Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

January 4, 2013

10 CFR 21

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Unit 1
Facility Operating License No. DPR-33
NRC Docket No. 50-259

Subject: **Anti-Rotation Pin Failure in Anchor Darling (Flowserve) Double Disc Gate Valve**

In accordance with Title 10 of the Code of Federal Regulations (10 CFR) 21, "Reporting of Defects and Noncompliance," the Tennessee Valley Authority is providing the required written notification of a defect in a basic component, i.e., a defect discovered in the High Pressure Coolant Injection system inboard containment isolation valve due to a failure in the anti-rotation pin in an Anchor Darling (Flowserve) double disc gate valve. The enclosure to this letter provides the information required by 10 CFR 21.21(d)(4).

There are no new regulatory commitments contained in this letter. Should you have any questions concerning this submittal, please contact J. E. Emens, Jr., Nuclear Site Licensing Manager, at (256) 729-2636.

Respectfully,

K. J. Polson
Vice President

Enclosure: Notification of 10 CFR 21 Defect, Anti-Rotation Pin Failure in Anchor Darling (Flowserve) Double Disc Gate Valve

cc (w/Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant

IE19
NRR

ENCLOSURE

Browns Ferry Nuclear Plant, Unit 1

Notification of 10 CFR 21 Defect,
Anti-Rotation Pin Failure in Anchor Darling (Flowserve) Double Disc Gate Valve

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(i) Name and address of individual informing the Commission

Mr. K. J. Polson
Tennessee Valley Authority
Vice President, Browns Ferry Nuclear Plant
Post Office Box 2000
Decatur, AL 35609-2000

(ii) Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

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Basic component contains a defect:

The subject valve is an Anchor Darling 10 inch, double disc gate valve. The equipment identification number for the valve is 1-FCV-073-0002. The valve is the High Pressure Coolant Injection (HPCI) system inboard containment isolation valve. The HPCI system is provided to assure that the reactor is adequately cooled to limit fuel cladding temperature in the event of a small break in the nuclear system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The HPCI system permits the nuclear plant to be shut down, while maintaining sufficient reactor vessel water inventory until the reactor vessel is depressurized. The HPCI system continues to operate until the reactor vessel pressure is below the pressure at which Low Pressure Coolant Injection (LPCI) operation or Core Spray system operation maintains core cooling.

The design functions of valve 1-FCV-073-0002 are as follows.

1. To provide a means of supplying steam to the HPCI system steam line.
2. To maintain structural integrity while installed in the HPCI system (i.e., the valve is designed to meet Seismic Class I requirements).
3. To maintain reactor pressure boundary integrity while installed in the HPCI system.
4. To provide primary containment pressure boundary integrity while installed in the HPCI system.
5. To provide a steam path isolation function in the event that HPCI system isolation is required.

(iii) Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.

Flowserve Corporation
Raleigh, NC

Contact: Mr. Mark Cowell, Senior Principal Product Engineer, 919-831-3377

For this particular valve, 1-FCV-073-0002, the manufacturing location was changed in the middle of its assembly. The Flowserve manufacturing plant for double disc gate valves was formerly located in Williamsport, Pennsylvania. In 2004, Flowserve moved their manufacturing plant to Raleigh, North Carolina. All of the valves for Browns Ferry Nuclear Plant (BFN), Units 2 and 3, provided by Flowserve were manufactured in Williamsport, Pennsylvania, between 1997 and 2001. Of the valves provided for the BFN by Flowserve, valve 1-FCV-073-0002 was the only valve for which the manufacturing/assembly was started in the Williamsport, Pennsylvania, plant and finished in Raleigh, North Carolina. The manufacturing/assembly of valve 1-FCV-073-0002 was completed by March 2004.

(iv) Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect of failure to comply.

Nature of the defect:

In the Tennessee Valley Authority (TVA) Corrective Action Program, Problem Evaluation Report 639155 identified that the disc retainer bolt was found sheared when maintenance was performed on valve 1-FCV-073-0002. Further investigation revealed that the anti-rotation pin had failed. A review of work order history identified that the valve was installed during BFN, Unit 1, recovery (Spring 2007) and had not been disassembled since installation. The valve was ordered under BFN, Unit 1, Design Change Notice 51198. The valve was repaired/restored during BFN, Unit 1, Fall 2012 refueling outage.

Valve Design

Valve 1-FCV-073-0002 is a 10 inch, Anchor Darling, double disc gate valve. This valve was installed during BFN, Unit 1, recovery. Valve 1-FCV-073-0002 is installed in a vertical line of pipe with the valve stem mounted in a horizontal orientation. Double disc gate valves are designed to improve the sealing capabilities of the valve utilizing the following features.

1. Four piece double disc wedge assembly to impart sufficient thrust to each disc to enhance seating of both the upstream and downstream discs.
2. Discs that rotate during each closing stroke to equalize wear on the seats and discs.

Safety hazard which could be created by such defect:

The cause of the anti-rotation pin failure for valve 1-FCV-073-0002 was determined to be that the stem was not adequately torqued to the upper wedge at the manufacturing plant. This cause was confirmed by internal inspections of the valve that were performed at BFN. Flowserve Corporation is also conducting an investigation of this event.

