agenda:

1. The NRC asked what guidance had been provided to group members/customers in response to the TVA and Flowserve Part 21 notifications and if there are plans to update this guidance.

The BWROG noted that last week it issued Revision 2 to BWROG-TP-13-006, “Recommendations to Resolve Flowserve 10 CFR Part 21 Notification Affecting Anchor Darling double Disc Gate Valve Wedge Pin Failures.” This revision was intended to address lessons learned from the LaSalle valve failure and includes the following updated guidance:

- Enhanced the stem-disc rotation checks to monitor rotational displacement over multiple valve cycles in order to detect “ratcheting” moving of the stem-disc connection.
- Provided an accelerated schedule for repair/replacement of susceptible valves. Specifically, the guidance prioritizes valve monitoring/follow-up activities. The guidance recommends that medium or high risk significant valves be repaired or replaced within 1 operating cycle (2 years from the date of the Rev 2 issuance). This may be extended to 2 operating cycles (4 years) if the susceptible valve is monitored with diagnostic testing (stem rotation checks, valve diagnostic testing) every two years. However, for valves that have a safety function to cycle multiple times during an accident, repair/replacement is recommended to be done in two years.

The BWROG noted that it had not seen a stem disc separation issue until the LaSalle high pressure core spray (HPCS) failure in February 2017 and the enhanced guidance was intended to address this potential issue. Although the accelerated repair/replacement schedule is a BWROG recommendation (rather than a regulatory commitment), the BWROG does track member actions related to recommendations. The BWROG further stated that this updated guidance would be provided to the

PWROG. It was also noted that the Part 21 notifications had been a topic of discussion at Motor Operated Valve User Group meeting since 2014.

The PWROG noted that it had not taken any action or provided a recommended schedule to PWR members for this issue. However, stated that there would be a call on May 16, 2017 to discuss initiating an “emergent issue” to address the valve issues. The PWROG also stated that it had received Revision 2 to BWROG-TP-13-006 and that the revised guidance had been made available to its members.

Flowserve indicated that it was in agreement with actions taken by the BWROG to issue Revision 2 to BWROG-TP-13-006 and felt that the guidance was aligned with the root cause and failure analysis for the LaSalle valve failure. Flowserve has no plans to issue additional guidance or revise the existing Part 21.

2. The NRC asked general questions on testing process in questions 2 and 3 on agenda. The participants discussed the objectives and basic assumptions used to develop the BWROG testing recommendations.

The BWROG noted that the focus of the testing approach was to detect active degradation of the stem-disc connection point rather than verification that the wedge pin was intact.

3. The NRC asked if there are there other diagnostic tests or methods that can be used to demonstrate functionality for valves within the scope of the Part 21 notifications.

The BWROG stated that other testing methods were considered (i.e., UT, radiography, etc.) but these methods were not recommended because they would be unable to show stem engagement or stem wear. It was also noted that stem unthreading might be detectable during valve diagnostic testing. The importance of providing trend data over time and look for ratcheting of the stem-disc connection was also noted.

4. The NRC staff asked if there was other available operating experience associated with follow-up to the Part 21 notifications (e.g., experience with valve inspection).

The following information was provided:

- Approximately 26 valves have been inspected. Although the full population of valves within the scope of the Part 21 notifications was not known, it is believed that only a small portion on the in-service valves have been inspected.
- The BWROG performed a survey of its members in support of the Revision 2 update to BWROG-TP-13-006. This survey identified the following:
  - One utility had disassembled more than 23 valves and found that the stem-disc connection was not torqued to the required preload value, but that no wedge pins or stem threads were damaged.
  - There was anecdotal evidence of four wedge pin failures discussed during the meeting, but the specific failures (plants, dates) were not known.
- It was noted that another utility is inspecting valves within the Part 21 scope during an ongoing outage and have found two valves with anomalous indications. Both of these valves are planned to be disassembled and inspected.

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:

Attachments:

- 1. Agenda for BWROG/PWROG/Flowserve Teleconference
- 2. LaSalle Unit 2 HPCS Injection Valve Failure during the February 2017 Refueling Outage
- 3. Attendee List

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**ADAMS Accession No.: ML17137A387**

**NRC-001**

**\*via email**

<b>OFFICE</b>	PLPB/PM	NRR/DE*	PLPB/BC	PLPB/PM
<b>NAME</b>	LWilkins	KCoynne	KHsueh	LWilkins
<b>DATE</b>	05/24/17	05/24/17	05/24/17	05/25/17

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## **Agenda for BWROG/PWROG/Flowserve Teleconference**

