Part 21 (PAR) Event # 48797

Rep Org: FLOWSERVE		**Notification Date / Time:** 03/01/2013 11:12	(EST)
Supplier: ANCHOR DARLING		**Event Date / Time:** 12/29/2012	(EST)
		Last Modification: 07/11/2017	
Region: 1	**Docket #:**		
City: RALEIGH	**Agreement State:**	Yes	
County:	**License #:**		
State: NC			
NRC Notified by: JAMES TUCKER	**Notifications:**	ART BURRITT	R1DO
HQ Ops Officer: BILL HUFFMAN		RANDY MUSSER	R2DO
Emergency Class: NON EMERGENCY		JAMNES CAMERON	R3DO
10 CFR Section:		DON ALLEN	R4DO
21.21(d)(3)(i) DEFECTS AND NONCOMPLIANCE		NRC HQ PART 21 GROUP	EMAIL

PART 21 - WEDGE PIN FAILURE IN ANCHOR DARLING MOTOR OPERATED DOUBLE DISC GATE VALVES WITH THREADED STEM TO UPPER WEDGE CONNECTIONS

The following is a summary of information received from Flowserve via facsimile:

"This is to notify the US Nuclear Regulatory Commission that, in accordance with the provisions of 10CFR Part 21, we have identified a potential issue and are submitting our evaluation of the event.

"Flowserve has been working with the Tennessee Valley Authority's (TVA) Browns Ferry Nuclear Plant to investigate the failure of a Size 10, Class 900 Anchor/Darling motor-operated double-disc gate valve. The failure was due to the shearing of the wedge pin which serves a joint locking function at the threaded interface between the valve stem and upper wedge. The pin is designed to ensure that the joint does not loosen due to vibration and other secondary loads. On some valve designs, the pin also is used to attach the disc retainers to the upper wedge. The pin shearing allowed rotation of the stem during the closing stroke when the valve was seating and ultimately resulted in loss of the stem to upper wedge joint integrity.

"Flowserve has completed an evaluation of the failure and concluded the root cause of the wedge pin failure was excessive load on the pin. The stem operating torque exceeded the torque to tighten the stem into the upper wedge before installation of the wedge pin. The additional stem torque produced a load on the wedge pin creating a stress which exceeded the pin shear strength causing the failure. The recommended assembly stem torque did not envelope the operating torque for the TVA application providing the potential for an over load situation and ultimate failure. The operating torque for the TVA valve was unusually high due to the fast closing time of the actuator and very conservative closing thrust margin.

"This situation can potentially occur on any Anchor/Darling type double-disc gate valve with a threaded stem to

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upper wedge connection, typically size 2.5" and larger, operated by an actuator that applies torque on the stem to produce the required valve operating thrust. An operating stem torque greater than the assembly stem torque can provide the opportunity for excessive pin load and potentially failure.

"We have reviewed our records, and the only similar wedge pin failure that we can identify, in addition to the Browns Ferry problems, is a sheared wedge pin at LaSalle Nuclear Station in 1993. Our investigation of the LaSalle failure concluded that the wedge pin failed due to excessive torque in the opening direction due to bonnet over pressurization.

"Flowserve recommends that all critical Anchor/Darling Double-Disc Gate valves with threaded stem to upper wedge connections and actuators that produce a torque on the stem be evaluated for potential wedge pin failure. Valves with electric motor actuators which produce high output torques are the most susceptible to failure. Valves which were assembled with stem torques that exceed the operating torque are not candidates for failure.

"Below is a list, based on our records, of customers, utilities and nuclear plants which were supplied with Anchor/Darling Double-Disc Gate valves with motor actuators on contracts with ASME Section III and/or 10 CFR 21 imposed.

"Flowserve plans to provide each of the customers identified [below] with a copy of this notification letter."

The following facilities in the United States may be affected:

ANO 1, Browns Ferry, Brunswick, Callaway, Catawba, Clinton, Columbia, Cook, Cooper, Crystal River, Dresden, Diablo Canyon, Duane Arnold, Fitzpatrick, Fort Calhoun, Grand Gulf, Hatch, Indian Point, Kewaunee, LaSalle, Limerick, Maine Yankee, Millstone, Monticello, Nine Mile, North Anna, Oconee, Oyster Creek, Peach Bottom, Perry, Pilgrim, Prairie Island, Quad Cities, River Bend, Robinson, San Onofre, St. Lucie, Surry, Three Mile Island 2, Waterford, VC Summer, Vermont Yankee, Wolf Creek.

See Related Part 21 EN #48650.

* * * UPDATE AT 1537 EDT ON 7/11/17 FROM AMY OATHOUT TO JEFF HERRERA * * *

The following is a summary of a report provided by Flowserve via email:

This is to notify the US Nuclear Regulatory Commission that, in accordance with the provisions of 10 CFR Part 21, Flowserve has gained additional insight and information concerning the referenced previously reported issue basec on a recent incident at the LaSalle County Station, Unit 2 involving a similar valve.

Evaluation of a similar incident at LaSalle added an element not addressed in the previous evaluation regarding the limitation of a pressed-on stem collar to support the actuator thrust and maintain the stem-wedge preload.

