

Paul A. Harden
Site Vice President724-682-5234
Fax: 724-643-8069February 18, 2013
L-12-393

10 CFR 50.73

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001SUBJECT:
Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
LER 2010-003-01

Enclosed is Licensee Event Report (LER) Supplement 2010-003-01, "Premature Lifting of ECCS Relief Valve Results in Post-Accident Outside-Containment Leakage Limits To Be Exceeded." This event was previously reported in accordance with 10 CFR 50.73(a)(2)(ii)(B) and 10 CFR 50.73(a)(2)(v)(C) on January 14, 2011. This LER supplement updates the cause of the event based on additional testing and engineering evaluation that was performed subsequent to the original LER submittal.

There are no regulatory commitments contained in this submittal. Any actions discussed in this document that represent intended or planned actions are described for the NRC's information, and are not regulatory commitments.

If there are any questions or if additional information is required, please contact Mr. Darin M. Benyak, Manager, Regulatory Compliance at 724-682-4284.

Sincerely,


Paul A. Harden

Enclosure - BVPS Unit 1 LER 2010-003-01

- c: Mr. W. M. Dean, NRC Region I Administrator
Mr. D. I. Spindler, NRC Senior Resident Inspector
Mr. P. J. Bamford, NRR Project Manager
INPO Records Center (via electronic image)
Mr. L. E. Ryan (BRP/DEP)

TEZZ
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 hrs. 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
Premature Lifting of ECCS Relief Valve Results in Post-Accident Outside-Containment Leakage Limits To Be 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
11	15	2010	2010	003	01	02	18	2013	None	
									FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)										
	<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)							
10. POWER LEVEL 100 %	<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 checked="" 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 checked="" type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER								
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input 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 Darin M. Benyak, Manager, Regulatory Compliance	TELEPHONE NUMBER (Include Area Code) (724) 682-4284
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	BP	RV	C710	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
<input type="checkbox"/> 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)

On 11/15/2010 during the performance of a Beaver Valley Power Station (BVPS) Unit 1 surveillance test on the 'A' Low Head Safety Injection (LHSI) Pump, discharge relief valve RV-1SI-845B lifted with approximately 20 gpm leakage rate going to the safeguards building area sump. Subsequent testing showed that this relief valve opened whenever the 'A' LHSI Pump operated. Engineering analysis determined that this outside-containment leakage rate would exceed regulatory limits for projected Exclusion Area Boundary (EAB) dose and projected Control Room Dose during a postulated Design Basis Accident since the relief valve is on a common discharge header. BVPS Unit 1 entered Technical Specification 3.5.2 for two trains of LHSI being inoperable and both BVPS Unit 1 and Unit 2 entered Technical Specification 3.7.10 for the Control Room Envelope boundary not being adequate since the units share a common control room. This condition was determined to be reportable per 10CFR50.73(a)(2)(ii)(B) as an unanalyzed condition that significantly degraded plant safety and per 10CFR50.73(a)(2)(v)(C) as a condition that could have prevented the safety function to control the release of radioactive material.

Gas voiding on the inlet side of RV-1SI-845B and system piping was determined to be the most probable cause of this relief valve lifting during the LHSI pump surveillance testing. Also, relief valve RV-1SI-845B did not reseal after opening due to an incorrect guide ring setting, resulting in a leakage rate outside containment that exceeded regulatory limits. The safety significance of the relief valve leakage event that occurred on 11/15/2010 was very low.

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There were no structures, components, or systems that were inoperable at the start of the event that contributed to the event beyond those described. Energy Industry Identification System (EIIS) codes are identified in the text using the format [XX].

DESCRIPTION OF EVENT

On 11/15/2010, Beaver Valley Power Station (BVPS) Unit 1 performed surveillance test 1OST-11.1, " Safety Injection Pump Test" on the 'A' low head safety injection (LHSI) pump [BP] while at 100 percent power. This test quarterly verifies that the LHSI pump starts and delivers sufficient flow on recirculation to satisfy Technical Specification (TS) and ASME (American Society of Mechanical Engineers) requirements.

During the test, the Safeguards Building (where the LHSI pump is located) area sump level alarm was received and the operating crew observed a corresponding lowering of the Refueling Water Storage Tank (RWST) level. No external leakage from the system was observed. The 'A' LHSI pump was stopped and the RWST level drop ceased. These initial indications suggested that a relief valve in the LHSI pump discharge piping was lifting.

