NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

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

TITLE (4)
#11 MSIV inoperable due to excessive actuator piston rod seal leakage

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)
1 2	1 2	8 4	8 4	0 1 8	0 0	0 1	0 9	8 5		0 5 0 0 0
										0 5 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

OPERATING MODE (9)							
POWER LEVEL (10) 1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
	20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
	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)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
	20.405(a)(1)(iv)	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)
J. E. Thorp, Operational Safety Analyst	3 0 1 1 2 6 0 - 4 9 8 3

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
X	S B	8 4	G 2 5 0	Y					
X	S B	S E A L	X 9 9 9	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 1	1 1	8 5

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

On December 3, 1984, oil leakage from the piston rod seal of #11 Main Steam Isolation Valve (MSIV) actuator generated a concern regarding its affect on valve operation. An evaluation was initiated to determine the potential for damage to the valve or its actuator if the valve fast stroked with this hydraulic oil leakage. At 1500 on December 12, 1984, the Plant Operations & Safety Review Committee (POSRC) reviewed the evaluation, and concurred that valve fast closure could result in an impact velocity sufficient to damage the seat to disk seal. Consequently, it was concluded that with this resultant leakage, #11 MSIV could not be relied on to perform its safety function. The POSRC declared the valve inoperable and recommended Unit 1 be shutdown. The Unit was shutdown at 1650. Because the MSIV had fast stroked shut with a degraded actuator piston rod seal after a unit trip on November 20, 1984, seat leakage testing and analysis were performed. Calculated seat leakage was 3.1 lb. m/sec. based on seat leakage measurements made on December 13, 1984 indicating there was insignificant, if any, damage to the valve. A safety analysis concluded the effects of seat leakage and any permanent deformation to be negligible. During actuator overhaul piston seals were also found to be damaged and were replaced. After actuator reassembly, the MSIV was stroke tested satisfactorily and returned to operable status on December 20, 1984.

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On July 28, 1984, a problem with #11 Main Steam Isolation Valve (MSIV) (SB-ISV) hydraulic actuator (SB-84) was identified, noting that when the low pressure hydraulic pump (P) was run (to raise rod end pressure or to fully open the MSIV following partial stroke testing), oil leakage from the actuator's piston rod seal was approximately one gallon per minute. To prevent excessive oil loss, the actuator rod end isolation valve (ISV) was shut, isolating the low pressure hydraulic pump from the piston rod end. The leakage slowed to approximately two gallons per week with the low pressure pump isolated from the piston rod end. Periodic replenishment of oil in the rod end cavity assured MSIV closure no faster than 1.5 seconds, the minimum time recommended by the valve manufacturer, Rockwell-Edwards.

A Preventative Maintenance (PM) procedure was initiated August 2, 1984, to pump up the piston rod end on a weekly basis to ensure the rod end cavity, which holds 29 gallons with the MSIV open, remained full. On September 11, 1984, the PM was discontinued since the weekly partial stroke test of the valves adequately ensured oil was pumped into the rod end cavity. Oil replenishment to the piston rod end cavity was evident. In spite of the leakage, rod end pressure immediately increased when the low pressure pump was aligned to it.

On November 20, 1984, following a unit trip, the MSIVs were fast stroked shut in response to a report of an extraction steam line rupture in the Turbine Building. The source of the rupture was a failed elbow on a steam extraction line to a feedwater heater.

Both MSIVs fast stroked shut with no apparent problem during that event. After the November 20, 1984 outage, the piston rod seal leakage apparently worsened, since attempts to raise rod end pressure met with increasing difficulty.

On December 3, 1984, the #11 MSIV piston rod seal leakage problem was discussed by the General Supervisor-Operations with the Plant Superintendent. At this point, it was decided a safety question might be involved and the concern was forwarded to the plant engineering staff on-site and the Electrical Engineering Department off-site for further evaluation. A preliminary analysis by plant engineering staff indicated that with no fluid in the rod end cavity the MSIV may shut in less than 1.5 seconds, possibly causing valve damage. Damage would be mitigated or prevented, however, by the presence of any fluid in the rod end cavity, and it was noted that #11 MSIV had apparently shut normally on November 20, 1984. Because of the above circumstances, it was decided to await a more detailed analysis of the problem by the Electric Engineering Department (EED) before taking any action.

On December 12, 1984, the requested evaluation was presented to the Plant Operations &

Safety Review Committee (POSRC). The detailed evaluation was based on two engineering analyses conducted by valve and hydraulic control system consultants. With the existing leakage condition, calculations showed it was possible on a fast valve closure to achieve a maximum impact velocity of almost 5.0 ft/sec. The maximum calculated impact velocity which could be sustained and still assure a seat to disk seal is 2.25 ft/sec, according to valve manufacturer calculations. This velocity is based upon the amount of kinetic energy which can be absorbed up to the point of valve seat yielding. Based on this information, the POSRC recommended that #11 MSIV be declared inoperable and at 1500 on December 12, 1984, the Plant Superintendent ordered a Unit 1 shutdown in accordance with the requirements of Technical Specification 3.7.1.5. Operators commenced reducing reactor power at 1505 and declared an Unusual Event due to the inoperability of #11 MSIV. At 1640, the Main Turbine (SB-TRB) was taken off-line and Reactor (AC) shutdown was completed at 1650.

