



SVP-17-041

May 26, 2017

10 CFR 50.73

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

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Licensee Event Report 254/2017-002-00, "Four Main Steam Isolation Valves (MSIVs) Closure Times Exceeded"

Enclosed is Licensee Event Report (LER) 254/2017-002-00, "Four Main Steam Isolation Valves (MSIVs) Closure Times Exceeded," for Quad Cities Nuclear Power Station, Unit 1.

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(i)(B) which requires the reporting of any operation or condition prohibited by Technical Specifications.

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,

A handwritten signature in black ink, appearing to read "Scott Darin".

Scott Darin
Site Vice President
Quad Cities Nuclear Power Station

Enclosure

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

bcc: NRC Project Manager – NRR (**electronic Ltr & LER**) Kimberly.green@nrc.gov
Illinois Emergency Management Agency - Department of Nuclear Safety (**hard copy Ltr & LER**)
Charlie Mathews, IEMA Resident (**electronic Ltr & LER**)
Senior Reactor Analyst – NRC Region III (**hard copy Ltr & LER**)
Glen T. Kaegi, Director, Licensing and Regulatory Affairs – Cantera (**electronic Ltr & LER**)
Patrick R. Simpson, Manager, Licensing, Dresden & Quad Cities Stations (**electronic Ltr & LER**)
Exelon Document Control Desk Licensing (**Hard Copy Ltr & LER**)
Exelon Document Control Desk Licensing (**Included in LER Completed**)
Spencer T. Moore- MidAmerican Energy Company (**electronic Ltr & LER**) STMoore@midamerican.com
LER Completed (**electronic Ltr & LER**)
Bruce Franzen, RA Manager - Dresden Nuclear Power Station (**electronic Ltr & LER**)
Wally Beck, RA Manager - Quad Cities Nuclear Power Station (**electronic Ltr & LER**)
Tom Petersen, NRC Coordinator - Quad Cities Nuclear Power Station (**electronic Ltr & LER**)
Kara Koett, NSRB Site Coordinator & INPO Site Coordinator - Quad Cities (**electronic Ltr & LER**)
INPO Records Center (**included in LER Completed**)
SVP Letter File (**Q:\SVP\20YY**)
Reg Assurance Clerk (**for record turnover in EDMS**)



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/>)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME Quad Cities Nuclear Power Station Unit 1	2. DOCKET NUMBER 05000254	3. PAGE 1 OF 5
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4. TITLE
Four Main Steam Isolation Valves (MSIVs) Closure Times Exceeded

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
03	27	2017	2017	- 002	- 00	05	26	2017	N/A	N/A

9. OPERATING MODE **11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)**

4	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
100	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(i)
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(ii)
	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> OTHER	Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT Rachel Luebbe – Regulator Assurance	TELEPHONE NUMBER (Include Area Code) (309)-227-2813
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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	SB	HCU	H198	Y					

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE	MONTH N/A	DAY N/A	YEAR N/A
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On March 27, 2017, during refueling outage Q1R24 at 0840 hours, the Unit 1 Main Steam Isolation Valve (MSIV) as-found closure time test results indicated that four MSIVs failed to close within the required Technical Specification (TS) time of less than or equal to five seconds. The safety significance of this event was minimal.

The cause of three of the slow closure timing events was due to a less than optimal replacement frequency for the MSIV actuators, and the cause of the fourth slow closure timing event was due to a less than optimal replacement frequency for the MSIV springs.

Corrective actions included replacing the 1-0203-1B and 1-0203-1D MSIV actuators, replacing the springs on the 1-0203-2C MSIV, readjusting the as-left closure times on all four MSIVs and satisfactory retesting prior to startup. Follow-up corrective actions include replacing the 1-0203-2D MSIV actuator and changing the preventive maintenance frequency and description.

Since the MSIV slow closure times were due to degradation from less than optimal replacement frequencies, it is likely the degradation occurred over time since the last successful refueling outage testing and during power operations when the required TS 3.6.1.3, Primary Containment Isolation Valves was applicable. Therefore, this condition is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B), which requires reporting of any operation or condition that was prohibited by the plant's TS.



**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
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Quad Cities Nuclear Power Station Unit 1	05000254	2017	- 002	- 00

NARRATIVE

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor, 2957 Megawatts Thermal Rated Core Power
Energy Industry Identification System (EIS) codes are identified in the text as [XX].

