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10 CFR 50.73

RA17-075

August 9, 2017

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

LaSalle County Station, Unit 2
Renewed Facility Operating License No. NPF-18
NRC Docket No. 50-374

Subject: Licensee Event Report 2017-003-01, High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation

In accordance with 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(v)(D), Exelon Generation Company, LLC (EGC) is submitting Licensee Event Report (LER) Number 2017-003-01 for LaSalle County Station, Unit 2.

There are no regulatory commitments in this letter. Should you have any questions concerning this report, please contact Mr. Guy V. Ford, Jr., Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

For H.T. Vinyard

Harold T. Vinyard
Plant Manager
LaSalle County Station

Enclosure: Licensee Event Report

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – LaSalle County Station

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NRC FORM 366 (04-2017) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

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4. TITLE

High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									NA	NA
02	11	2017	2017	- 003	- 01	08	09	2017	FACILITY NAME NA	DOCKET NUMBER NA

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
5	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
000	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☒ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
John Kowalski, Maintenance Director	(815) 415-2500

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	BG	V	A391	Y	NA	NA	NA	NA	NA

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On February 11, 2017, Unit 2 was in Mode 5 for a planned refueling outage. While attempting to fill and vent the Unit 2 High Pressure Core Spray (HPCS) system, no flow was observed from the drywell vent valves or downstream of the HPCS injection valve. The HPCS system was already inoperable to support scheduled surveillances performed on February 8, 2017 in which the HPCS injection isolation valve had been cycled five times satisfactorily. Troubleshooting determined the cause of the valve malfunction was due to stem-disc separation. The valve internal components were replaced prior to restart of the unit from the refueling outage. The root cause of the valve failure was insufficient capacity of the shrink-fit stem collar, combined with multiple high-load cycles, which resulted in loosening and eventual shear failure of the wedge pin and threads.

This component failure is reported in accordance with 10 CFR 50.73(a)(2)(v)(D) as an event or condition that could have prevented fulfillment of the safety function of structures or system that are needed to mitigate the consequences of an accident. This condition could have prevented the HPCS system, a single train safety system, from performing its design function if the valve failure occurred during an actual demand. This component failure is also reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specifications (TS) 3.5.1 "ECCS – Operating," since the HPCS system could have been inoperable for greater than the TS 3.5.1, Required Action B.2, Completion Time of 14 days to restore HPCS system to operable status. There were minimal safety consequences associated with the condition since HPCS was not required to be operable at the time of the failure, and other required emergency safety systems remained operable. There were no actual demands for Unit 2 HPCS, other ECCS systems, or the reactor core isolation cooling (RCIC) system during this period.

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PLANT AND SYSTEM IDENTIFICATION

LaSalle County Station Unit 2 is a General Electric Boiling Water Reactor with 3546 Megawatts Thermal Rated Core Power.

The affected system was the Division 3 High Pressure Core Spray (HPCS) system, one of the stand-by emergency core cooling systems (ECCS) credited for emergency injection into the reactor pressure vessel (RPV). The HPCS system is designed to provide sufficient cooling to the reactor core to prevent excessive fuel cladding temperatures following any break in the nuclear system piping. The affected component was the motor operated HPCS injection isolation valve (2E22-F004). This valve is normally closed and automatically opens following a HPCS injection signal to allow injection to the RPV from the HPCS pump.

CONDITION PRIOR TO EVENT

Unit(s): 2 Date: February 11, 2017 Time: 1200 CST
Reactor Mode(s): 5 Mode(s) Name: Refueling Power Level: 0 percent

DESCRIPTION

During the Unit 2 refueling outage, with the reactor in Mode 5, the Unit 2 HPCS system was declared inoperable on February 8, 2017 to support performance of the HPCS high pressure water leak rate test and stem lubrication and rotation check of the HPCS injection isolation valve 2E22-F004. On February 11, 2017, while attempting to fill and vent the HPCS system, problems arose when finishing the drywell portion of the fill. Full flow water was observed from the high point vents (valves 2E22-F349 / 2E22-F350) with the water leg pump and cycled condensate systems lined up for fill. With the HPCS injection isolation valve 2E22-F004 opened from the main control room, and the HPCS check valve 2E22-F005 pinned open, no air or water was observed through the vents in the drywell. The check valve 2E22-F005 was cycled to verify proper operation, and the HPCS injection isolation valve 2E22-F004 was also cycled to verify the valve was open. However, again no air or water was observed from the drywell vents. Additional trouble shooting was performed that determined there was no flow downstream with the valve open.

