



# PECO NUCLEAR

A Unit of PECO Energy

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10CFR50.73

May 28, 1997  
Docket No. 50-353  
License No. NPF-85

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555

**SUBJECT:** Licensee Event Report  
Limerick Generating Station - Unit 2

This LER concerns pressure setpoint drift of eleven Main Steam System safety relief valves (SRV) primarily caused by corrosion induced bonding within the SRVs. This resulted in a condition where a common cause resulted in more than two independent trains becoming inoperable in a single safety system.

Reference: Docket No. 50-353  
Report Number: 2-97-003  
Revision Number: 00  
Event Date: April 29, 1997  
Report Date: May 28, 1997  
Facility: Limerick Generating Station  
P.O. Box 2300, Sanatoga, PA 19464-2300

This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(vii).

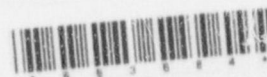
Very truly yours,

DMS:cah

cc: H. J. Miller, Administrator Region I, USNRC  
N. S. Perry, USNRC Senior Resident Inspector, LGS

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**LICENSEE EVENT REPORT (LER)**

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ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001 AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

FACILITY NAME (1) Limerick Generating Station, Unit 2		DOCKET NUMBER (2) 05000 353	PAGE (3) 1 OF 6
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TITLE (4) Corrosion Induced Bonding Results in Several Main Steam System Safety Relief Valves Having Setpoint Drift.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	29	97	97	-- 003 --	0	05	28	97	FACILITY NAME	DOCKET NUMBER 05000
									FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9) 1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10) 100	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
	<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
	<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input checked="" type="checkbox"/> 50.73(a)(2)(vii)	OTHER
	<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	(Specify in
	<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	Abstract below
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(x)	and in Text, NRC Form 366A)	

LICENSEE CONTACT FOR THIS LER (12)

NAME J. L. Kantner, Manager - Experience Assessment, LGS	TELEPHONE NUMBER (Include Area Code) (610) 718-3400
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	SB	RV	T020	YES					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO				

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

On 04/29/97, Station Engineering was informed that as-found test results for 11 of 14 Main Steam Safety Relief Valves (SRVs) did not meet the 1% setpoint tolerance of Technical Specification 3.4.2. These results were for 11 SRVs replaced during the fourth Unit 2 refueling outage (2R04) in February 1997, and for 3 SRVs replaced during the 19<sup>th</sup> Unit 2 maintenance outage (2M19) in December 1996. The performance of these SRVs for Unit 2 Cycle 4 resulted in a condition where a common cause resulted in more than 2 independent trains in a single safety system becoming inoperable. The consequences were minimal since there was only minimal challenge to the reactor overpressure protection system. Fourteen SRV pilot valves were replaced with calibrated spares during 2R04 and 2M19. The SRVs are Target Rock Corporation Model 7567F pilot operated 2 stage valves. The cause of the setpoint drift was corrosion induced bonding between the pilot disc and seat. Seven of the 14 pilot valves during cycle 4 contained platinum pilot discs recommended by the BWR Owners Group. Performance of the platinum pilots was no better than the standard stellite pilot discs since 5 of 7 SRVs with platinum discs exceeded the required setpoint tolerance. PECO Energy is in the process of evaluating alternative SRV designs.

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

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Unit Conditions Prior to the Event

Unit 2 was in Operational Condition 1 (Power Operation) at 100% power level. There were no structures, systems, or components out of service which contributed to this event.

Background

Unit 2 was shutdown during the week of December 9, 1996, for its 19<sup>th</sup> maintenance outage (2M19) at which time 3 leaking Main Steam system Safety Relief Valves (SRV), 2E, 2G, and 2H, were replaced. The other 11 SRVs were replaced during the fourth Unit 2 refueling outage (2R04) which commenced on January 30, 1997. SRV 2E was also replaced again during 2R04 due to slight pilot valve leakage. Technical Specifications (TS) 4.4.2.2 requires 7 SRVs to be recalibrated or replaced each 24 month surveillance interval and previous commitment requires 14 SRVs to be recalibrated or replaced each 24 month surveillance interval based on industry generic setpoint drift issues.