Valve evaluations and actions resulting from the previous notification are applicable and still apply. This notification includes additional information for maintaining the stem preload that was not addressed previously. The actuator thrust as well as the torque must be reviewed to insure the preload is maintained.

A list of customers, utilities and nuclear plants which were supplied with Anchor/Darling DD Gate valves with motor actuators on contracts with Section 111 and/or 10CFR21 was provided. This list added a few sites not included on the list provided with the original notification.

For questions or additional information please contact:

Joseph Carter
Manager, Quality Assurance
Flowserve Corporation, FCD
Raleigh, NC
919-831-3220

Notified R1DO(Dimitriadis), R2DO(Bonser), R3DO(Peterson), R4DO(Proulx), Part 21 group (via email).

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Flow Control Division
Anchor/Darling Valves
BW/IP Valves
Edward Valves
Valtek Control Products
Worcester Valves

July 11, 2017

US Nuclear Regulatory Commission
Document Control Desk
11545 Rockville Pike
Rockville MD 20852-2746

Subject: Stem-Wedge Separation of an Anchor/Darling Double Disc Gate Valve at Exelon, LaSalle County Station, Unit 2, February 2017.

Reference: Flowserve, Raleigh 10CFR Part 21 Notification Letter dated February 25, 2013, Wedge Pin Failure of Anchor/Darling DD Gate Valve.

Attachment 1: List of Affected Customers and Plants

Gentlemen:

This is to notify the US Nuclear Regulatory Commission that, in accordance with the provisions of 10CFR Part 21, we have gained additional insight and information concerning the referenced previously reported issue based on a recent incident at the LaSalle County Station, Unit 2 involving a similar valve.

Flowserve has been working with Exelon and nuclear industry groups to investigate and evaluate the stem-wedge separation in a size 12 class 900 Anchor/Darling motor-operated double disc (DD) gate valve. The valve stem was completely separated from the upper wedge, the wedge pin was sheared, the wedge threads stripped away and the pressed-on stem collar was pushed up leaving the valve inoperable. The valve operating thrust and torque is transmitted through the stem-wedge assembly, therefore separation of the stem and wedge will prevent the valve from opening and can adversely affect closing. See Figure 1 for a sketch of the stem-wedge joint.

This incident is related to the wedge pin failure of a similar valve reported to the NRC under 10CFR21 on February 25, 2013. A wedge pin sheared on a 10-900 DD at TVA – Browns Ferry although the stem remained engaged in the wedge and the valve could be opened and closed. The conclusion in the evaluation of that incident was that wedge pin shear could lead to stem-wedge joint degradation and eventual stem-wedge failure similar to this incident at LaSalle.

Evaluation of this event added an element not addressed in the previous evaluation regarding the limitation of a pressed-on stem collar to support the actuator thrust and maintain the stem-wedge preload.

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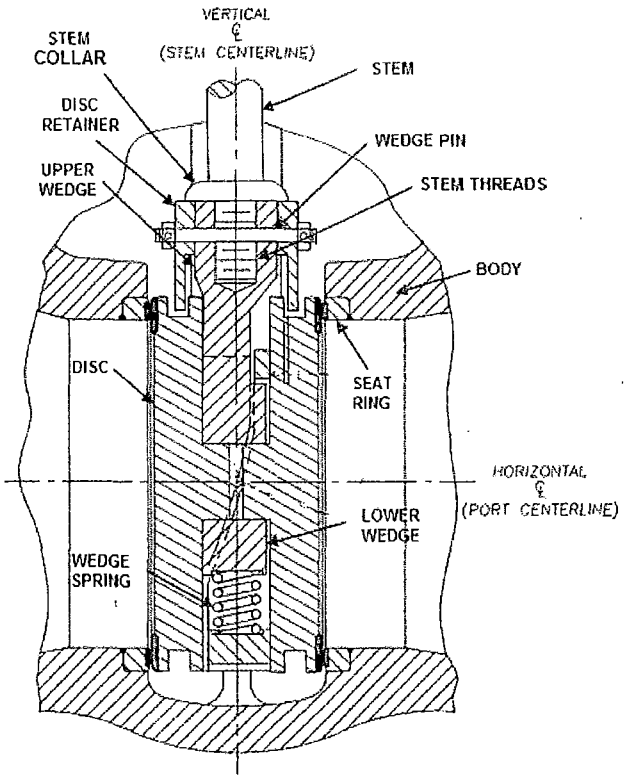
Review of the LaSalle incident concluded repeated valve cycles at high actuator loads eventually wore the wedge threads to the point of failure in shear during a valve closing cycle and subsequent separation of the stem from the wedge. Before thread failure the wedge pin sheared which allowed stem to wedge movement with accompanying wedge thread wear and degradation. In additional the pressed-on collar was pushed up out of position, which would reduce or eliminate any existing preload in the joint. Wedge pin failure is attributed to both limited preload on the stem threaded section and exposure to actuator torques higher than the limit of the pin material. Since stem-wedge preload can be reduced or removed by a stem thrust which exceeds the stem-wedge joint capability, high thrust can be a precursor for wedge pin shear for applications with wedge pins that cannot independently withstand the actuator stem torque. The capability to maintain the preload is much less for stems with pressed-on collars than for stems with integral collars.

