Exelon Generation.

June 24, 2016 10 CFR 50.73

SVP-16-042

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

Quad Cities Nuclear Power Station, Unit 2
Renewed Facility Operating License No. DPR-30
NRC Docket No. 50-265

Subject: Licensee Event Report 265/2016-002-00, "High Pressure Coolant Injection System Declared Inoperable Due to Valve Packing Leak"

Enclosed is Licensee Event Report (LER) 265/2016-002-00, "High Pressure Coolant Injection System Declared Inoperable Due to Valve Packing Leak," for Quad Cities Nuclear Power Station, Unit 2.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,

Scott Darin
Site Vice President
Quad Cities Nuclear Power Station

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

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NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Quad Cities Nuclear Power Station Unit 2	05000265	1 OF 5

4. TITLE
High Pressure Coolant Injection System Declared Inoperable Due to Valve Packing Leak

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
									N/A	N/A
04	25	2016	2016 -	002	- 00	06	24	2016	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 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)
100	☐ 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
Mark Humphrey – Regulatory Assurance	(309) 227-2810

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
E	BJ	V	C684	N					

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

ABSTRACT

On April 25, 2016, at 06:07 hours, the High Pressure Coolant Injection (HPCI) System was isolated to stop a packing leak on the Motor Operated (MO) HPCI Outboard Main Steam Isolation Valve (MO 2-2301-5). The packing leak was causing a two (2) foot steam plume to impinge on the valve limit switch compartment, potentially impacting the motor operator for the MO 2-2301-5 valve. Due to the uncertainty on how the steam impingement would affect the valve limit switch compartment, Operations conservatively isolated the steam leak by closing the HPCI Inboard Main Steam Isolation Valve (MO 2-2301-4). With the steam supply isolated, HPCI was declared inoperable and Technical Specification (TS) 3.5.1 Condition G was entered.

The cause of the packing leak was a non-modern style packing installed in 2007 to repack valve MO 2-2301-5. This packing material was susceptible to premature degradation.

Corrective actions included repacking the valve with modern packing and performance of valve diagnostic testing.

The safety significance of this event was minimal. Given the impact on the HPCI system, this report is submitted for Unit 2 in accordance with the requirements of 10 CFR 50.73 (a)(2)(v)(D), which requires the reporting of any event or condition that could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor, 2957 Megawatts Thermal Rated Core Power

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

EVENT IDENTIFICATION

High Pressure Coolant Injection System Declared Inoperable Due to Valve Packing Leak

A. CONDITION PRIOR TO EVENT

Unit: 2	Event Date: April 25, 2016	Event Time: 06:07 hours
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 100%

B. DESCRIPTION OF EVENT

On April 25, 2016 at 04:50, while performing Reactor Building basement rounds, an Equipment Operator (EO) identified a small puddle of water in Bay 2 of the Unit 2 Torus area with water actively leaking from the overhead area at 2 drops per minute (dpm). An additional, much larger, puddle was discovered in Bay 3 with approximately 15 dpm leaking from the overhead area. A second EO was dispatched to the top of the Unit 2 Torus to inspect for leaks. The EO on top of the Torus reported a two foot steam plume coming from the packing of the MO 2-2301-5, Unit 2 HPCI Outboard Main Steam Isolation Valve. It was noted that the steam was impinging on the MO 2-2301-5 limit switch compartment, but not directly on any other components.

At 06:07, Operations isolated the identified steam leak by closing the MO 2-2301-4, Unit 2 HPCI Inboard Main Steam Isolation Valve. Operations declared Unit 2 HPCI inoperable and unavailable at this time and entered TS 3.5.1 Condition G.

At 12:05, Operations closed the MO 2-2301-5 valve as part of the Clearance Order (CO) boundary. The valve closed as expected and no ground alarms were received.

At 12:39, ENS #51880 was made to the NRC under 10 CFR 50.72(b)(3)(v)(D) to report this event as an event or condition that could have prevented the fulfillment of a safety function.

On April 27, 2016 at 05:44, after repacking the valve with a modern packing set (AP Services 6000/6300J) and diagnostic testing, Unit 2 HPCI was returned to the standby line-up and declared operable; TS LCO 3.5.1 Condition G was exited.

