



DEC 10 2012

LR-N12-0395

10CFR50.73

United States Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-001

Hope Creek Generating Station  
Facility Operating License No. NPF-57  
Docket No. 50-354

Subject: Licensee Event Report 2012-004-01

Reference PSEG Letter LR-N12-0199 dated July 3, 2012  
Licensee Event Report 2012-004

The Reference, Hope Creek Generating Station's (HCGS) Licensee Event Report (LER), reported six Safety Relief Valve (SRV) pilot valve setpoints being outside the allowable tolerance for Technical Specifications. The Reference stated that HCGS would supply a supplement to the LER with the results of the technical evaluation of the stresses imposed by the increased lift setpoint of the SRVs. The results of this technical evaluation are being communicated in the LER supplement.

The supplement is included in the Attachment to this letter. Should you have any questions concerning this letter, please contact Mr. Paul Bonnett at (856)-339-1923.

No regulatory commitments are contained in the LER.

Sincerely,

A handwritten signature in black ink, appearing to read "Eric S. Carr", with a long horizontal flourish extending to the right.

Eric S. Carr  
Plant Manager  
Hope Creek Generating Station

Attachment: Licensee Event Report 2012-004-01

TE22  
MLR

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cc: Mr. W. Dean, Regional Administrator – Region I  
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Hope Creek Commitment Tracking Coordinator (H02)

Corporate Commitment Coordinator (N21)

Attachment: Licensee Event Report 2012-004-01

# LICENSEE EVENT REPORT (LER)

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 Records and 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**  
As-found Values for Safety Relief Valve Lift Setpoints Exceed Technical Specification Allowable

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
5	10	2012	2012	- 004 -	01	12	10	2012	N/A	
									N/A	DOCKET NUMBER

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

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME Paul Bonnett, Compliance Engineer	TELEPHONE NUMBER (Include Area Code) (856) 339-1923
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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
B	SB	RV	T020	Y					

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

On May 10, 2012, PSEG received the initial results for the safety relief valve (SRV) pilot valve 'as-found' setpoint testing. The results indicated that two SRV pilot valve setpoints exceeded Technical Specification (TS) allowable tolerance specified in TS 3.4.2.1. This specification requires SRV setpoint limits to be within +/- 3% of the specified value. The valves failing to meet limits were Target Rock Model 7567F two-stage SRVs. As planned all 14 SRV pilot valves were removed and replaced with pre-tested, certified spare pilot valves during refueling outage H1R17. All 14 SRV pilot valves were 'as-found' tested at an offsite test facility. A total of six of the 14 SRV pilot valves experienced setpoint drift outside of the TS 3.4.2.1 limits.

Five of the six SRVs were within the maximum allowable percent increase (MAPI) value. The SRV-F was the only SRV that did not meet the MAPI value. A Technical Evaluation assessed whether the stresses imposed by the increased lift setpoint would have been below the ASME Section III, Appendix F value for failure. The results of the Technical Evaluation are being communicated in this supplemental LER.

The cause of the setpoint drift for all six SRVs is corrosion bonding, which is consistent with industry experience. The materials combination for the pilot disc and the pilot seat has been a known industry issue because of the design of the Target Rock 2 stage SRV.

This condition is reportable under 10CFR50.73(a)(2)(i)(B) as any operation or condition prohibited by the plant Technical Specifications.

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**NARRATIVE**

**PLANT AND SYSTEM IDENTIFICATION**

General Electric – Boiling Water Reactor (BWR/4)  
 Main Steam – EIS Identifier {SB}\*  
 Safety Relief Valves – EIS Identifier {SB/RV}\*

\* Energy Industry Identification System {EIS} codes and component function identifier codes appear as {SS/CCC}

**IDENTIFICATION OF OCCURRENCE**

Event Date: May 10, 2012

Discovery Date: May 10, 2012

**CONDITIONS PRIOR TO OCCURRENCE**

Hope Creek was in Operational Condition Five (OPCON 5) for the seventeenth refueling outage (H1R17). No structures, systems or components were inoperable at the time of discovery that contributed to the event.