EVENT IDENTIFICATION

Four Main Steam Isolation Valves (MSIVs) Closure Times Exceed Technical Specifications Limit

A. CONDITION PRIOR TO EVENT

Unit: 1 Event Date: March 27, 2017 Event Time: 0840 hours
Reactor Mode: 4 Mode Name: Cold Shutdown Power Level: 0%

B. DESCRIPTION OF EVENT

On March 27, 2017, while Unit 1 was in Mode 4 for refueling outage Q1R24, Operations was performing surveillance, "MSIV Closure Timing," when four of the eight Unit 1 Main Steam [SB] Isolation Valves [ISV] (MSIVs), 1-0203-1B, 1-0203-1D, 1-0203-2C, and 1-0203-2D failed to close within the required cold shutdown Technical Specification (TS) limit of greater than or equal to three seconds and less than or equal to five seconds. The closure times for those four MSIVs were 5.7, 5.2, 5.1, and 5.6 seconds, respectively. The other four MSIVs all closed within the required TS time.

As part of the event investigation, the actuator vendor provided that an increase in closure timing of the valves is linked to degradation of the actuator [HCU] because it has surpassed its recommended eight year lifespan. The current preventive maintenance (PM) frequency for valve actuator replacement was established based off of the theoretical lifespan of the elastomers. The PM frequencies are currently at 12 years (six refueling outages) for MSIVs 1-0203-1B and 1-0203-1D and 14 years (seven refueling outages) for MSIVs 1-0203-2C and 1-0203-2D. The actuators for MSIVs 1-0203-1B, 1-0203-1D and 1-0203-2D were last replaced in November 2002, while the 1-0203-2C MSIV actuator was last replaced in March 2015. However, when the 1-0203-2C MSIV actuator was replaced in March 2015, the springs were not replaced. The springs had been in-service for nearly 15 years.

Since the MSIV slow closure times were due to age related degradation from less than optimal PM frequencies, it is likely the degradation occurred over time since the last successful refueling outage testing and during power operations when the required TS 3.6.1.3, Primary Containment Isolation Valves, was applicable. Therefore, this condition is being reported in accordance with 10 CFR 50.73(a)(2)(i)(B), which requires reporting of any operation or condition that was prohibited by the plant's Technical Specifications.



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C. CAUSE OF EVENT

The cause of the slow closure timing for MSIVs 1-0203-1B, 1-0203-1D and 1-0203-2D is due to a less than optimal replacement frequency of the MSIV actuator. The basis of this decision was because ten Unit 1 MSIVs have had slow closure times since the valve actuator replacement PM frequency was extended in 2002. The vendor recommended replacement frequency is eight years (every fourth outage) and the Exelon PM Template replacement frequency is eight years as well. The current PM frequency is either every sixth (twelve years) or every seventh (fourteen years) refueling outage.

The cause of the slow closure for the 1-0203-2C MSIV was due to a less than optimal replacement frequency of the MSIV springs. The springs were replaced for the 1-0203-2C MSIV after being in-service for nearly 15 years. The MSIVs are normally open valves, which have their springs in compression for the entire cycle. If a spring is in compression for nearly 15 years continuously, the overall free length and spring rate decrease with age.

D. SAFETY ANALYSIS

System Design

The design of the MSIVs is to prevent reactor coolant [AD] inventory loss and protect plant personnel in the event of steam line breakage outside the isolation valves, and to complete the primary containment [NH] boundary after a Loss of Coolant Accident (LOCA). The MSIVs are 20-inch air/spring operated, balanced "Y"-type globe valves. There are four main steam lines and each steam line has two isolation valves, one inside (inboard MSIV) and one outside (outboard MSIV) of primary containment.

Updated Final Safety Analysis Report (UFSAR) Section 6.2.4.1 provides the valve closure time for the main steam line is based on the main steam line break accident discussed in Section 15.6. Ensuring the MSIV closure time less than or equal to five seconds, sufficient coolant will remain in the reactor vessel to provide adequate core cooling. The valves are designed to close and to be leak-tight during the worst conditions of pressure, temperature, and steam flow following a break in the main steam line outside the containment. The MSIVs are leak tested in accordance with the 10 CFR 50 Appendix J program. UFSAR Section 15.6 provides that a maximum MSIV closure time of 10.5 seconds would limit the total amount of liquid and steam lost from the primary system to prevent the core from being uncovered, and this closure time will ensure the radiological doses are well below the guidelines set forth in 10 CFR 100.

Proper adjustment of the MSIV closure times prevents operation outside of the operational and design limits.

Safety Impact

Technical Specifications and the In-Service Testing program require the MSIVs to close in a three to five second time range. Five seconds is fast enough to prevent a gross release of fission products, and three seconds is slow enough to minimize the severity of the pressure transient resulting from isolating the main steam lines during full power operation. Slow MSIV stroke times would challenge the steam release limits of a steam line break outside of containment should the corresponding inboard valve simultaneously fail to close.