The SRVs are Target Rock Corporation, Model 7567F, pilot operated two stage SRVs which have generically experienced upward setpoint drift in the BWR industry. The BWR operating environment causes a corrosion induced bond to form between the pilot disc and seat. This bond often influences the first lift point of the two stage Target Rock SRV.

As found testing of the 3 SRVs removed during 2M19 showed that 2 SRVs met the setpoint criteria and the third met the ASME 3% criteria. As found testing of the SRVs removed during 2R04 showed that 10 additional SRVs did not meet the 1% criteria. Six of these SRVs did not meet the ASME 3% criteria. All SRV pilots were replaced with calibrated spares.

Description of the Event

On April 29, 1997, Station Engineering was notified that the as found setpoint tests for 10 SRVs removed during 2R04 exceeded the 1% tolerance specified in TS 3.4.2. Since 1 SRV removed during 2M19 also exceeded the 1% criteria, a total of 11 SRVs exceeded this criteria for Unit 2 Cycle 4. TS 3.4.2 requires specific setpoints with a  $\pm 1\%$  tolerance. The as found setpoint for the 14 SRVs for Unit 2 Cycle 4 are listed below:



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SRV	Required Setpoint	Pilot #	First Lift Point	
2A	1190	1213 p	No Lift	
2B	1190	1212	1225	102.9%
2C	1190	1211	1216	102.2%
2D	1180	1215 p	1258	106.6%
2E	1180	1210 p	1188	100.7%
2F	1190	507	1260	105.9%
2G	1190	524 p	1219	102.4%
2H	1170	502 p	1179	100.8%
2J	1170	1214	1173	100.3%
2K	1180	503 p	No Lift	
2L	1170	531	1188	101.5%
2M	1180	1209	1195	101.3%
2N	1170	532 p	1229	105.0%
2S	1180	530	1293	109.6%

Serial # followed by 'p' indicates a platinum doped pilot disc.

Reactor overpressure protection for Nuclear Steam Supply System (NSSS) is provided by the safety valve mode of the 14 Target Rock Corporation pilot operated two stage SRVs. General Electric (GE) provided these SRVs with the NSSS design. TS 3.4.2 requires at least 11 of 14 SRVs to be operable within 1% of the required setpoint with 4 SRVs set at 1170 psig, 5 SRVs set at 1180 psig, and 5 SRVs set at 1190 psig. The Overpressure Protection System is designed to prevent the primary coolant pressure boundary from exceeding the ASME Section III level B service (i.e., upset) limit. This limit is 110% of the 1250 psig design pressure, or 1375 psig.

On April 29, 1997, a reportability evaluation for the Unit 2 Cycle 4 test results was completed upon receipt of the vendor's test report. There is no recommended method of verifying functional operability of an installed SRV during plant operation. Therefore, end of cycle testing is performed at a test facility to determine whether the SRVs are within the required setpoint tolerances.

Eleven of the SRVs were found to have setpoints out of tolerance due to corrosion induced bonding. This condition resulted in more than two independent trains of a single safety system

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being inoperable due to a common cause. This report is being submitted in accordance with the requirement of 10CFR50.73(a)(2)(vii).

Analysis of the Event

There were no actual adverse consequences associated with the SRV setpoint drifting since there was only 1 event that minimally challenged the Overpressure Protection System. On May 14, 1996, a Main Turbine trip with bypass caused the 2E SRV to open for approximately 8 seconds. This event was reviewed and it was concluded that this response was reasonable considering the transient pressure wave which may have occurred. In-plant instrumentation cannot determine the pressure at the individual SRVs. The Main Turbine bypass system operated normally throughout the cycle. The Reactor Protection System (RPS) also was operable from both the Main Turbine valve position switches and the Main Steam Isolation Valve (MSIV) position switches. The RPS system would have anticipated the pressure spike and mitigated the overpressure transient.

