Exelon Generation Company, LLC
Quad Cities Nuclear Power Station
22710 206th Avenue North
Cordova, IL 61242-9740

www.exeloncorp.com

Exelon Nuclear

July 27, 2007

SVP-07-047

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 30
NRC Docket Nos. 50-254 and 50-265

Subject: Licensee Event Report 265/05-002, Revision 1, "Main Steam Relief Valve Actuator Degradation Due to Failure to Correct Vibration Levels Exceeding Equipment Design Capacities"

Enclosed is Licensee Event Report (LER) 265/05-002, Revision 1, "Main Steam Relief Valve Actuator Degradation Due to Failure to Correct Vibration Levels Exceeding Equipment Design Capacities," for Quad Cities Nuclear Power Station.

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; Part 50.73(a)(2)(i)(A), which requires the reporting of completion of a shutdown required by Technical Specifications; Part 50.73(a)(2)(i)(B), which requires the reporting of any operation or condition prohibited by Technical Specifications; and Part 50.73(a)(2)(vii), which requires the reporting of any event where a single cause or condition caused at least two independent trains or channels to become inoperable in a single system.

This report is revised to include the results of the root cause investigation. There are no regulatory commitments included in this report. Should you have any questions concerning this report, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,

Timothy J. Tulon
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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NRR

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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	2. DOCKET NUMBER	3. PAGE
Quad Cities Nuclear Power Station Unit 2	05000265	1 of 6

4. TITLE: Main Steam Relief Valve Actuator Degradation Due to Failure to Correct Vibration Levels Exceeding Equipment Design Capacities

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									Quad Cities Nuclear Power Station Unit 1	05000254
12	30	2005	05	- 002 -	01	07	27	2007	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE	1
10. POWER LEVEL	024

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

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20.2203(a)(2)(iv)	X	50.73(a)(2)(i)(A)	X	50.73(a)(2)(v)(D)		
	20.2203(a)(2)(v)	X	50.73(a)(2)(i)(B)	X	50.73(a)(2)(vii)		
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Wally Beck, Regulatory Assurance Manager	(309) 227-2800

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	SB	ER	D243	Y					

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

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

Between December 30, 2005, and January 19, 2006, each unit at Quad Cities Nuclear Power Station was shut down twice to inspect and/or repair Main Steam Line (MSL) Electromatic Relief Valve (ERV) actuators. The actuator damage was caused by MSL vibration levels that exceeded the design capabilities of the components during operation at Extended Power Uprate (EPU) power levels. The root cause was failure to correct the source of the MSL vibrations identified soon after original startup of the plant.

The safety significance of this issue was minimal. The eight MSL Safety Valves and the Target Rock Safety/Relief Valve were not affected by this issue, and remained operable throughout these events. Additionally, for the most limiting case two ERVs were available.

Acoustic Side Branches have been installed on the main steam system for both Unit 1 and Unit 2. Subsequent testing has shown that overall MSL vibrations have been reduced to a level to support safe and reliable operation of the MSLs and attached components during future operating cycles at EPU.

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

Main Steam Relief Valve Actuator Degradation Due to Failure to Correct Vibration Levels Exceeding Equipment Design Capacities

A. CONDITION PRIOR TO EVENT

Unit: 1	Event Date: January 6, 2006	Event Time: 1900 hours
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 085%
Unit: 2	Event Date: December 30, 2005	Event Time: 0900 hours
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 024%

B. DESCRIPTION OF EVENT

On December 21, 2005, the 2-0203-3D Main Steam Electromatic Relief Valve (ERV) [RV] [SB] was declared inoperable due to the inability to determine whether or not a 125 VDC negative ground was affecting the valve control circuit. Operations personnel entered Technical Specification Limiting Condition of Operation (LCO) 3.4.3 Condition A and 3.5.1 Condition G for an inoperable safety relief valve, which placed Unit 2 in a 14-day allowed outage time (AOT). Station personnel continued troubleshooting efforts to determine the effect and precise circuit location of the negative ground.

On December 30, 2005, a load drop was initiated to allow personnel to enter the Unit 2 drywell to conduct an inspection of the 3D ERV. The inspection team found internal damage in the 3D ERV solenoid [SOL] actuator, and a unit shutdown was initiated at 0900 hours.

Inspections of the other three Unit 2 ERV solenoid actuators were conducted. Significant wear and some loose parts were identified on the 3B, 3C and 3E ERV actuators. These ERV actuators were electrically stroked from the main control room one time prior to the initial inspections and two more times after the initial inspections, with personnel in attendance to verify operation of the actuators; however indications of an open valve via control room annunciation and sequence of event recorder (SER) computer points were not received for the 3C and 3E valves.

All four ERV solenoid actuators were replaced with rebuilt actuators and Unit 2 was synchronized to the grid on January 1, 2006, and returned to pre-Extended Power Uprate (pre-EPU) power (approximately 2511 MWt) on January 3, 2006.