This portion of the LHSI system has three relief valves to provide overpressure protection. Relief valve RV-1SI-845A protects the LHSI Train 'A'; relief valve RV-1SI-845C protects the LHSI Train 'B'; relief valve RV-1SI-845B protects a line common to both the 'A' and 'B' trains. The capacity of each of the three LHSI discharge relief valves is 20 gallons per minute (gpm). The RWST level drop and sump level changes coincided with a 20 gpm leak rate. Subsequent information suggested that the 'B' relief valve was lifting.

Additional testing using the surveillance test procedure was performed to help determine the problem and the testing substantiated that the 'B' relief valve was opening during the operation of the 'A' LHSI pump.

During the investigation into this anomaly, Engineering reported that the 20 gpm flowrate of LHSI System flow into the Safeguards Building sump during LHSI operation should be considered as Emergency Core Cooling System (ECCS) leakage outside of containment, and that projected Exclusion Area Boundary (EAB) dose and the Control Room dose following a postulated design basis Large Break Loss of Coolant Accident (LBLOCA) would exceed regulatory limits as described in the Updated Final Safety Analysis Report (UFSAR), assuming design post-accident containment sump conditions. The projected dose would exceed the 10CFR50.67 EAB dose limit, and the 10CFR50 General Design Criteria (GDC) 19 control room dose limit.

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BVPS Unit 1 License Condition 2.C.6 requires a program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident to as low as practical levels. BVPS Unit 1 License Condition 2.C.6 would apply to LHSI System flow after the 'Transfer to Recirculation' phase occurs post-LBLOCA since the piping would contain potentially highly contaminated sump fluid. Although License Condition 2.C.6 does not specify an explicit limit for outside-containment leakage, the BVPS Unit 1 licensing basis safety analyses utilize a limit of 5700 cubic centimeters per hour (cc/hr). Thus, the identified RV-1SI-845B leakage would exceed the intent of BVPS Unit 1 License Condition 2.C.6 since the 20 gpm is well above the safety analyses limit of 5700 cc/hr.

Since BVPS Unit 1 and Unit 2 share a common control room, both BVPS Units entered TS 3.7.10, Action B for an inadequate control room envelope boundary to assure compliance with projected post-accident control room personnel dose when the dose concern was initially discovered at 0001 hours on 11/16/2010. The specification applied since the source term used to calculate the control room dose was significantly elevated due to the elevated outside-containment leakage, even though the control room envelope boundary was not physically challenged, and assumed control room in-leakage was unchanged.

In addition, TS Bases for 3.5.2, "Emergency Core Cooling System – Operating" which includes the LHSI System, does not address either BVPS Unit 1 License Condition 2.C.6 nor ESF leakage outside of containment, and only addresses decay heat removal considerations and other flow-related criteria. In this event, there was a reduction in the total LHSI flow of 20 gpm going to the Reactor Coolant System [AB]. However, this reduction was not significant as there was sufficient flow margin above this reduction for each train. Hence, the flow loss through the relief valve leakage would not have prevented the LHSI System from performing its flow-related safety functions.

Nevertheless, as with the precedent for non-compliance with "Programs" listed in TS Chapter 5.5, any non-compliance with a License Condition would similarly require invoking the applicable TS Chapter 3 Limiting Condition for Operation (LCO) for the subject system. In this case, the BVPS Unit 1 License Condition 2.C.6 limit for outside-containment leakage was challenged by the lack of LHSI System integrity due to the inappropriate opening of RV-1SI-845B. This adversely affected both trains of LHSI since RV-1SI-845B is aligned to a common discharge pipe location. Therefore, both trains of LHSI were not operable per TS 3.5.2. Action A for one or more trains of ECCS inoperable was entered, even though two trains of sufficient LHSI flow capability remained functional.

Given the excessive projected post-accident EAB and control room doses, this was an unanalyzed condition that significantly degraded plant safety, and is reportable pursuant to 10CFR50.73(a)(2)(ii)(B). Given that both trains of LHSI trains were declared inoperable, this was a condition that could have prevented the fulfillment of the safety function of a system

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needed to control the release of radioactive material and is reportable pursuant to 10CFR50.73(a)(2)(v)(C).

Following the post-maintenance test after installing a temporary gag on RV-1SI-845B through the temporary modification process, the BVPS Unit 1 LHSI System was declared operable at 15:45 hours on 11/16/2010, and both BVPS Units exited applicable Technical Specifications Actions.