C. CAUSE OF EVENT

Non-modern style packing (Crane 387-I) was used in 2007 to repack the MO 2-2301-5 valve. This packing material was susceptible to premature degradation and hardening. At the time of installation, the long term temperature effects on Crane 387-I packing were not yet discovered.

Crane 387-I (non-modern style) packing has a history of drying out and becoming very hard. This typically happens when Crane 387-I packing is used in high temperature and pressure systems. The materials used in this packing are

NARRATIVE

susceptible to drying out. When the packing dries out, and is no longer flexible, it typically leads to packing leaks.

This is especially true with the Crane 387-I (I indicates that there is Inconel wire impregnated in the rope). This was initially believed to be used as a reinforcement material; however, it was later discovered to be a potential foreign material issue. During valve unpacking, the Inconel wire may break apart and the wire pieces can potentially enter into the system.

D. SAFETY ANALYSIS

System Design

Per the Updated Final Safety Analysis Report (UFSAR) Section 6.3.2.3, the HPCI subsystem is designed to pump water into the reactor vessel under Loss of Coolant Accident (LOCA) conditions which do not result in rapid depressurization of the pressure vessel. The loss of coolant might be due to a loss of reactor feedwater or to a small line break which does not cause immediate depressurization of the reactor vessel. The sizing of the HPCI subsystem is based upon providing adequate core cooling during the time that the pressure in the reactor vessel decreases to a value that the Core Spray subsystem and/or the Low Pressure Coolant Injection (LPCI) subsystem become effective. The HPCI subsystem is designed to pump 5600 gallons per minute into the reactor vessel within a reactor pressure range of about 1120 psig to 150 psig. Initiation of the HPCI subsystem occurs automatically on signals indicating reactor low-low water level or high drywell pressure. HPCI injection into the reactor vessel may be accomplished manually by the operator or without operator action by the HPCI automatic initiation circuitry. HPCI can also operate in a pressure control mode of consuming steam from the reactor vessel without providing full injection into the vessel (down to and including zero injection).

Per UFSAR Section 6.3.3.1.3.2, the LOCA analysis by Westinghouse at 2957 MWt for SVEA-96 Optima2 fuel analyzed the entire break spectrum. This analysis included the various combinations of single failures as described in Table 6.3-7D. The HPCI turbine oil cooler and gland seal condenser are cooled by water from the suppression pool. Since these components are rated at 140°F, continued operation above a suppression pool temperature of 140°F is not permitted. Also, operation of HPCI above 140°F would exceed the current net positive suction head (NPSH) calculations for rated HPCI pump flows. Another limitation on the HPCI system is related to the dependence of the HPCI room cooler on the unit emergency diesel generator (EDG). Therefore, any single failures of the unit EDG need to assume consequential loss of the HPCI system after 10 minutes of operation. As a result of these considerations, the HPCI system is not credited when any of these conditions are exceeded. The results of the analysis show that the HPCI system met its requirements before the 10 minute mission time was exceeded and the suppression pool temperature exceeded 140°F.

Safety Impact

The safety impact of this condition was low. Valve MO 2-2301-5 is normally open and required to remain open during HPCI initiation. Due to the potential impact of the steam plume on the valve's motor operator, Operations conservatively closed the HPCI Inboard Main Steam Isolation Valve (MO 2-2301-4) to stop the packing leak. The valve actuator area did have some condensation from the steam but did not exhibit any 250 VDC grounds or any other abnormalities. The valve closed satisfactorily during placement of the CO and showed no signs of electrical or mechanical degradation. The identified packing leak would not have affected the valve's ability to remain open if HPCI was required for injection into the reactor vessel. The MO 2-2301-5 valve has a normal open position for the HPCI System and must remain open for the HPCI System to perform its intended safety function. Even though the packing had failed within the valve, based on the leakage observed, the valve remained in the normal open position. The HPCI System remained capable of performing its intended design/safety function. The packing leak was

NARRATIVE

considered insignificant compared to the total steam consumption of the HPCI System and would not have hindered the system from fulfilling any required safety function or injection over the required 10 minute mission time.

Per UFSAR Table 6.2-7, valve MO 2-2301-5 is considered a primary containment isolation valve with a normal position of open. Valve MO 2-2301-5 is one of two primary containment isolation valves present in line 2-2305-10"-B, the other is the MO 2-2301-4 valve. As with valve MO 2-2301-5, the normal position for the MO 2-2301-4 valve is open. At the time the leak was identified on valve MO 2-2301-5, the MO 2-2301-4 valve was closed to stop the leak. Since the line could effectively be isolated utilizing one of two primary containment isolation valves, the primary containment integrity could be assured, therefore, the primary containment system remained capable of performing its intended design/safety function.

