

## PRECURSOR DESCRIPTION SHEET

LER No.: 336/84-012  
Event Description: Trip, LOFW, and AFW Degraded  
Date of Event: November 28, 1984  
Plant: Millstone 2

### EVENT DESCRIPTION

#### Sequence

The unit had been operating at 100% power when a tube leak was detected in feedwater heater 5A. An orderly shutdown of the unit had been under way for some time when a steady rise in the level in the feedwater heater 5A was noted. The reactor was then tripped to protect the turbine from water intrusion. At the time of the trip, the unit was operating at 62% power.

Following the trip, standard posttrip actions were carried out. In addition, trip recovery procedures were also followed. When the "B" steam generator feed pump was taken to minimum speed, the level in both SGs started decreasing. The "B" SG feed pump was secured due to low discharge pressure, and AFW flow was initiated. The level in the SG 1 increased while the level in SG 2 continued to decrease. AFW flow to SG 2 was increased with no effect on the level decrease in SG 2. Operations personnel noted steam escaping from the "B" SG feed pump. It was theorized that the MFV check valve to the SG 2 (2-FW-5B) failed to seat, thus resulting in a backflow of AFW to the "B" SG feed pump. At this time, the feed-regulating valves, the feed-regulating block valves, and the SG feed pump discharge valves were shut. Level in SG 2 was brought on scale and returned to normal.

The unit was placed in hot standby (mode 3). The tubes in the feedwater heater 5A were inspected and plugged as required. An inspection of the malfunctioning check valve, 2-FW-5B, determined that the valve stem had bound up slightly, not allowing the valve to seat. Adjustments were made to the valve, and its operability was evaluated through in-service test T84-36. The valve was deemed operable before the unit was returned to 100% power operation.

#### Corrective Action

Check valves 2-FW-5A and 2-FW-5B were inspected and reworked during the 1985 refueling outage. The rework consisted of machining a spacer ring internal to the valves to eliminate binding. The valve vendor concurred with this modification.

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Plant/Event Data

Systems Involved:

AFW, MFW

Components and Failure Modes Involved:

MFW check valve — failed in operation

MFW pump — failed in operation

AFW train flow — degraded

Component Unavailability Duration: NA

Plant Operating Mode: 1 (62% power)

Discovery Method: Operational event

Reactor Age: 9.1 years

Plant Type: PWR

Comments

For information concerning a similar event, see: J. W. Minarick and J. D. Harris, Analysis of the November 21, 1985, San Onofre 1 Transient from the Standpoint of Potential Severe Core Damage, ORNL Letter Report from J. R. Buchanan to F. J. Hebdon, Office for Analysis and Evaluation of Operational Data, U.S. Nuclear Regulatory Commission, January 17, 1986.

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	No recovery (manual trip)
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Branches Impacted and Branch Nonrecovery Estimate

AFW	Base case	Degraded flow, one train failed
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MFW	1.0	No recovery assumed
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Plant Models Utilized

PWR plant Class G

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 336/84-012  
 Event Description: Trip With LDFW and AFW Degraded  
 Event Date: 11/28/84  
 Plant: Millstone 2

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
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CV

TRANS	5.3E-05
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Total	5.3E-05
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CD

TRANS	3.0E-05
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Total	3.0E-05
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ATWS

TRANS	3.0E-05
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Total	3.0E-05
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DOMINANT SEQUENCES

End State: CV	Conditional Probability:	4.1E-05
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118 TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW

End State: CD	Conditional Probability:	2.1E-05
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119 TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW

End State: ATWS	Conditional Probability:	3.0E-05
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121 TRANS RT

SEQUENCE CONDITIONAL PROBABILITIES

	Sequence	End State	Prob	N Rec**
112	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI PORV.OPEN -SS.DEPRESS -COND/MFW	CV	9.7E-06	1.8E-01
113	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI PORV.OPEN -SS.DEPRESS COND/MFW	CD	5.0E-06	9.2E-02
118	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW	CV	4.1E-05 *	9.3E-02
119	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW	CD	2.1E-05 *	4.8E-02
120	TRANS -RT AFW MFW HPI(F/B) SS.DEPRESS	CD	2.3E-06	1.4E-01
121	TRANS RT	ATWS	3.0E-05 *	1.2E-01

\* dominant sequence for end state

\*\* non-recovery credit for edited case

MODEL: b:\PWRGTREE.CMP

DATA: b:\MILL2PRO.CMP

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.0E-03	1.0E+00	
LOOP	2.3E-05	3.4E-01	
LOCA	4.2E-06	3.4E-01	
RT	2.5E-04	1.2E-01	
RT/LOOP	0.0E+00	1.0E+00	
EMERG.POWER	5.4E-04	5.1E-01	
AFW	1.0E-03 > 5.9E-03	2.7E-01	
Branch Model: 1.OF.3+ser			
Train 1 Cond Prob:	2.0E-02 > Failed		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	5.0E-02		
Serial Component Prob:	9.2E-04		
AFW/EMERG.POWER	5.0E-02	3.4E-01	
MFW	2.0E-01 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	2.0E-01 > Failed		
PORV.OR.SRV.CHALL	2.0E-02	1.0E+00	
PORV.OR.SRV.RESEAT	1.0E-02	1.2E-01	
PORV.OR.SRV.RESEAT/EMERG.POWER	1.0E-02	1.2E-01	
SS.RELEAS.TERM	1.5E-02	3.4E-01	
SS.RELEAS.TERM/-MFW	1.5E-02	3.4E-01	
SS.DEPRESS	3.6E-02	1.0E+00	

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COND/MFW	1.0E+00	3.4E-01	
HPI	3.0E-04	5.2E-01	
HPI(F/B)	3.0E-04	5.2E-01	4.0E-02
PORV.OPEN	1.0E-02	1.0E+00	
HPR/-HPI	1.0E-03	1.0E+00	
CSR	2.0E-03	3.4E-01	

\*\*\* forced

Minarick  
04-12-1987  
16:23:05

Event Identifier: 336/84-012