On December 31, 2006, power was decreased on Unit 1 to pre-EPU power as a conservative measure. On January 6, 2006, based on the results of the Unit 2 ERV actuator inspections, a Unit 1 shutdown was initiated to perform an extent of condition (EOC) review. Unit 1 was taken off line at 0001 on January 7, 2006.

Three of the four Unit 1 ERVs were declared inoperable based on unsuccessful actuator stroke tests or inspection results. Loose hardware and spring guidepost wear were noted on all four of the ERV solenoid actuators. All four Unit 1 ERV actuators were removed and quarantined for further evaluation. Rebuilt actuators were installed and stroke tested satisfactorily. Unit 1 was synchronized to the grid on January 8, 2006, and returned to pre-EPU power on January 9, 2006.

During inspections of the quarantined Unit 1 ERV actuators, it was noted that the actuator pivot plate bolting was worn. This condition created the potential for failure of the actuator to function as designed. Procedure reviews conducted in light of this information determined that the pivot plate bolts were not normally inspected. This brought into question the continued operability of the refurbished and currently installed Unit 2 ERV actuators. Unit 1 was not immediately called into question because new pivot plate bolts had just been installed during the January 7, 2006, shutdown.

On January 14, 2006, Unit 2 was shut down for inspection of the ERV actuator pivot plate bolts. During the as-found stroke testing, the 3D ERV actuator stroked once and then became bound. The cause of this condition was determined to be over-tightening of the roller plunger and ERV actuator equipment tolerances. Changes were made to the guidance for rebuilding the actuators, and the removed Unit 2 ERV actuators were then rebuilt using the new rebuild criteria and reinstalled.

Also during the Unit 2 shutdown, an inspection was conducted on the support between the ERV main valve and the ERV pilot valve. This support is referred to as the turnbuckle. The inspection identified that both valve and pilot side turnbuckle tack welds had cracked on the 3D ERV. Because cracked turnbuckle tack welds might be a precursor to fretting wear of the turnbuckle threads, the turnbuckle was removed and further analyzed on site, and fretting wear was identified.

As a result of the roller-plunger over-tightening issue identified on Unit 2, the Unit 1 ERVs were declared inoperable. On January 15, 2006, Unit 1 was shut down and the Unit 1 ERV actuators were satisfactorily stroke tested in place. The Unit 1 ERV turnbuckles were inspected with no cracks found on the tack welds. The Unit 1 ERV actuators were replaced with actuators rebuilt in accordance with the new criteria developed in response to the Unit 2 issues. Also, the Unit 1 3D ERV was replaced due to high tailpipe temperatures experienced during the previous start up.

Both Unit 1 and Unit 2 were returned to power operation on January 19, 2006.

C. CAUSE OF EVENT

The ERV actuator damage was caused by main steam line (MSL) vibration levels that exceeded the design capabilities of the components during operation at EPU power levels. The root cause was the adoption of a maintenance strategy to minimize the effects of the vibration on MSL attached components rather than correcting the source of the MSL vibrations soon after original startup of the plant.

Although ERV actuator problems had been encountered early in the life of the plant, the actions taken involved increasing the frequency of maintenance. This strategy supported ERV actuator response at pre-EPU power levels; however it did not address operation of the actuator in an increasing vibration environment. Failure to recognize this as a potential issue associated with operation at EPU power resulted in the 2006 Unit 1 and Unit 2 forced outages.

This investigation also determined that although an attempt was made through testing to determine the wear and failure mechanism of an ERV actuator, the testing was ineffective because of a less than adequate process to evaluate potential failure modes feeding into the configuration change process.

One of the organizational weaknesses in this event was the failure to incorporate recommendations from contracted studies and analysis into the station's processes for documented evidence of disposition.

Another organizational weakness identified in this event was the lack of management oversight. Three major projects were progressing in parallel, specifically, the steam dryer project, EPU Vulnerability Study, and the ERV Vibration Issue Resolution. The first two projects had Corporate Engineering Directors assigned as Sponsors while the ERV Vibration Issue Resolution Team had a Project Engineer providing oversight while simultaneously providing production work. The resolution for this issue has been completed with the development and issuance of HU-AA-1212, Technical Task Risk/ Rigor Assessment, Pre-Job Brief, Independent Third Party Review and Post-Job Brief procedure, which did not exist prior to development and performance of ERV actuator testing.

The organizational contributors taken in aggregate demonstrate weaknesses in managing information, over-reliance on contractor-performed analysis, and weaknesses in applying a systematic approach to decision making for complex high-risk situations.

D. SAFETY ANALYSIS

Exelon has determined that the risk to overall plant operation was minimal, based upon the following equipment configurations.