During the subsequent refueling outage, the temporary gag on RV-1SI-845B was removed and the relief valve discharge piping was realigned. The LHSI full flow test was then conducted on 04/15/2012 while the plant was in Mode 6. During this LHSI full flow testing, relief valve RV-1SI-845B again lifted. An engineering evaluation was then conducted to determine the cause of the repeat relief valve lifting. The original most probable cause of the relief valve lifting (i.e., relief valve discharge piping misalignment resulting in relief valve nozzle loading) was not confirmed through subsequent bench testing of this relief valve.

CAUSE OF EVENT

Relief valve RV-1SI-845B lifted during the LHSI full flow testing and did not reseat, resulting in a leakage rate outside containment that exceeded regulatory limits. Gas voiding on the inlet side of RV-1SI-845B and system piping was determined to be the most probable cause for this relief valve to lift and an incorrect guide ring setting caused the relief valve to not reseat after it opened. The gas voiding created a condition that exposed the relief valve to an increase in pressure when the LHSI pump was started. The increase in pressure from the LHSI pump starting resulted in the relief valve lifting. The significant contributor to the gas voiding on the inlet side of the relief valve is most probably the result of a height difference of approximately one and a half feet between the relief valve and the discharge of the LHSI pump. During filling and venting it is postulated that this height difference would be enough to keep a gas void at the inlet to the relief valve without a path to vent the gas.

An incorrect guide ring setting resulted in the relief valve not reseating following the relief valve opening. The guide ring setting for RV-1SI-845B was verified to be incorrectly set such that the valve had a significantly lower reset pressure than desired. An adjustable guide (or blowdown) ring determines when a relief valve will reseat after lifting. The incorrect guide ring setting was most probably caused by not having process or procedural controls in place to ensure that the relief valves with adjustable guide ring settings are set correctly. Although relief valve nozzle loading was confirmed to exist on RV-1SI-845B, the contribution of the nozzle loading to the occurrence of this event is not considered to be significant.

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ANALYSIS OF EVENT

The plant risk associated with the BVPS Unit 1 relief valve RV-1SI-845B lifting on 11/15/2010 during the Safety Injection Pump test is considered to be very low. This is based on an Engineering technical assessment, which concluded that there is reasonable assurance that the loss of ECCS flow was small enough that there would not be a loss of safety function or significant impact on the BVPS Unit 1 ECCS, and the containment bypass would not lead to any large, unmitigated releases in a time frame prior to effective evacuation of the nearby population that have the potential to cause early health effects.

Based on the above, the safety significance of the relief valve RV-1SI-845B lifting event that occurred on November 15, 2010 was very low.

This event was previously reported as an unanalyzed condition that significantly degraded plant safety, pursuant to 10 CFR 50.72(b)(3)(ii)(B), and as an event that could have prevented the fulfillment of a safety function of systems needed to control the release of radioactive material, pursuant to 10 CFR 50.72(b)(3)(v)(C) at 05:48 hours on 11/16/2010 (Event Notification No. 46421).

CORRECTIVE ACTIONS

1. The discharge piping configuration for relief valve RV-1SI-845B and for sister valves RV-1SI-845A/C was adjusted to minimize nozzle loading as required.
2. Steps (barriers) were established in the maintenance procedures and work orders task list instructions on relief valves to check for improper piping configuration.
3. The engineering process documents were reviewed and revised as necessary to consider the effects of nozzle loading on relief valves. Additional relevant changes were also incorporated into plant procedures.
4. Plant operating experience reports were issued on this event (OE 32604 and OE 36020).
5. An analysis was performed to determine the maximum amount of air in the system which would result in relief valve lift. Limits were incorporated into the void monitoring program.
6. The LHSI pump discharge piping fill and vent procedures have been modified to require the use of a vacuum fill to minimize the potential for air trapped in the system.

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7. Procedures were revised to ultrasonically test the inlet piping on RV-1SI-845B during the fill and venting of the associated piping and on a periodic basis to ensure that any gas voiding will not adversely affect the relief valve's performance.
8. Plant maintenance procedures associated with safety related relief valve corrective maintenance activities were revised as necessary to ensure that adjustable relief valve guide ring settings are set correctly.

Completion of the above and other corrective actions are being tracked through the BVPS corrective action program.

PREVIOUS SIMILAR EVENTS

BVPS Unit 1 experienced a premature opening of RV-1SI-845B during operation following replacement while in a refueling outage in October 2007 (CR 07-28855). This relief valve demonstrated no adverse as-found set pressure during a post-removal bench test.

CR 10-85863
CR 2012-06658
CR 2012-05832