

## PRECURSOR DESCRIPTION AND ANALYSIS

LER No.: 318/85-001  
Event Description: Stuck-Open Atmospheric Dump Valve  
Date of Event: April 25, 1985  
Plant: Calvert Cliffs 2

### EVENT DESCRIPTION

#### Sequence

At 0933 h on April 25, 1985, Unit 2 was manually tripped while operating in Mode 1 (full power) at 100% power. This trip was caused by a rapid degradation of the 21A RCP shaft seal. Both MFW pumps were under manual control at this time. The core scram and turbine trip caused a loss of MFW. No. 21 MFW pump tripped on high pressure, and No. 22 MFW pump was manually tripped. No. 21 RCP was tripped 60 s after the scram. AFW was initiated. No. 21 atmospheric dump valve stuck open, contributing to a RCS cooldown to 517°F. The dump valves malfunctioned because of a fault in the valve positioner. The positioners have a tendency for their internal levers to interfere with one another, causing the levers to disengage, resulting in failure of the valves to close.

By 1000 h the reactor plant was stable, and boration to shutdown had commenced. Subsequently, the plant was cooled down to affect RCP seal replacement.

Two days before the trip, temperature fluctuations (over a 5-h period) in the CCW system had begun to cause large pressure oscillations between the stages of the 21A RCP seal that continued until it degraded and a manual trip was initiated. The 21A seal had exhibited some pressure oscillations in the past.

The seal pressure/temperature fluctuations began when the No. 21A SW heat exchanger was removed from service for maintenance. This removal caused a heat imbalance in the salt-water cooling system. The SW system and the CCW system are both cooled by the salt-water system and operate in parallel to each other. All interfacing systems experienced temperature transients; the CCW experienced the greatest fluctuations. Efforts to control the CCW pressure oscillation (300 to 500 psi  $\Delta P$ ) were unsuccessful.

#### Corrective Action

The RCP seal was replaced, and Unit 2 was restored to operation on May 6, 1985. The SW heat exchanger was returned to service.

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An investigation has been initiated to determine the effect of SW and CCW system transients on RCP operation. Number 21 atmospheric dump valve was repaired, and an inspection program that should prevent similar failures in the future was begun.

#### Plant/Event Data

##### Systems Involved:

SW, salt water, CCW, RCP seal, atmospheric steam dump, MFW

##### Components and Failure Modes Involved:

SW heat exchanger — out for maintenance

CCW — temperature and pressure transients in operation

ASD valve — failed to open in operation

RCP seals — degrade in operation

MFW pumps — trip in transient

Component Unavailability Duration: NA

Plant Operating Mode: 1 (100% power)

Discovery Method: Operational event

Reactor Age: 8.4 years

Plant Type: PWR

#### Comments

Potential for an RCP seal LOCA to occur except plant was aware of RCP seal problems

#### MODELING CONSIDERATIONS AND DECISIONS

#### Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	Nonrecoverable
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#### Branches Impacted and Branch Nonrecovery Estimate

Secondary-side release terminated	0.34	Base-case value
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Secondary-side release terminated; given MFW success	0.34	Base-case value
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MFW	0.34	Base-case value; manually tripped pump was recoverable
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#### Plant Models Utilized

PWR plant Class G

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# CONDITIONAL CORE DAMAGE CALCULATIONS

LER Number: 318/85-001  
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## INITIATING EVENT

### NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.000E+00
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### SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CV	
TRANS	5.609E-05
Total	5.609E-05
CD	
TRANS	1.795E-06
Total	1.795E-06
ATWS	
TRANS	3.000E-05
Total	3.000E-05

### DOMINANT SEQUENCES

End State: CV	Conditional Probability:	5.090E-05
104 TRANS -RT -AFW -PORV.DR.SRV.CHALL SS.RELEAS.TERM HPI		
End State: CD	Conditional Probability:	1.232E-06
119 TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW		
End State: ATWS	Conditional Probability:	3.000E-05
121 TRANS RT		

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# SEQUENCE CONDITIONAL PROBABILITIES

	Sequence	End State	Seq. Prob	Non-Recov**
101	TRANS -RT -AFW PORV.OR.SRV.CHALL -PORV.OR.SRV.RESEAT SS.RELE AS.TERM HPI	CV	2.119E-06	1.766E-01
102	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI	CD	3.998E-08	5.000E-02
104	TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI	CV	5.090E-05 *	1.768E-01
113	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI PORV.OPEN -SS.DEPRESS COND/MFW	CD	2.942E-07	2.996E-02
118	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW	CV	2.392E-06	2.527E-03
119	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW	CD	1.232E-06 *	1.302E-03
120	TRANS -RT AFW MFW HPI(F/B) SS.DEPRESS	CD	1.353E-07	3.829E-03
121	TRANS RT	ATWS	3.000E-05 *	1.200E-01

\* dominant sequence for end state

\*\* non-recovery credit for edited case

## Note:

Conditional probability values are differential values which reflect the added risk due to observed failures. Parenthetical values indicate a reduction in risk compared to a similar period without the existing failures.

MODEL: b:pwrgtree.cmp

DATA: b:calvprob.cmp

No Recovery Limit

## BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.030E-03	1.000E+00	
LOOP	2.280E-05	3.400E-01	
LOCA	2.560E-02	3.400E-01	
RT	2.500E-04	1.200E-01	
RT/LOOP	0.000E+00	1.000E+00	
EMERG.POWER	5.415E-04	5.100E-01	
AFW	1.020E-03	2.700E-01	
AFW/EMERG.POWER	5.000E-02	3.400E-01	
MFW	2.000E-01 > 1.000E+00	3.400E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob: 2.000E-01 > Failed			
PORV.OR.SRV.CHALL	4.000E-02	1.000E+00	
PORV.OR.SRV.RESEAT	2.000E-02	5.000E-02	
PORV.OR.SRV.RESEAT/EMERG.POWER	2.000E-02	5.000E-02	
SS.RELEAS.TERM	1.500E-02 > 1.000E+00	3.400E-01	
Branch Model: 1.0F.1			

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Train 1 Cond Prob:	1.500E-02 > Failed		
SS.RELEAS.TERM/-MFW	1.500E-02 > 1.000E+00	3.400E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.500E-02 > Failed		
SS.DEPRESS	3.600E-02	1.000E+00	
COND/MFW	1.000E+00	3.400E-01	
HPI	3.000E-04	5.200E-01	
HPI(F/B)	3.000E-04	5.200E-01	4.000E-02
PORV.OPEN	1.000E-02	1.000E+00	
HPR/-HPI	1.000E-03	1.000E+00	
CSR	2.000E-03	3.400E-01	

\*\*\* forced

JD HARRIS  
10-07-1986  
14:50:06

Event Identifier: 318/B5-001