The scope remains the same as the previous notification, Anchor/Darling type DD gate valve with a threaded stem to upper wedge connection, typically size 2-1/2 inch and larger, operated by an actuator that applies torque on the stem to produce the required valve operating thrust. Note that most size 2 valves utilize a tee head stem connection, however while addressing the original wedge pin issue a few size 2 valves were discovered that have threaded stem connections.

Figure 1
Typical Double-Disc Gate Valve Trim



Valve evaluations and actions resulting from the previous notification are applicable and still apply. This notification includes additional information for maintaining the stem preload that was not addressed previously. The actuator thrust as well as the torque must be reviewed to insure the preload is maintained.

A loose connection is the result of inadequate stem thread preload whether not applied initially during assembly or not maintained during operation. The initial stem preload can be reduced if the stem closing thrust in service is high enough to cause local yielding of the joint. Stems with integral collars typically have allowable thrusts which do not govern the thrust limit of the valve however a stem with a pressed-on collar, supplied with many of the originally supplied valves, has a thrust limit which is less than the typical maximum allowed thrust values previously determined by weak-link or maximum thrust analyses.

Industry groups, such as BWROG, are determining appropriate corrective actions and priorities based on valve application. Consideration should be given to the following Flowserve recommendations:

- Torque the stem into the wedge to the maximum joint capacity.
- Replacement stems should have integral collars in lieu of press-on.
- Replacement wedge pins are manufactured from high strength material.
- Verify the actuator stem thrust is less than the maximum allowed to maintain the stem preload.

Attachment 1 is a list, based on our records, of customers, utilities and nuclear plants which were supplied with Anchor/Darling DD Gate valves with motor actuators on contracts with Section III and/or 10CFR21 imposed. This list added a few sites not included on the list provided with the original notification.

Flowserve plans to provide each of the customers identified in Attachment 1 with a copy of this notification letter.

Please do not hesitate to contact us if you have questions or require additional information.

Respectfully submitted,

7/11/2017

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7/11/17.

Mark Cowell
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ATTACHMENT 1

ANCHOR/DARLING DOUBLE DISC GATE VALVES WITH THREADED STEMS AND MOTOR ACTUATORS	
AE / UTILITY	NUCLEAR PLANT
B&W	THREE MILE ISLAND 2
BECHTEL	ANO 1, CALLAWAY, MILLSTONE, SSES*, WOLF CREEK
CFE	LAGUNA VERDE
COM ED	DRESDEN, LASALLE, QUAD CITIES
CPL	BRUNSWICK, ROBINSON
DOMINION	SURRY
DUKE	CATAWBA, OCONEE
DUQUESNE LIGHT	BEAVER VALLEY*
EBASCO	MILLSTONE
ENTERGY	GRAND GULF, NINE MILE, WATERFORD
EXELON	PEACH BOTTOM
FPL	CRYSTAL RIVER, ST. LUCIE
GE	BROWNS FERRY, BRUNSWICK, CHINSHAN, CLINTON, COLUMBIA, CONFENTES
GE	COOPER, DUANE ARNOLD, FITZPATRICK, FORT CALHOUN, FUKISHIMA
GE	GRAND GULF, HATCH, KUOSHENG, LAGUNA VERDE, LASALLE, LIMERICK
GE	NINE MILE, PEACH BOTTOM, PERRY, PILGRIM, RIVER BEND, SHIMANE
GPC	HATCH
GPU	OYSTER CREEK
GULF STATES	RIVER BEND
ILL POWER	CLINTON
INDIANA MICH POWER	COOK
MAINE YANKEE	MAINE YANKEE
NEU	MILLSTONE
NIAGARA MOHAWK	NINE MILE
NORTHEAST NUC	MILLSTONE
NPPD	COOPER
NSP	MONTICELLO, PRARIE ISLAND
NYPA	FITZPATRICK
ONT HYDRO	BRUCE
PG&E	DIABLO CANYON
PHILA ELECTRIC	PEACH BOTTOM
PPL	SSES
PROGRESS ENERGY	ROBINSON
SCE	SAN ONOFRE
SCE&G	VC SUMMER

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SNC LAVALIN	BRUCE
TPC	CHINSHAN, KUOSHENG, LUNGMEN
TVA	BROWNS FERRY
VEPCO	NORTH ANNA, SURRY
VERMONT YANKEE	VERMONT YANKEE
WESTINGHOUSE	COOK, DIABLO CANYON, GINNA*, INDIAN POINT, KANSAI ELECTRIC,
WESTINGHOUSE	KORI 1, NORTH ANNA, POINT BEACH, PRAIRIE ISLAND, RINGALS, KEWAUNEE,
WESTINGHOUSE	ROBINSON, SALEM*, SEQUOYAH*, SURRY, TAKAHAMA*, TURKEY POINT*,
WESTINGHOUSE	WISC-MICH POWER*
*Sites added from previous notification	

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