In the first Unit 2 outage, one ERV was inoperable. The Target Rock Safety/Relief Valve (S/RV), the 3B, 3C and 3E ERVs and all eight of the safety valves were operable and available during this event.

In the first Unit 1 outage, three ERVs were found to be inoperable. The S/RV, the 3E ERV and all eight of the safety valves were operable during this event. The 3B ERV was determined to be available for operation after the first initial stroke. The 3C valve was available for the initial stroke, but not for subsequent strokes. Based on this, the 3C valve was available for the probabilistic risk assessment (PRA) function of manual depressurization of the reactor (ADS). Therefore, although three valves were inoperable, only two valves were unavailable for the PRA manual depressurization function.

In the second Unit 2 outage, one electromatic relief valve was inoperable. The S/RV, the 3B, 3C and 3E ERVs and all eight of the safety valves were operable and available during this event.

In the second Unit 1 outage, all ERVs were operable.

The limiting event was the Unit 1 outage on January 7, 2006, in which two of four ERVs were available. Exelon had a probabilistic risk assessment performed based on 147 days of Unit 1 EPU operation. The conclusion of the Exelon analysis was that the risk for the event was WHITE. This includes internal events Core Damage Frequency

(CDF), internal events Large Early Release Frequency (LERF), and external events.

This LER is being submitted in accordance with:

- 10 CFR 50.73(a)(2)(i)(A), Completion of shutdown required by TS, (January 15, 2006, Unit 1 shutdown - ENS call made January 15, 2006, at 1136 hours, in accordance with 10 CFR 50.72(b)(2)(i))
- 10 CFR 50.73(a)(2)(i)(B), Operation or condition prohibited by TS, (December 30, 2005, Unit 2 shutdown, and January 6, 2006, Unit 1 shutdown)
- 10 CFR 50.73(a)(2)(v)(D), Any event or condition that could have prevented the fulfillment of a safety function, (January 6, 2006, Unit 1 shutdown)
- 10 CFR 50.73(a)(2)(vii), Single cause inoperability of independent trains or channels, (January 6, 2006, Unit 1 shutdown)

E. CORRECTIVE ACTIONS

Following the event, the ERV actuators on Unit 1 and Unit 2 were rebuilt in accordance with guidance incorporating the results of the inspections.

Unit 1 and Unit 2 remained limited to pre-EPU power until the Acoustic Side Branches were installed.

Acoustic Side Branches (ASBs) have been designed for and installed on the main steam system for both Unit 1 and Unit 2. Subsequent testing has shown that overall MSL vibrations have been reduced to a level to support safe and reliable operation of the MSLs and attached components during future operating cycles at EPU.

The ERV actuators for both Unit 1 and Unit 2 have been replaced with actuators with a more robust design.

Guidance has been provided concerning how to process recommendations and conclusions affecting system/equipment operation from contracted studies/projects. This process includes requirements to track reports and recommendations to ensure disposition is documented.

The Operational and Technical Decision Making Process procedure and the Technical Task Risk/Rigor Assessment, Pre-Job Brief, Independent Third Party Review and Post-Job Brief procedure have been revised to add the rigor and documentation necessary to ensure proper evaluation of complex engineering decisions and risk analysis products.

Corrective Action to be Completed:

The test control process is being revised to address failure modes and effects analysis and also requirements for owner reviews of test plans and test reports.

F. PREVIOUS OCCURRENCES

The following instances of ERV actuator failure due to vibration were identified:

August 11, 1990 (Quad Cities Unit 1) - The 3C ERV failed to open manually due to a worn solenoid spring bracket bushing. A worn bushing permitted a spring to work its way up around the bushing.

March 1, 1993 (Quad Cities Unit 1) - The 3C ERV showed unusual wear. Excessive wear noted on the plunger guides of the actuator was attributed to vibration.

October 20, 2003 (Dresden Unit 2) - The 3D ERV was discovered with a missing limit switch screw, damaged housing, and a broken wire.

November 21, 2003 (Quad Cities Unit 1) - Inspection of the 3C, 3D, and 3E ERVs revealed degraded components, which was attributed to vibration.

April 27, 2005 (Dresden Unit 3) - The 3E ERV was found with loose mounting hardware for the microswitch. Both switches were found in their expected position; however, one screw was found missing on one switch and one mounting screw was found loose on the other switch. Several other actuators were inspected with no problems found.

These five events include findings of loose parts, worn bushings, worn springs and worn posts. The corrective actions taken in response to the January shutdowns at Quad Cities address each of these events. They include redesign/replacement of the actuator and reduction in the source of the vibration. The earlier corrective actions taken to prevent these events included increased preventive maintenance performance and addition of thread lock on certain components. No action was taken to reduce the source of the damaging vibration.

G. COMPONENT FAILURE DATA

The valves are 6 inch, model 1525VX relief valves manufactured by Dresser Industries.