**DESCRIPTION OF OCCURRENCE**

From May 10, 2012, through May 11, 2012, engineering personnel received the results of the Main Steam Safety Relief Valve (SRV){SB/RV} (Target Rock Model 7567F) setpoint testing required by Technical Specification (TS) Surveillance Requirement (SR) 4.4.2.2. The initial report documented the failure of SRVs 'B', and 'H' to meet the TS 3.4.2.1 limit of +/- 3% (initial testing performed on May 7 and May 9, 2012). Action (a) of TS 3.4.2.1 specifies "With the safety valve function of two or more of the above listed 14 safety/relief valves inoperable, be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours". At the time, Hope Creek was in OPCON 5 (refueling) with the reactor head removed and the reactor cavity flooded and connected to the spent fuel pool for refueling operations. As scheduled for H1R17, all 14 SRV pilot valves were 'as-found' tested at an offsite test facility. A total of six of the 14 SRV pilot valves experienced setpoint drift outside of the TS 3.4.2.1 limit.

**SAFETY CONSEQUENCES AND IMPLICATIONS**

The SRV 'as-found' setpoint drift occurrences experienced during H1R17 were evaluated per Technical Evaluation 70138789, Operation 0050.

The Technical Evaluation assessed the aggregate impact of H1R17 SRV setpoint drift failures. The analysis performed by GE (NEDC-32511P, "Safety/Relief Valve Tolerance Analysis") to assess the impact of the SRV Technical Specification setpoint tolerance change from +/-1% to +/-3% was used as a basis to perform this evaluation. There were two parts to the evaluation. The first is the actual lift setpoints being less than 1250 psig for the reactor vessel overpressure protection. The second is the increase in mechanical stresses on the torus & torus attached piping due to the higher lift setpoints.

The six H1R17 valves that experienced a setpoint drift above the allowable +3% value would have lifted below the 1250 psig limit, thus the reactor vessel overpressure protection was not affected by the SRV pilot valve setpoint drifts. The ECCS/LOCA & High Pressure System Performance was included as part of the evaluation. It was determined that the setpoint drift would not have impacted the design functions of these systems.

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**NARRATIVE**

The analysis performed by GE (NEDC-32511P) remains valid for the existing plant configuration and the maximum allowable percent increase (MAPI) above the SRV nominal setpoints can still be applied. For the H1R17 testing, the 'as-found' setpoints of SRV-B, F, H, K, L, and P exceeded the +/- 3% TS value, but were within tolerance for the second lift test. SRV-B, H, K, L, and P remained below the value which is the lesser of 1250 psig or MAPI limit. Thus the SRV 'as-found' setpoints remained within the analyzed limits (NEDC-32511P).

The SRV-F (F013F) was the only SRV that drifted above the MAPI value of 5.5%. The SRV-F reached +7.7%, which was 2.2% greater than the MAPI value. The Technical Evaluation (70138789, Operation 0055) assessed whether the stresses imposed by the increased lift setpoint would have been below the ASME Section III, Appendix F value for failure. The results of the Technical Evaluation are being communicated in this supplemental LER.

The final test results for the SRVs that had setpoint drift outside the tolerance were as follows:

Valve ID	As-found	TS Setpoint	Acceptable Band (psig)	% Difference	
	(psig)	(psig)		Actual	Limit <sup>#</sup>
F013B	1169	1130	1096 – 1163	3.50%	39.4%
F013F	1193	1108	1075 – 1141	7.70%	5.5%
F013H	1157	1108	1075 – 1141	4.40%	37.7%
F013K	1202	1108	1075 – 1141	8.50%	22.40%
F013L	1193	1120	1087 – 1153	6.50%	16.30%
F013P	1185	1120	1087 – 1153	5.80%	27.4%

<sup>#</sup>The limit is based on the SRV discharge piping mechanical stress limit identified in Table 7-1 of GE analysis (NEDC-32511P) and is known as the "Maximum Allowable Pressure Increase" (MAPI).

The SRV-F 'as-found' lift setpoint pressure was 1193 psig, which is 7.7% greater than the required setpoint pressure of 1108 psig. Although the pipe stresses and pipe support loads of the 'B' Main Steam Line and SRV-F discharge line increased by 10% due to the setpoint drift, the ASME allowable stresses and pipe support capacities were not exceeded and significant margin existed. The SRV-F piping and supports inside of the torus, more specifically the T-Quencher saddle support that experiences the water force from the vertical segment of pipe upstream of the T-Quencher, is within the allowable stresses with considerable margin available. It should be noted that for determining past operability, ASME allows the use of higher stress allowables (i.e. ultimate stress) for materials. However, the higher material allowables were not used since the increased stresses due to the setpoint drift are within the standard allowables. In conclusion, the SRV-F setpoint pressure drift of 7.7% above the required lift setpoint pressure did not adversely affect the design function of the 'B' Main Steam Line or any segment of the SRV-F discharge line.