In this non-conforming condition, valve 1-FCV-073-0002 was able to perform its design function for the operation of the HPCI system and maintain seat leakage to a minimum. The HPCI system was able to provide flow to support shutdown down to a reactor pressure of 150 psig for the BFN, Unit 1, Fall 2012 refueling outage. The as-found 10 CFR 50 Appendix J Local Leak Rate Test (LLRT) performed on 1-FCV-073-0002 showed the upstream (reactor side) disc had a gross failure. However, when the LLRT was performed between valves 1-FCV-073-0002, -0003, and -0081, the downstream (sealing side) disc of 1-FCV-073-0002 was able to perform its isolation function. Due to the installed configuration of valve 1-FCV-073-0002 (i.e., installed in a vertical run of pipe), any loose parts are expected to fall through the pipe and into valve 1-FCV-073-0003. Valve 1-FCV-073-0003 is located in a horizontal pipe line. Therefore, valve 1-FCV-073-0002 remained capable of performing its containment isolation function. There is a potential that the loose parts from the sheared disc retainer bolt and the failed anti-rotation pin of valve 1-FCV-073-0002 could fall through the piping and stick in the seat area of downstream valve 1-FCV-073-0003 preventing this valve from closing. However, with the steam flow that exists through 1-FCV-073-0003 when the HPCI system is operated, there is reasonable assurance that the loose parts would be transported to the drain pot upstream of valve 1-FCV-073-0016. In addition, during the BFN, Unit 1, Fall 2012 refueling outage, the as-found LLRT was successfully performed on valve 1-FCV-073-0003 and no loose parts were found in this valve. Therefore, valve 1-FCV-073-0003 remained capable of performing its containment isolation function.

HPCI System Injection Function

The HPCI system design basis is to provide adequate core cooling for all break sizes which do not result in rapid depressurization of the reactor vessel and to function independent of off-site power sources and diesel generators. The HPCI system provides adequate reactor core cooling to depressurize the reactor primary system such that the LPCI and Core Spray systems can be initiated. During normal plant operation, the HPCI system is not required to operate. However, the HPCI system is required to be in standby condition whenever there is fuel in the reactor and the reactor pressure is greater than 150 psig.

The HPCI system is safety related and consists of a steam driven turbine used to operate two pumps in series in the event of a break that creates a LOCA with the reactor still pressurized above 150 psig. A series of valves and piping provide a path for steam to travel from the "B" main steam line to the HPCI turbine. This series of valves includes valves 1-FCV-073-0002, 1-FCV-073-0003, and 1-FCV-073-0016. Another series of valves and piping transfer water from the suction source through the HPCI pumps to the reactor via injection into the "A" feedwater line. The design functions of valves 1-FCV-073-0002 and 1-FCV-073-0003 are to provide a means of supplying steam to the HPCI turbine while maintaining primary containment pressure boundary integrity, including the function of isolating the steam supply line when necessary. Valves 1-FCV-073-0002 and 1-FCV-073-0003 are maintained in the normally open position during routine plant operations but close on HPCI system isolation signals.

Valves 1-FCV-073-0002 and 1-FCV-073-0003 remained opened prior to discovery of the failure. As a result, HPCI system operability was maintained and this failure did not result is a loss of the HPCI system injection function.

HPCI System Primary Containment Isolation Function

As previously stated, valves 1-FCV-073-0002 and 1-FCV-073-0003 are maintained in the normally open position during routine plant operations but close on HPCI system isolation signals. The HPCI system isolation signals are in response to conditions indicative of a HPCI system pipe break.

Valves 1-FCV-073-0002 and 1-FCV-073-0003 are HPCI steam supply line primary containment isolation valves (PCIVs). Valves 1-FCV-073-0002 and 1-FCV-073-0003 are the PCIVs for penetration X-11 as identified in Updated Final Safety Analysis Report Table 5.2-2, "Principle Primary Containment Penetrations and Associated Isolation Valves." The function of the PCIVs associated with the HPCI system is to limit fission product release and to prevent or minimize core damage during and following a postulated HPCI steam line break.

In the event of a postulated failure of valve 1-FCV-073-0003 to perform its containment isolation function (due to the loose parts generated as a result of this defect) and a postulated single failure of the redundant PCIV in the penetration, i.e., valve 1-FCV-073-0002, the primary containment isolation function for the HPCI system steam line would have been lost. Therefore, this condition can result in a loss of safety function necessary to mitigate the consequences of an accident and is considered to be a substantial safety hazard.

(v) The date on which the information of such defect or failure to comply was obtained.

December 29, 2012

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, being supplied for, or may be supplied for, manufactured, or being manufactured for one or more facilities or activities subject to the regulations in this part.

The TVA is not the basic component supplier. Therefore, TVA does not have a listing of where these valves are in use.

The following BFN valves potentially share the same vulnerability as valve 1-FCV-073-0002.

- 2/3-FCV-073-0002, HPCI Steam Line Inboard Isolation Valves
- 1/2/3-FCV-073-0003, HPCI Steam Line Outboard Isolation Valves
- 2/3-FCV-073-0016, HPCI Steam Admission Valves
- 1-FCV-075-0009, Core Spray Loop I Minimum Flow Isolation Valve
- 1-FCV-075-0037, Core Spray Loop II Minimum Flow Isolation Valve
- 1/2/3-FCV-069-0001, RWCU Inboard Containment Isolation Valve
- 1/2/3-FCV-069-0002, RWCU Outboard Containment Isolation Valve

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been taken or will be taken to complete the action.

Valve 1-FCV-073-0002 was repaired/restored during the BFN, Unit 1, Fall 2012 refueling outage.

All valves listed in the response to item (vi) above were evaluated. As a result of this evaluation, valve 2-FCV-073-0002 is considered to be non-conforming and will be inspected by TVA personnel during the BFN, Unit 2, Spring 2013 refueling outage.

For the other valves listed in the response to item (vi) above,

1. Documentation exists demonstrating that the stem to upper wedge was torqued to manufacturer requirements, or
2. It can be reasonably concluded that the anti-rotation pin has not been sheared based on MOVATS test data, or
3. The valve was disassembled and inspected and the anti-rotation pin was determined to not be sheared.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensee.

Future procurement requests will require documentation of verification of stem to upper wedge torque during valve manufacture/assembly.