At 1845 on December 12, 1984, #11 MSIV was slowly stroked shut to prevent possible damage to the valve or its actuator. With the valve shut, the hydraulic accumulators were unisolated to perform a one hour pressure drop test across the actuator piston seals (SB-SEAL). Pressure remained steady at 4900 psig on the cap end of the valve actuator throughout the test, indicating the piston seals were performing properly. At 0330 on December 13, 1984, a combined seat leakage test with the Reactor Coolant System (AB) at normal operating temperature and pressure was completed on both MSIVs. Seat leakage testing could not be performed on #11 MSIV alone, but the resulting total calculated leakage from both MSIVs and their bypasses was conservatively applied entirely to #11 MSIV in a safety analysis conducted later to determine valve operability. The total calculated seat leakage rate was 3.1 lb m/sec. At 0815 on December 13, 1984, the unit entered **MODE** 4 and reached **MODE** 5 by 1500 that day. After entering **MODE** 5, disassembly of the #11 MSIV actuator was commenced to inspect and replace the rod seal. When the actuator cap end was opened the cap end piston seal ring was discovered to be partially extruded from its seat and small pieces of piston seal material were found. A complete actuator overhaul was deemed necessary at this point. The actuator was disassembled, rebuilt, and the damaged seals were replaced. Seal ring debris was also found in the flow restrictor valves, which were disassembled and overhauled. A system hydraulic flush was performed to ensure all debris was removed from the system. The various parts which failed are as follows:

MANUFACTURER - UTEX

Rod Seal	"Hytrel" Seal Item Number 11, Drawing Number A72533-200 Part Number A 72533-211

Utex Part Number 0026-98-005300

Piston Seals

"Hytrel" Seal Item Number 6, Drawing Number A72533-200

Greer Part Number A72533-206

Utex Part Number 0026-98-0052-00

The valve actuator overhaul and hydraulic system flush was completed on December 18, 1984.

A safety analysis issued December 19, 1984, considered the effect of the 3.1 lb m/sec calculated leakage past an MSIV on the applicable Design Basis Events, and addressed the damage #11 MSIV may have suffered during the November 20, 1984, fast stroke. This analysis, utilizing information received from Copes-Vulcan, Combustion Engineering, and Rockwell International, showed that the effect of this seat leakage on core response, Containment pressure response, Auxiliary Feedwater Pump performance, and off-site boundary dose is negligible. The possible damage to #11 MSIV was calculated to not exceed five or six mils permanent deformation directly below the stellite seat, with some brinelling at the disk end of the stem expected. This damage is not considered significant, and additional impact loads as a result of normal fast closure of the valve would not increase deformation at the seat or contribute to another failure mode. This analysis concluded that the MSIV will perform its safety function even when considering the above noted leak rate, and this leak rate would have negligible effect on core and plant response.

At 2100 on December 19, 1984, #11 MSIV was tested by performing a fast stroke in accordance with the Surveillance Test Procedure. The valve closed in 3.67 seconds, slightly above the specification of 3.3 seconds plus or minus .3 seconds. The flow restrictor valves were adjusted and the valve was tested satisfactorily with a stroke time of 3.46 seconds at 0350, on December 20, 1984, restoring the valve to operability.

The cause of actuator piston rod seal leakage on #11 MSIV was a failed piston rod seal. It is believed, based upon visual examinations, that the seal failures on the #11 MSIV actuator were due to a combination of aging and accelerated deterioration resulting from higher than normal ambient heat load in the MSIV room caused by a leaking (steam) pressure seal on #12 MSIV. The rod end seals were last replaced on June 22, 1982. New seals made of "Viton", a fluorocarbon elastomer with improved resistance to heat-induced failure over the older material, ethylene propylene rubber, were installed as part of the corrective maintenance conducted on #11 MSIV. These type of seals were installed in the Unit 2 MSIVs during the last Unit 2 refueling outage (April 21 -

July 1, 1984) as part of a modification to improve seal performance, with no problems noted since installation. The performance of the new type seal will be evaluated and an optimum replacement interval will be established.

ASSESSMENT OF SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT

This event occurred with Unit 1 at 100% power in **MODE** 1. At this power level, had the MSIV fast stroked shut in response to a Design Basis Event that required the valve to shut, the potential damage to the valve seat disk or stem could have precluded a complete seat to disk seal. If #12 MSIV had failed to shut, this would have allowed leakage of #12 steam generator inventory through the valve. This leakage would have contributed to the pressure added to the containment for a Main Steam Line Break inside containment. Leakage through both valves would have added to the steam generator inventory released to the atmosphere for a Main Steam Line Break outside containment.

While any damage to #11 MSIV from another such fast stroke as described above may have produced larger than acceptable leakage, the valve would probably have still provided protection against rapid blowdown of the steam generator, mitigating the consequences of any Design Basis Event. In addition, the simultaneous failure of #12 MSIV to fully close would not be considered likely to occur.

Yet, since #12 MSIV experienced difficulty shutting following the plant shutdown on December 12, 1984, (see LER 84-19), a demand on both valves to shut with their respective problems may have produced consequences that are essentially outside the assumptions of the safety analyses, for **MODE** 1-3 operation. Several mitigating aspects of the difficulty with #12 MSIV as discussed in LER 84-19 would reduce the severity of these consequences.

The use of a superior seal material combined with periodic seal replacement should reduce the probability of similar events occurring in the future. Examination of previous LERs dealing with MSIV problems revealed no similar events.

The contact person for this event is J. E. Thorp (301) 260-4983.

BALTIMORE GAS AND ELECTRIC COMPANY

P.O. BOX 1475

BALTIMORE, MARYLAND 21203

NUCLEAR POWER DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

January 11, 1985

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

Docket No. 50-317 (Unit 1)

License No.DPR 53 (Unit 1)

Dear Sirs:

The attached LER 84 - 18 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,

L B Russell

L. B. Russell
Plant Superintendent

LBR:JET:ajm

cc: Dr. Thomas E. Murley
Director, Office of Management Information and Program Control
Messrs: A. E. Lundvall, Jr.
J. A. Tiernan

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