BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER • P.O. BOX 1475 • BALTIMORE, MARYLAND 21203

June 9, 1989

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

Docket No. 50-317
License No. DPR 53

Dear Sirs:

The attached LER 89-007 is being sent to you as required by 10 CFR 50.73.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

LB Russell

L. B. Russell
Manager-Calvert Cliffs Nuclear Power Plant Department

LBR:MDM:llw

cc: William T. Russell
Director, Office of Management Information
and Program Control
Messrs: G. C. Creel
L. B. Russell
C. H. Cruse

IE22
1/1

NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 1	0 5 0 0 0	1 OF 0 7

TITLE (4)

Damaged LPSI/Shutdown Cooling Suction Piping Restraint

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 NAMES	DOCKET NUMBER(S)
												0 5 0 0 0
0 3	1 7	8 9	8 9	—	0 0 7	—	0 0	0 6	1 1	8 9		0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
5		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
0 0 0		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
M. D. Milbradt, Engineer	3 0 1 — 2 6 0 — 4 3 5 2

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	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 9	0 1	8 9

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

On March 17, 1989, while performing a test on #11 Containment Spray pump, with the plant at 0% power and in Mode 5, the system engineer identified a bent vertical support for a piping restraint (restraint R-2) on the shutdown cooling portion of the Low Pressure Safety Injection (LPSI) suction piping.

The cause of the event was the slamming shut of the #12 LPSI pump discharge check valve when #12 pump was stopped with both LPSI pumps running. This was confirmed by analysis and observation.

Corrective actions included replacing the restraint with a new stronger design, inspecting the LPSI system for additional damage before declaring it operable, and establishing a check valve slam project to address long term effects on the LPSI system.

I. Description of Event

Discovery

On March 17, 1989, while performing a test on #11 Containment Spray pump, with the plant at 0% power and in Mode 5, the system engineer identified a bent vertical support for a piping restraint (restraint R-2) on the LPSI suction piping in Unit 1 (see Figure 1). The system engineer immediately notified the quality control, design engineering, and inservice inspection (ISI) groups. The system engineer then took pictures of the damaged support and along with a design engineer informed the Shift Supervisor that the shutdown cooling system should be declared inoperable due to the bent restraint. Operators made provisions to use the steam generators for decay heat removal, to meet the intent of technical specification requirements, while keeping the shutdown cooling system in service because it was still functional.

Further inspection that evening revealed a 13/16" deflection on the east vertical members of restraint R-2. The design engineer then contacted Bechtel Power Corporation to discuss the problem and develop an action plan that would address the analysis and redesign of restraint R-2.

Design and Approval

The following morning, March 18, design engineering and Bechtel engineering redesigned the supports for R-2 based on the calculated load necessary to deform the supports. After the design was generated and a safety evaluation was written, maintenance personnel began to prefabricate the new supports. At this stage several root causes were postulated but it was believed the damage to the support was probably caused by the slamming shut of #12 LPSI pump discharge check valve when #12 pump was tripped with both LPSI pumps running. That evening the Plant Operations and Safety Review Committee (POSRC) approved the new design and safety evaluation.

Repair Work

On March 19 a Field Engineering Change (FEC-89-01-34) was written and reviewed to approve a change in materials for the new supports. This change in materials was necessary, due to the unavailability of the original material specified in the new design. Later that day the two existing east side vertical members of R-2 were removed and no pipe movement was observed. However, workers did note:

* Both of the east side verticals were bent back about 13/16". The normal distance between the stanchion on the pipe and the vertical members is 1/16".

* The horizontal beams and base plate connected to the vertical members and attached to the ceiling were also damaged. The deflection on the lower flange of the beams was approximately 1/8" and on the upper flange approximately 1/16". FEC 89-01-35 was written to replace the beams and base plate with stronger ones.

As workers started to remove the west side vertical members there was an inadvertent Safety Injection Actuation Signal (SIAS) actuation (LER 317/89-03). The #12 LPSI pump started as a result of the SIAS and the LPSI suction piping moved about 1/16". The #11 LPSI pump was already inservice providing shutdown cooling.