Setpoint drift would have had no effect on the Automatic Depressurization System or the remote manual operation of the Main Steam system SRVs. These functions were previously analyzed by GE for the BWR Owners Group (BWROG). These functions utilize a pneumatic actuator to remove set spring pressure from the pilot disc, allowing the SRV to open. In the event of an overpressure transient on the reactor vessel, Operation's Emergency Procedures and training direct the use of SRVs to maintain control of reactor pressure if normal pressure relief functionality is unavailable.

Due to the generic concern of SRV setpoint drift under power rerate conditions, a sensitivity analysis was done to evaluate the effects of setpoint drift on SRVs that do not open on the overpressure analysis. GE report NEDC-32403P evaluates that an average setpoint drift of 4% can be tolerated without exceeding the ASME upset pressure limit if 2 SRVs are out of service. The most severe pressurization transient event was conservatively assumed to be the simultaneous closure of all MSIVs with a coincident failure of the MSIV position switch SCRAM signal. Neutron flux SCRAM signal initiates the required power reduction to protect the vessel. Since the actual average setpoint drift for the 12 SRVs which lifted is 3.25%, reactor pressure would have remained below the upset limit even though SRV pilots #1213 and #503 failed to actuate.

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GE performed a specific analysis for the Unit 2 Cycle 4 core reload and the as-found test results. This analysis concluded that the primary coolant pressure boundary would not have exceeded 1340 psig, below the ASME upset limit of 1375 psig. This analysis assumes that the SRVs would have performed as tested. Therefore, there were no safety consequences as a result of 11 SRVs being out of setpoint tolerance.

Cause of the Event

The cause of the setpoint drift is corrosion induced bonding. This cause is evident when subsequent test actuations of the SRV are at lower pressures than the first actuation. The 2 SRVs which failed to open showed visible bonding of the disc at the seat interface.

Corrective Actions

PECO is participating in the BWROG Setpoint Drift Committee. The BWROG recommended fix has been to install a modified platinum doped pilot disc in pilot assemblies to reduce the corrosion potential at the disc/seat interface. This fix has been done to 27 of 42 SRV pilots including a set of 14 spare SRVs. Unit 1 and Unit 2 have a total of 15 modified valves in-service at this time. This modification has failed to prevent SRV setpoint drift due to corrosion bonding as evidenced by Unit 2 Cycle 4 experience and recent other BWR experience.

Future Actions

The second recommended corrective action by the BWROG Setpoint Drift Committee is to implement the 'pressure switch' modification which would actuate the SRVs through logic and auxiliary actuators. PECO Energy is in the process of evaluating alternative SRV designs because of setpoint drift issues and because of pilot and main valve leakage which, although greatly improved, has not been totally eliminated. Hardware changes will be required to modify the SRVs to provide acceptable setpoint and leakage performance. This plant change will require appropriate design and testing to qualify SRV components. Therefore, this modification is tentatively scheduled to be implemented, at the earliest, during the fifth refueling outage for Unit 2 (2R05) and during the eighth refueling outage for Unit 1 (1R08). This SRV modification will supersede the need for the pressure switch modification. Current SRV performance, in conjunction with realistic performance of plant safety systems, provides



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interim assurance that the ASME overpressure limit of 1375 psig will not be exceeded. For example, MSIV and Main Turbine stop valve limit switches provide anticipatory RPS actuations to reduce the reactor pressure vessel peak pressure by approximately 60 psig. Therefore, the SRV modification will provide appropriate corrective action to enhance the performance of the safety system.

Previous Similar Occurrences

Limerick Generating Station LERs 1-87-034, 1-91-015, 1-92-017, 1-95-009, 1-96-009, 2-92-010, 2-95-009, report Main Steam system SRV setpoint drift. The cause of each of these events is primarily the same as stated in this LER. PECO is considering the BWROG recommended options as well as other industry SRV experience in determining the modifications which must be made to improve overpressure protection performance.