PSEG Nuclear LLC
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PSEG
Nuclear LLC

JUL 03 2012

10CFR50.73

LR-N12-0199

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

Hope Creek Generating Station Unit 1
Facility Operating License No. NPF-57
Docket No. 50-354

Subject: Licensee Event Report 2012-004

In accordance with 10 CFR 50.73(a)(2)(i)(B), PSEG Nuclear LLC is submitting Licensee Event Report (LER) Number 2012-004.

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,

David P. Lewis
Plant Manager
Hope Creek Generating Station

Attachment: Licensee Event Report 2012-004

IE22
NRR

cc: Mr. W. Dean, Regional Administrator – Region 1
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Hope Creek Commitment Tracking Coordinator (H02)

Corporate Commitment Coordinator (N21)

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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
									N/A	
5	10	2012	2012	- 004 -	00	7	3	2012	N/A	DOCKET NUMBER

9. OPERATING MODE
5

10. POWER LEVEL
000

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

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Paul Bonnett, Compliance Engineer	(856) 339-1923

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					

14. SUPPLEMENTAL REPORT EXPECTED

☒ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☐ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
9	30	2012

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.

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 – EIIS Identifier {SB}*
Safety Relief Valves – EIIS Identifier {SB/RV}*

* Energy Industry Identification System {EIIS} 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

Using a technical evaluation prepared to address SRV pilot valve setpoint drift occurrences during a previous refueling outage (H1R15), the as-found setpoint drifts experienced during H1R17 are being evaluated (70138789, Op.50).

A previous Technical Evaluation, performed during H1R15, was used to assess the aggregate impact of H1R15 SRV setpoint drift failures. The analysis performed by GE (NEDC-32511P, "Safety/Relief Valve Tolerance Analysis") to assess the impact of the SRV Tech Spec 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 H1R15 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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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, 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 are expected to remain within the analyzed limits (NEDC-32511P). SRV-F drifted above the MAPI value of 5.5%. The Technical Evaluation (70138789, Op.50) will assess that if the setpoint drift of SRV-F reached +7.7%, that the stresses imposed by the increased lift setpoint would have been below the ASME Section III, Appendix F, value for failure. These results will be communicated in the supplemental LER.

Therefore, the increase in five of the six SRV setpoints should not have impacted the vessel overpressure protection or the torus and torus attached piping. The sixth SRV, SRV-F, will be evaluated in 70138789, Op.0050.

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

Valve ID	As Found (psig)	TS Setpoint (psig)	Acceptable Band (psig)	% Difference	
				Actual	Limit[#]
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%

[#]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).

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.

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 improve performance. 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

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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 was a similar event during the 2009 and 2010 Hope Creek refueling outages when six SRVs were found out of the TS required limits of +/- 3%. This event was 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.

The recently completed SRV Setpoint Drift root cause evaluation (70128407) identified that the pilot valve for the Target Rock 2-Stage SRV design has an industry wide chronic history of corrosion bonding leading to set point drifting.

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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. Complete 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. Begin replacing 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.