The Unit 1 MSIVs 1-0203-1B, 1-0203-1D, 1-0203-2C, and 1-0203-2D failed to close within the required Technical Specification limit of less than or equal to five seconds. The closure times for those four MSIVs were 5.7, 5.2, 5.1, and 5.6 seconds, respectively, however, the four MSIVs all closed inside the UFSAR limit of less than or equal to 10.5 seconds. Although the required five second Technical Specification limit was not met for these four MSIVs, the MSIVs were capable of performing the required UFSAR safety function during the operating cycle prior to Q1R24.



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Furthermore, since the MSIVs were not required to be operable or available at the time of discovery, this condition did not create any actual plant or safety consequences since the unit was not in an accident or transient condition requiring the use of main steam line isolation valves during this period of time.

Risk Insights

The closure times for the four MSIVs were 5.7, 5.2, 5.1, and 5.6 seconds and recorded as slow, but the MSIVs did fully close. The MSIV success criterion in the Plant Probabilistic Risk Assessment (PRA) model, however, does not depend on closure time. Therefore, a difference of a fraction of a second between actual MSIV closure time and the acceptance criterion for the Technical Specification closure time has no effect on the PRA model. As a result, there is no effect on Core Damage Frequency (CDF) or Large Early Release Frequency (LERF).

In conclusion, the failure of the four MSIVs to close within the required time would not have caused the station to exceed the inventory and dose release limits. Furthermore, the impact on risk of this event is negligible. Therefore, the overall safety significance of this event was minimal.

E. CORRECTIVE ACTIONS

Immediate:

1. The 1-0203-1B and 1-0203-1D MSIV actuators were replaced during the outage, Q1R24 in 2017.
2. The 1-0203-2C MSIV springs were replaced during the outage, Q1R24 in 2017.
3. All four MSIVs were adjusted for proper as-left closure times, and retested satisfactorily.

Follow-up:

1. The 1-0203-2D MSIV actuator will be replaced during the next refuel outage, Q1R25, in 2019.
2. The PM frequency will be changed to eight years for replacing the Unit 1 and Unit 2 MSIV actuators with additional instructions to replace the MSIV springs during the actuator replacement.

F. PREVIOUS OCCURRENCES

The station events database, LERs, and INPO ICES were reviewed for similar events at Quad Cities. Specifically, this event was primarily attributed to a less than optimal replacement frequency of the MSIV actuators and springs. Based on the causes of this event and associated corrective actions, the events listed below, assisted with the resolution of this event.

- Station Issue Report (IR) 1213432, Unit 1 Outboard MSIV 1-0203-2C Failed QCOS 0250-04 (05/09/2011) - The 1-0203-2C outboard MSIV closure time exceeded the acceptance criteria for cold timing, which is less than or equal to five seconds. The stroke time recorded was 5.2 seconds. The cause was dirty contacts within the control circuitry creating an electrical time delay. This is one of the ten slow closure time events on Unit 1 since 2002, which led to the current action to reduce the valve actuator PM frequency. Therefore, IR 1213432 provided useful insights associated with this event.
- Station Issue Report (IR) 333083, Unit 2 Inboard MSIV 2-0203-1C Slow Closure (05/09/2005) - While performing QCOS 0250-04, "MSIV Closure Timing," the 2-0203-1C MSIV closure time was 5.05 seconds, which is outside of the surveillance acceptance criteria of 3-5 seconds. The cause of the slow valve stroke time was determined to be within the human response time for actuating the stopwatch. This previous event is similar in that stopwatches continue to be used to perform the closure time surveillance. However, this past event is not directly applicable



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and is not considered a significant station experience that would have directly contributed to preventing the event of this current LER.

- LER 2013-002-00 Outboard Main Steam Isolation Valves (MSIVs) Stroke Times Exceeded (03/11/2013) – All four Unit 1 outboard MSIVs closed slowly due to actuator seals had degraded due to age and wear. The vendor recommended a replacement frequency of eight years for the actuators. This event was four of the ten slow closure events on Unit 1 since 2002, which led to the current action to reduce the valve actuator PM frequency. Therefore, LER 2013-002-00 provided useful insights associated with this event.

G. COMPONENT FAILURE DATA

The failed component was the air/hydraulic actuator on three of the four MSIVs and springs on the fourth MSIV. These actuators are Model Numbers SA-A104 and SA-A119 manufactured by Rotork Hiller. The MSIVs are manufactured by Crane.

This event has been reported to ICES under record #407880.