Introductions and Roll Call – NRR/DPR	5 minutes
Purpose and Objective of Call – NRR/DE	5 minutes
<ul style="list-style-type: none"><li>• Provide information on recent observations related to Anchor/Darling Double Disc Gate Valves</li><li>• Gain better understanding of industry actions in response to Part 21</li></ul>	
Review of LaSalle Event/Preliminary Observations – Region III	15 minutes
Industry Perspectives - BWROG/PWROG/Flowserve	30 minutes
<ol style="list-style-type: none"><li>1. What guidance has been provided to group members/customers in response to the TVA and Flowserve Part 21 notifications and are there plans to update this guidance?</li><li>2. Based on your understanding of the progression of valve failure, operating experience, and available data, provide your perspectives on the following:<ol style="list-style-type: none"><li>a. The use of stem rotation checks to demonstrate valve functionality.</li><li>b. The use of motor operated valve diagnostic testing (e.g., stem strain measurement traces) to demonstrate valve functionality</li></ol></li><li>3. Do current methods (and supporting data) for addressing the Part 21 notifications ensure full stem thread engagement for the valves within scope of the Part 21 notifications?</li><li>4. Are there other diagnostic tests or methods that can be used to demonstrate functionality for valves within the scope of the Part 21 notifications?</li><li>5. Is there other available operating experience associated with follow-up to the Part 21 notifications (e.g., experience with valve inspection)?</li></ol>	
Summary – NRR/DPR	5 minutes

## **LaSalle Unit 2 HPCS Injection Valve Failure during the February 2017 Refueling Outage**

On February 11, 2017, the Unit 2 HPCS injection valve stem was found to be separated from the upper wedge/disc assembly during a fill and vent activity<sup>1</sup>. Prior to the failure, the valve had successfully passed a local leak rate test where the valve had cycled successfully several times. Valve disassembly and inspection revealed the wedge pin had sheared and the valve stem threads were damaged. This valve was an Anchor/Darling 12 inch Double Disc Gate Valve (ADDDGV) and was included in those valves associated with the Flowserve and Browns Ferry Part 21 reports submitted in 2013 (ADAMS ML13008A321 and ML13064A012). The licensee was addressing the Part 21 reports by using industry guidance provided by the Boiling Water Reactor Owners Group (BWROG) prior to the failure. Following the identification of the separation, the licensee redesigned and repaired the failed Unit 2 HPCS Injection valve.

### **Preliminary LaSalle Observations Related to ADDDGV Part 21 Notifications**

1. A December 2016 Update to the BWROG Guidance (BWROG-TP-13-006, "Recommendations to Resolve Flowserve 10 CFR Part 21 Notification Affecting Anchor Darling double Disc Gate Valve Wedge Pin Failures,") associated with the Part 21 Reports, documented that another utility disassembled and inspected similar valves associated with the Part 21 Report and identified that 24 of the 26 valves stems and upper wedges were not properly torqued prior to installation. As a result, the stem could be unthreaded from the upper wedge by hand after the wedge pin was removed. None of these inspected valves were noted to have broken or sheared wedge pins.
2. Valves with operating torques greater than the stem-disc assembly pre-installation torques can result in the wedge pins experiencing excessive load and pin failure. Therefore, for valves that may have been inadequately torqued, the NRC questions whether an operability evaluation should consider the load carrying capability of the wedge pin versus the operating torque.
3. The NRC is questioning whether the use of the MOV diagnostic testing (i.e., stem strain trace measurements) and the stem rotation deflection check reliably demonstrate that wedge pins remain intact, that prior over-torquing did not occur, or that stem / wedge thread degradation has not already occurred. Specifically, if the stem has been over torqued into the wedge in the closed direction, the wedge pin may have been sheared, the force may have caused an unknown thread geometry and material condition between the stem and wedge threads without the valve behaving abnormally for a period of time prior to failure.
4. For valves susceptible to wedge pin failure, simple unthreading of the stem and wedge could occur in addition to galling of the threads with unknown thread geometry. As a result, it may be difficult to justify how the shear analysis and friction coefficient of the threads can be used to prove operability.
5. Based on the experience for the failed Unit 2 HPCS valve, the methods described in BWROG-TP-13-006 combined with thread shear analysis, the NRC is questioning if this approach is sufficient to demonstrate operability of valves within the scope of the Part 21 notifications.

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<sup>1</sup> See LER 50-374/2017-003-00, "High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation" (ADAMS ML17102B424).

Figure: As Found Pictures of Failed Unit 2 HPCS Injection Valve Stem to Wedge Connection



## Meeting Attendees

### Nuclear Regulatory Commission (NRC) Participants

Lynnea Wilkins	Kevin Coyne
John Lubinski	Theresa Clark
Jonathan Ortega	Michael Farnan
Terry Jackson	Louise Lund
Greg Bowman	Mirela Gavrilas

### Participated Remotely

#### NRC Participants

Brian Benney	Geoff Ottenberg
Ken O'Brien	Stephen M. Pindale
Mark Jeffers	Nick Hansing
Karla Stoedter	Thomas Herrity
Geoff Ottenberg	Yamir Diaz-Castillo
Chad Stott	Nicholas Hansing
Ryan Lantz	Thomas Scarbrough
John Burke	

#### Pressurized Water Owners Group

Jack Stringfellow

#### Boiling Water Owners Group

Lesa Hill  
Rich Rusin  
Brian Kibler

#### Flowserve Corporation

Wade Shephard  
Matt Hobbs  
Joe Carter  
Mark Cowell  
Floyd Bensinger

#### Energy Northwest

Bill Trappett