Prior to this fill and vent sequence, the HPCS system had been taken out of service for leak rate testing and then drained for relief valve work. The leak rate tests (which involved cycling the 2E22-F004 valve open and closed) all passed satisfactory. Upon completion of those tests, the system was drained from the drywell down to the pump suction. System parameters observed during the leak rate tests provided firm evidence that the HPCS injection isolation valve satisfactorily cycled as designed.

Therefore, it was concluded that the HPCS injection isolation valve 2E22-F004 failure occurred sometime after the successful leak rate tests, and most likely during the fill and vent sequence. The Unit 2 HPCS injection valve had been successfully cycled open and closed five times during previous surveillances required by Technical Specifications (TS) during the refueling outage.

CAUSE

Upon investigation, troubleshooting determined the cause of the valve malfunction was due to stem-disc separation. The valve stem threads and wedge pin were found to be damaged, causing separation from the valve disc. There have been industry issues documented in a Flowserve 10 CFR Part 21 Notification concerning the quality of the wedge pin connections of Anchor Darling double disc gate valves. Topical Report BWROG-TP-13-006 documents instances where this type of valve has stem to upper wedge threaded connection failures caused by the valve stems not being properly torqued into the upper wedge. This operating experience suggests that vendor quality was a causal factor for the component failure.

Valve disassembly and inspection revealed the wedge pin to be sheared, and the valve stem threads damaged, causing the stem to separate from the valve disc. Anchor Darling double disc gate valves are unique in design as the disc assembly consists of dual floating discs with a two piece wedging mechanism between them. The valve stem is threaded and torqued into the upper wedge. A hole is drilled through the stem for the wedge pin to hold the disc retainers in place. There have been instances documented within BWROG-TP-13-006 that state the cause of stem disc separation was the stem was not properly torqued into the upper wedge. BWROG-TP-13-006 states that there is no non-intrusive test or inspection method to determine if the stems were adequately torqued into the upper wedge prior to pin installation. Flowserve recommends that all critical Anchor Darling double disc gate valves with threaded stem to upper wedge connections and actuators that produce torque be evaluated for

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potential wedge pin failure. At the time of the failure, the station was following vendor and industry guidance for inspection of the valve related to the Flowserve Part 21 Notification.

The root cause of the HPCS injection isolation valve 2E22-F004 stem-to-wedge connection failure was insufficient capacity of the shrink-fit stem collar, combined with multiple high load closing cycles (with both axial thrust and torque components), resulting in loosening and eventual shear failure of the wedge pin and threads. A contributing cause was insufficient preload and insufficient capacity of the stem collar and wedge pin assembly. In particular, the collar axial load capacity was 50 to 60 percent of the normal applied loads, allowing collar slippage along the stem to occur.

REPORTABILITY AND SAFETY ANALYSIS

This component failure is reported in accordance with 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by TS due to the failure to complete TS 3.5.1, "ECCS – Operating," Required Action B.2, to restore HPCS system to operable status within the specified Completion Time of 14 days. This component failure is also reported in accordance with 10 CFR 50.73(a)(2)(v)(D) as an event or condition that could have prevented fulfillment of the safety function of structures or system that are needed to mitigate the consequences of an accident. This condition could have prevented the HPCS system, a single train safety system, from performing its design function.

There were minimal safety consequences associated with the condition since HPCS was not required to be operable at the time of discovery of the condition, and other required emergency safety systems remained operable. The HPCS injection isolation valve 2E22-F004 was cycled open and closed satisfactorily during previous flow surveillances. There were no actual demands for Unit 2 HPCS, other ECCS systems, or the reactor core isolation cooling (RCIC) system during this period.