Operators secured the SIAS actuation and when #12 LPSI pump was stopped its discharge check valve slammed shut. When the valve shut, workers in the room watched as the suction piping moved in the east direction (towards the #12 LPSI pump) then west, for a total peak to peak movement of about 1". This movement provided evidence to support the idea on how the R-2 support was bent. After removing the old R-2 restraint the new design was installed.

Follow-on Analysis

On March 20 Bechtel Engineering was contracted to determine if the damaged support would have met its designed function under accident conditions. Additionally, MPR Associates was contracted to perform a root cause analysis of the event.

II. Cause of Event

The supports for the R-2 piping restraint were damaged due to the slamming of #12 LPSI discharge check valve when #12 LPSI pump was stopped while both LPSI pumps were running. The damage most-likely occurred when the check valve slammed shut thereby causing a pressure wave in the west direction with a resulting force in the east direction back towards the pump and the suction piping. The supports were not of sufficient design to withstand the forces generated by the check valve slam.

Evidence confirming that the slamming of the check valve caused the support damage includes:

*U.S. GPO: 1988-520-589-00070

* Piping restraint R-2 was damaged in the east direction.

* Piping boxhangers H-4 and H-3 had skid marks more in the east direction than west.

* Damaged insulation existed on the east end of #12 LPSI pump suction piping.

* Damaged fire barrier (knocked loose) existed at the wall penetration between #11 and #12 ECCS pump rooms.

* Eyewitness accounts of pipe movement as a loud bang was heard, indicating the check valve slammed closed.

The results from MPR's study confirm there was adequate force generated from the check valve slam to cause deformation.

III. Analysis of Event

Piping restraint R-2 is designed to prevent damage to the LPSI suction piping during a seismic event. Bechtel was contracted to determine if the damaged members for R-2 would have been sufficient to withstand a seismic event. Bechtel concluded that the observed deformations of the horizontal and vertical members reflect local yielding of the members. Based on the data supplied to them they felt the supports in this condition could not be considered effective in resisting additional loads and must be considered nonexistent for operability evaluation purposes.

Without the supports, the LPSI piping would have exceeded the code allowable values for piping stress if a seismic event occurred. Further analysis is being performed to determine to what extent the LPSI piping would have failed.

IV. Corrective Actions

Immediate Corrective Actions

Prior to declaring the Unit 2 LPSI system operable the following actions were taken:

1. A new, stronger design for the R-2 restraint was installed.

2. ISI performed a walkdown of Unit 1 low pressure safety injection, high pressure safety injection, containment spray, and component cooling water piping supports. No damage attributable to pipe movement from check valve slams was found.

3. The discharge check valves on #11 and #12 LPSI pumps were tested for backleakage. The results of this test were satisfactory.

4. The #12 LPSI pump was tested to check for excessive vibration caused by possible misalignment due to the event. There were no problems found.

5. The ISI group performed a walkdown of Unit 1 LPSI discharge and suction piping up to the first anchor. The supports adjacent to R-2 received a detailed ASME inspection. No damage attributable to pipe movement was found.

6. The ISI group also performed NDE liquid penetrant testing on six support attachment welds, five suction piping welds and on the LPSI pump suction nozzles welds that experienced the highest loads. The results were satisfactory.

Long-Term Corrective Actions

As a result of this event, a check valve slam investigation project has been initiated to evaluate the effects of repeated LPSI pump discharge check valve slams. The results of this project will be applied, as necessary, to similar systems.

The project team will decide:

1. If there is any benefit in comparing the Unit 1 and Unit 2 shutdown cooling designs;

2. If instrumentation should be added to detect LPSI pipe motion;

3. The benefit of performing a fatigue assessment of the LPSI piping;

4. If there is a need to change operating procedures to prevent check valve slam;

5. If better designed check valves are available.

A supplemental report, to be submitted by 9/1/89, will describe the results and conclusions of our piping analysis and resulting accident analysis.

V. Additional Information

There have been no previous similar events at Calvert Cliffs which involved damaged pipe restraints in the LPSI piping system.

The reportability time clock on this event did not start until it was determined the hanger would not support the LPSI suction piping in a seismic event. The damaged support was found on March 17, 1989 but the preliminary restraint analysis was not completed until May 12, 1989.

