



# Exelon Generation

May 9, 2013  
SVP-13-034

10 CFR 50.73

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

Quad Cities Nuclear Power Station, Unit 1  
Renewed Facility Operating License No. DPR-29  
NRC Docket No. 50-254

**Subject: Licensee Event Report 254/2013-002-00, Outboard Main Steam Isolation Valves (MSIVs) Stroke Times Exceeded**

Enclosed is Licensee Event Report (LER) 254/2013-002-00, Outboard Main Steam Isolation Valves (MSIVs) Stroke Times Exceeded, for Quad Cities Nuclear Power Station, Unit 1.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(i)(B), which requires the reporting of any operation or condition which was prohibited by the plant's 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,

Tim Hanley  
Site Vice President  
Quad Cities Nuclear Power Station

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

JE22  
NRR

# LICENSEE EVENT REPORT (LER)

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

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 FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet 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.

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**4. TITLE**  
Outboard Main Steam Isolation Valves (MSIVs) Stroke 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	11	2013	2013	- 002 -	00	05	10	2013	N/A	N/A
									FACILITY NAME	DOCKET NUMBER
									N/A	N/A

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

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME Tom Petersen – Regulatory Assurance	TELEPHONE NUMBER <i>(Include Area Code)</i> (309) 227-2825
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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					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b> <input type="checkbox"/> YES <i>(If yes, complete 15. EXPECTED SUBMISSION DATE)</i> <input checked="" type="checkbox"/> NO	<b>15. EXPECTED SUBMISSION DATE</b>	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 11, 2013, during refueling outage Q1R22 at approximately 0750 hours, the Unit 1 Main Steam Isolation Valve (MSIV) as-found stroke time test results indicated that all four outboard MSIVs failed to close within the required Technical Specification (TS) time of less than or equal to five (5) seconds. The four inboard MSIVs, tested just prior to the outboard MSIVs, all closed within the required TS time of less than or equal to five (5) seconds. The safety significance of this event was minimal.

The cause of the Unit 1 outboard MSIV slow closure timing is the actuator seals had degraded due to age and wear.

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

Since all four outboard MSIVs failure to stroke within the required times was attributed to degraded actuator seals, 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 (PCIVs), 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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**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**

Outboard Main Steam Isolation Valves (MSIVs) Stroke Times Exceed Technical Specifications Limit Due to Degraded Air/Hydraulic Actuators

**A. CONDITION PRIOR TO EVENT**

Unit: 1	Event Date: March 11, 2013	Event Time: 0750 hours
Reactor Mode: 4	Mode Name: Cold Shutdown	Power Level: 0%

**B. DESCRIPTION OF EVENT**

On March 11, 2013, while Unit 1 was in Mode 4 for refueling outage Q1R22, Operations was performing surveillance, "MSIV Closure Timing," when the Unit 1 outboard Main Steam [SB] Isolation Valves [ISV] (MSIVs) 1-0203-2A, 2B, 2C, and 2D failed to close within the required cold shutdown TS limit of less than or equal to five (5) seconds. The closure times for the outboard MSIVs were 5.1, 5.7, 5.8, and 5.9 seconds, respectively. The inboard MSIVs all closed within the required five (5) second TS time.

As part of the event investigation, an additional trend review of the MSIV closure times was performed which indicated an increase in closure timing of the Unit 1 outboard MSIVs. The vendor provided that an increase in closure timing of the valves is linked to actuator [HCU] degradation after the actuator has surpassed its recommended eight (8) year elastomer life span. Station specific performance monitoring data was used to establish a Preventive Maintenance (PM) frequency of 14 years, or every seven (7) refueling outages. The Unit 1 outboard MSIV actuators were last replaced in October 2000. The subsequent investigation indicated the cause of the MSIV slow closure times to be degradation of the Unit 1 outboard MSIV actuators.

The 1-0203-2B MSIV actuator was replaced during the outage (1 out of the 4 MSIV actuators), and will be sent to the vendor for material condition analysis and refurbishment. All four outboard MSIVs were adjusted for proper as-left closure times and retested satisfactorily. The "MSIV Closure Timing" surveillance, and the "Main Steam Line Isolation Valve Closure Time Adjustment" procedure were revised to monitor the speed control valve [SCV] adjustments and to expand the margin between the as-left closure time and the TS closure time.