This condition was determined to not be a safety system functional failure (SSFF) as defined in accordance with NEI 99-02, Regulatory Assessment Performance Indicator Guideline. The failure analysis demonstrated that valve failure occurred during the refueling outage when HPCS was not required to be operable. Therefore, the HPCS system was fully functional for the past operating cycle. During the past operating cycle, the valve was capable of performing its design function, which is four required cycles.

CORRECTIVE ACTIONS

Following discovery of the failure, the Unit 2 HPCS injection isolation valve 2E22-F004 was overhauled using a new stem, and the upper wedge threads were repaired. In addition, a stem lube and rotation check was performed satisfactorily. A review of the diagnostic testing results and pin analysis criteria was performed on all the affected valves in this population. The remaining valves in the population were within the latest vendor's recommendation for rotation criteria.

The internals of the remaining impacted valves will be replaced during upcoming Unit 1 and Unit 2 refueling outages. The Unit 1 HPCS injection isolation valve 1E22-F004 internals were replaced during a maintenance outage performed in late June 2017.

PREVIOUS OCCURRENCES

A review of station Licensee Event Reports for the past three years, related to stem-disc separation issues, identified the following similar instances:

LER 374-2014-001: On August 5, 2014, LaSalle County Station Unit 2 automatically scrammed from 100 percent power on high neutron flux, followed by a Group I containment isolation. Following the Group I isolation, the control room operators noted that the position indication for valve 2B21-F022C, the inboard 2C Main Steam Isolation Valve (MSIV), showed dual indication rather than full closed. Troubleshooting of the 2C MSIV determined that the valve stem disc had separated from the stem, which allowed the main disk to drop into the main steam flow path. The resulting reactor pressure transient added positive reactivity, which caused the high neutron flux scram. Increased steam flow in the other three main steam lines resulted in a nearly simultaneous high main steam line flow Group I containment isolation. The cause of the stem-disc separation on the 2C MSIV was fretting wear attributable to marginal design. The root cause of the event was a legacy decision made in 2008 deferring installation of a

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

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manufacturer upgrade that would have prevented the failure. Corrective actions include installing the upgrade on all MSIVs on both units, and reviewing previous deferral decisions made using the same decision-making process.

LER 374-2017-001: On January 23, 2017, operators initiated a manual scram of the LaSalle County Station Unit 2 reactor as a result of observing a generator run-back due to a generator stator winding cooling (GC) system malfunction. Initial troubleshooting identified the most likely cause was plugging in the 'A' GC heat exchanger, based on inspection of the GC system flow-path components. The GC system was realigned to the 'B' heat exchanger until inspections could be performed in the upcoming refueling outage, and the unit was re-started on January 24, 2017. Further inspections of the GC components were performed while the unit was shut down for a planned refueling outage. These inspections determined the cause of the GC system failure was stem-disc separation in the 'A' GC heat exchanger inlet valve. The valve was repaired during the refueling outage. This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event or condition that resulted in manual or automatic actuation of the Reactor Protection System (RPS). There were no safety consequences associated with the event since there was no loss of safety function, and the RPS functioned as designed.

LER 374-2017-002: On January 30, 2017, during routine surveillance testing of the LaSalle County Station Unit 2 Division 3 Diesel Generator Cooling Water (DGCW) system, the cooling water strainer backwash valve was unable to open due to stem-disc separation. The valve was replaced, and the HPCS system was returned to operable on February 2, 2017. This condition could have prevented the HPCS system, a single train safety system, from performing its design function. There was minimal safety consequences associated with the event since the other emergency safety systems remained operable, and the Division 3 DGCW system remained functional as it retained the ability to provide the required flow through the system. The apparent cause of the stem-disc separation was erosion due to the carbon-steel valve internals in a raw water system environment.

COMPONENT FAILURE DATA

Manufacturer: Anchor Darling (A391)
Device: Gate Valve, 12-inch
Component ID: Model C900