Component Identification

Component	IEEE 803 EIIS Funct.	IEEE 805 System ID
#11 Containment Spray pump	P	BE
#12 LPSI pump	P	BP
LPSI discharge Check valve	ISV	BP

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	8 9	— 0 0 7	— 0 0	0 7 OF 0 7

TEXT *(If more space is required, use additional NRC Form 366A's)* (17)

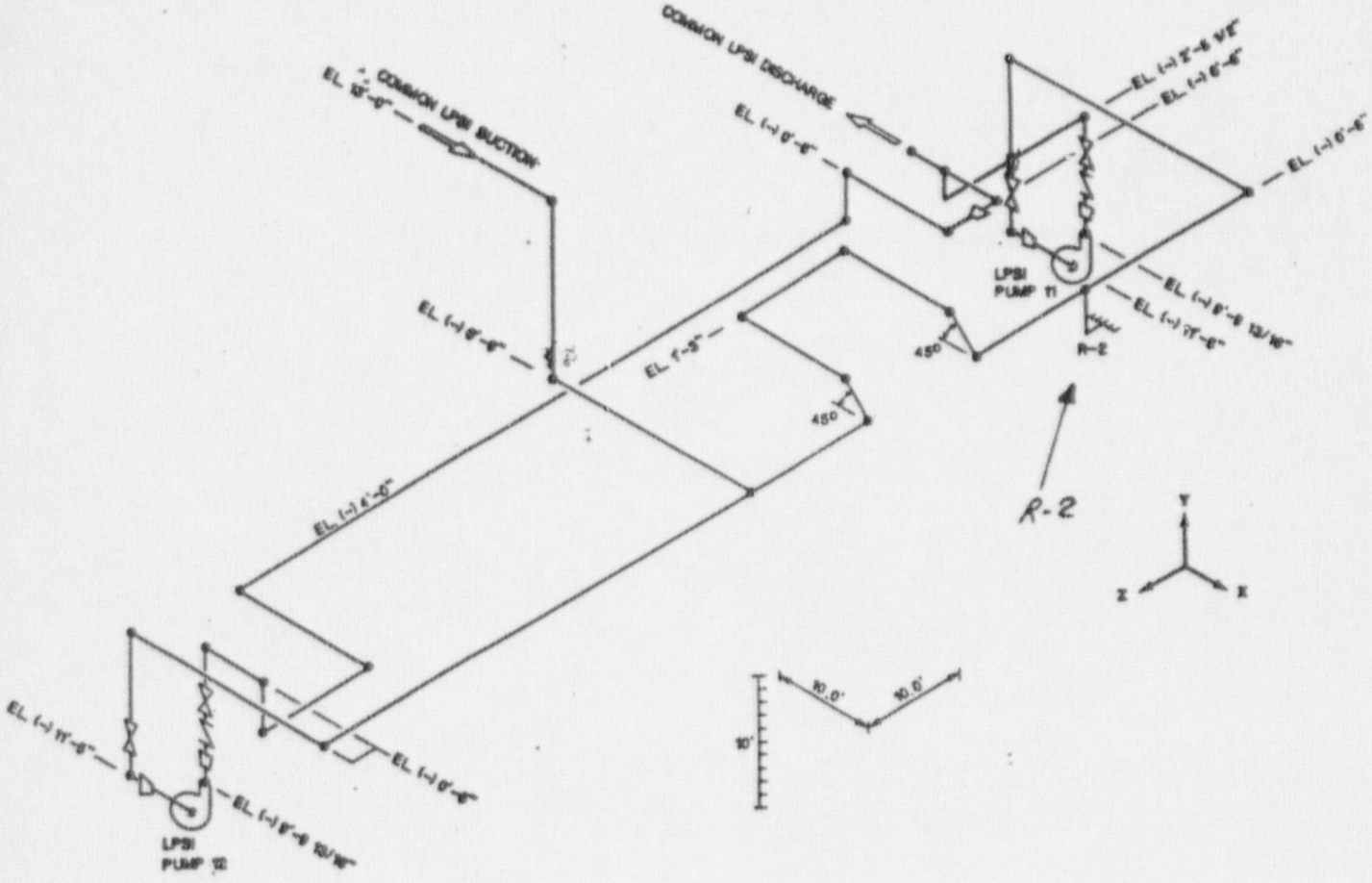

FIGURE 1

UNIT 2 LPSI/SHUTDOWN COOLING PIPING

*U.S. GPO: 1988-520-589