With MO 2-2301-4 closed, HPCI was declared inoperable and TS 3.5.1 Condition G was entered. Required action G.2 is to, restore HPCI System to OPERABLE status, with a completion time of 14 days. The valve was repacked with a modern packing set, post maintenance tested and the HPCI system declared operable in approximately 48 hours. There were no other issues or problems identified with valve MO 2-2301-5 during the packing replacement. No other repairs were required or performed. The valve closed satisfactorily during placement of the CO and showed no signs of electrical or mechanical degradation. Electrical and Mechanical visual inspections were performed with no issues identified. The Post Maintenance Testing was performed satisfactorily with no identified issues. Since valve MO 2-2301-5 showed no signs of electrical degradation due to the steam impingement, the HPCI System remained capable of performing its intended design/safety function.

Since HPCI is a single train safety system, this notification is being made per NUREG-1022, Revision 3, Section 3.2.7 (Event or Condition that Could Have Prevented Fulfillment of a Safety Function), which states, "There are a limited number of single-train systems that perform safety functions (e.g., the HPCI system in BWRs). For such systems, inoperability of the single train is reportable even though the plant TS may allow such a condition to exist for a limited time."

The engineering analysis that was performed demonstrated this event did not constitute a Safety System Functional Failure (SSFF). (Reference NEI 99-02, Revision 7, Regulatory Assessment Performance Indicator Guideline, Section 2.2, Mitigating Systems Cornerstone, Safety System Functional Failures, Clarifying Notes, Engineering analyses.) As such, this event will not be reported in the NRC Performance Indicator (PI) for SSFF since an engineering analysis was performed which determined that the system was capable of performing its safety function during this event.

Risk Insights

The plant Probabilistic Risk Assessment (PRA) model was reviewed with respect to this event. Since HPCI was unavailable for only 48 hours, the incremental change in risk was minimal.

In conclusion, the overall safety significance and impact on risk of this event were minimal.

E. CORRECTIVE ACTIONS

Immediate:

1. Mechanical Maintenance replaced the packing in the valve with a modern packing set, and Electrical Maintenance performed a post maintenance valve diagnostic thrust test.

Follow-up:

NARRATIVE

2. Component Maintenance Organization will verify modern packing sets are installed in all primary containment isolation valves.

F. PREVIOUS OCCURRENCES

The station events database, LERs, and INPO Consolidated Event System (ICES) were reviewed for similar events at the Quad Cities Nuclear Power Station. This event was attributed to non-modern style packing material that was susceptible to premature degradation. Based on the nature of this failure, the event listed below, although similar in topic, are not considered significant station experience that would have directly contributed to preventing this event.

- INPO ICES #199278 "HPCI Inboard Steam Supply Isolation Valve Packing Leak Causes Reactor Shutdown to Repair" – During a MOV valve timing test on July 24, 2002, at Quad Cities Unit 1, the HPCI Steam Supply Inboard Isolation Valve (1-2301-4) was successfully cycled closed and then open. Following the testing, the Unit 1 Drywell in-leakage increased from approximately 1.5 gpm to approximately 2.2 gpm. During the subsequent troubleshooting for the cause of the increased in-leakage, MOV 1-2301-4 was closed. The Drywell in-leakage then decreased from approximately 2.2 gpm to approximately 0.38 gpm. The as-found valve condition was steam leaking from the stuffing box. The packing gland nuts were not at rated torque and the live-load washers were not in complete compression when the valve packing was disassembled. The apparent cause of this event was the gradual loss of packing gland force. The loss of gland force allowed the packing to decompress and steam to eventually escape.

G. COMPONENT FAILURE DATA

Failed Equipment: High Pressure Coolant Injection Outboard Steam Supply Primary Containment Isolation Valve MO 2-2301-5
Component Manufacturer: Crane Valve Corporation.
Component Model Number: SPL783U-10-900-SR-A-N
Component Part Number: LIMITORQUE, 783 U, 10.0

This event will not be reported to ICES due to not meeting the INPO reporting criteria (14 day unplanned LCO; not 72 hours or less).