A review of this event determined that a Safety System Functional Failure (SSFF) did not occur as defined in Nuclear Energy Institute (NEI) 99-02, "Regulatory Assessment Performance Indicator Guideline".

**CAUSE OF OCCURRENCE**

Corrosion bonding occurs when an oxide forms between the mating surfaces of the Pilot Disc (solid Stellite 21) and the seat in the Pilot Body (Stellite 6 overlay). This bridging oxide fractures when the pilot disc lifts. The load required to fracture this bridging oxide increases the lift point and can lead to pilots failing high during initial lift tests. Subsequent lifts following the initial 'as-found' lift, typically are within setpoint tolerances.

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The apparent cause of the setpoint drift is corrosion bonding, which is consistent with industry experience. The materials combination for the pilot disc and the pilot seat have been a known industry issue since the design of the Target Rock 2 stage SRV was initially installed. The oxygen content of the steam, in the pilot disc area, aggravates the natural corrosive reaction in the pilot disc seating area. Numerous industry attempts to resolve the oxide formation have failed to eliminate performance issues. A summary of the BWROG recommendations to improve SRV reliability with regard to setpoint drift was documented in NRC Regulatory Issue Summary 2000-12 dated August 7, 2000: "Resolution of Generic Safety Issue B-55, Improved Reliability of Target Rock Safety Relief Valves". The three modification options recommended were: (1) the installation of ion beam implanted platinum (IBAD Process) pilot valve discs, (2) the installation of Stellite 21 pilot valve discs, and (3) the installation of additional pressure actuation switches. Hope Creek has implemented options 1 & 2 with limited success. Option three has not been considered due to mixed industry results/performance.

Following H1R15, Southwest Research was contracted to metallurgically evaluate the Pilot Body and Disc from SRV-K (setpoint failure at +9.4%) using both stereomicroscopy and scanning electron microscopy (SEM) to determine if evidence of bonding between the mating surfaces of the disc and body was present. The SEM examinations of the seating area on the Pilot Disc showed clear evidence of brittle oxide fracture along the seating line. These sharp fracture lines are typically produced as a brittle oxide grown between two surfaces fractures as the surfaces are separated, leaving islands of the oxide on each surface. Spectra taken from various regions along the seat confirmed that portions of the oxide were being removed from the Pilot Disc seat, i.e., left behind on the seat face, as the disc lifted off the seat. These results confirm that an oxide had formed between the mating surfaces of the Pilot Disc and the seat in the Pilot Body and that this bridging oxide fractured when the disc lifted. The load required to fracture this bridging oxide increases the lift point and can lead to pilots failing high during lift tests.

Based on these previous examinations and the fact that the second lift for all of the six SRVs was within the +/-3% tolerance, corrosion bonding is the apparent cause for all six SRVs.

**PREVIOUS OCCURRENCES**

A review of LERs for the three prior years at Hope Creek was performed to determine if a similar event had occurred. There were similar events during the 2009 and 2010 Hope Creek refueling outages when six SRVs were found out of the TS required limits of +/- 3%. These events were reported as LER 354/2009-002-00 and its supplement 354/2009-002-01, and 354/2010-002-00 and its supplement 354/2010-002-01.

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**NARRATIVE**

**CORRECTIVE ACTIONS**

1. All 14 SRV pilot valves were removed and replaced with pre-tested, certified spare pilot valves (H1R17).
2. All six pilot valves that failed to meet the +/- 3% TS setpoint tolerances will be disassembled and inspected to determine the cause.
3. Completed a Technical Evaluation in accordance with procedure CC-AA-309-101 to assess the aggregate impact associated with the six 'as-found' setpoint test failures in H1R17.
4. All 14 SRV pilot valves will be removed, tested and replaced with pre-tested, certified spare pilot valves during the next refueling outage (H1R18).
5. Implement the modification to replace the currently installed Target Rock 2-stage SRVs with a design that eliminates setpoint drift events exceeding +/-3% and improves SRV reliability.

**COMMITMENTS**

This LER contains no commitments.