Since all four outboard MSIVs failure to stroke within the required times was attributed to degraded actuator seals [SEAL], 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 (PCIVs), 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**

Considering the age of the Unit 1 outboard MSIV actuators, input from the vendor, and a review of the MSIV closure time trends, the apparent cause of the Unit 1 outboard MSIV slow closure timing is the actuator seals had degraded due to age and wear. The 1-0203-2B outboard MSIV actuator will be sent to the vendor for material condition analysis and refurbishment.

A contributing cause is the as-left stroke times of the valves during the previous refueling outage, Q1R21. The as-left stroke times in Q1R21 were left in the high end of the acceptance band. If adjustments had been made to place the stroke times in the middle of the acceptance band, the valves likely would have stroked within the TS limits during Q1R22.

Another contributing cause is the trend data used prior to this event did not provide a clear and easy to evaluate presentation to support adequate monitoring and trending of the stroke times. The new trending approach developed to support this investigation indicated the difference (drift) between the previous outage as-left stroke times and the current outage as-found stroke times. This new trending approach eliminated the influence from maintenance activities performed on the valves. The new trend indicated an increasing time difference between the as-left stroke times and the as-found stroke times.

**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) 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. By keeping the MSIV closure time less than or equal to five (5) 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 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 provide the MSIVs are required 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.

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The Unit 1 outboard MSIVs 1-0203-2A, 2B, 2C, and 2D failed to close within the required TS limit of less than or equal to five (5) seconds. The closure times for the outboard MSIVs were 5.1, 5.7, 5.8, and 5.9 seconds, respectively, however, the four outboard MSIVs closed inside the UFSAR limit of less than or equal to 10.5 seconds. The inboard MSIVs all tested satisfactorily and closed within the required five (5) second TS limit and were available to provide isolation if needed. The as-left condition of the outboard MSIVs in the previous refueling outage, Q1R21, indicated the valves all closed in less than or equal to 5 seconds. Although the required five (5) second TS limit was not met for the outboard MSIVs, the inboard and outboard MSIVs were capable of performing the required UFSAR safety function during the operating cycle prior to Q1R22.

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 use of main steam line isolation during this period of time.

**Risk Insights**

The closure times for the outboard MSIVs were 5.1, 5.7, 5.8, and 5.9 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 TS 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 outboard 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 1-0203-2B MSIV actuator was replaced during the outage, Q1R22 in 2013.
2. All four outboard MSIVs were adjusted for proper as-left closure times, and retested satisfactorily.
3. Revised the "MSIV Closure Timing" surveillance, and the "Main Steam Line Isolation Valve Closure Time Adjustment" procedure to monitor the speed control valve adjustments and to expand the margin between the as-left closure time and the TS closure time.

**Follow-up:**

1. The 1-0203-2A, 2C, and 2D MSIV actuators will be replaced during the next refuel outage, Q1R23, in 2015.
2. The PM frequency will be increased to eight (8) years for replacing the Unit 1 MSIV actuators.
3. The trending data will be reviewed for the Unit 2 MSIVs and evaluated for proper PM frequency.
4. Trend reports will be revised for display clarity to ensure adverse trends are more easily recognized.
5. The removed 1-0203-2B MSIV actuator will be sent to the vendor for material condition analysis and refurbishment.

**F. PREVIOUS OCCURRENCES**

The station events database, LERs, and INPO Consolidated Event System ICES (EPIX) were reviewed for similar events at Quad Cities. Specifically, this event was primarily attributed to the outboard MSIV actuator seals had degraded due to age and wear. Based on the causes of this event and associated corrective actions, the events

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listed below, although similar in topic, are not considered significant station experiences that would have directly contributed to preventing 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 (5) seconds. The stroke time recorded was 5.2 seconds. The cause was dirty contacts within the control circuitry creating an electrical time delay. This previous event, although similar to this LER event was caused by an electrical time delay and not actuator failure, hence is not directly applicable and is not considered a significant station experience that would have directly contributed to preventing the event of this current LER.
- Station Issue Report (IR) 333083, Unit 2 Inboard MSIV 2-0203-1C Slow Closure (05-09-2005) - While performing QCOS 0250-04 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, since all four Unit 1 outboard MSIVs had closed slowly in this LER event, and the apparent cause was attributed to actuator failure, this past event is not directly applicable and is not considered a significant station experience that would have directly contributed to preventing the event of this current LER.
- LERs - A review of LERs at Quad Cities Nuclear Power Station over the past 10 years did not identify any events that were associated with failures of MSIV stroke times.

**G. COMPONENT FAILURE DATA**

The failed component was the air/hydraulic actuator on each MSIV. These actuators are Model Numbers SA-A104 and SA-A119 manufactured by Ralph A. Hiller Company.

This event has been reported to ICES.