PRECURSOR DESCRIPTION AND ANALYSIS

LER No.: 269/85-007
Event Description: LOFW and Stuck-Open Relief Valves
Date of Event: April 25, 1985
Plant: Oconee 1

EVENT DESCRIPTION

Sequence

On April 25, 1985, at 0533 h, Oconee 1 tripped from 94% full power when both MFW pumps tripped on high discharge pressure. The trip occurred because of a chain of events that began at 0448 h with alarms actuating on five separate static inverters. In actual fact, there was only a consecutive failure of one static inverter and a related static transfer switch. Most of the Unit 1 control room statalarm panelboards and chart recorders were disabled when the 1KX static transfer failed to occur, incorrectly indicating that four other inverters had failed. A loss of power occurred to the MFW pump turbine controls. When power was restored, feedwater flow oscillations developed because of integrated control system action, and the feedwater pumps tripped shortly thereafter. A reactor trip followed the feedwater pump trip.

Main steam relief valves (MSRVs) lifted to reduce secondary side pressure. MSRVs failed to reseat until main steam pressure was reduced to 900 psig in loop A and 835 psig in loop B. Emergency feedwater pumps actuated and maintained adequate steam generator loads.

Corrective Action

The immediate corrective actions ensured that the unit was stabilized at hot shutdown conditions. The problem was investigated, and the failed components were identified and repaired.

Plant/Event Data

Systems Involved:
MFW, 1KX auxiliary power system, main steam relief

Components and Failure Modes Involved:
MFW pumps — tripped on high discharge pressure caused by inverter failure
MSRVs — failed to close on demand (1MS-4, 1MS-8, and 1MS-10)

Component Unavailability Duration: NA
Plant Operating Mode: 94% power
Discovery Method: Operational event
Reactor Age: 12.0 years
Plant Type: PWR

Comments

None

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	Nonrecoverable

Branches Impacted and Branch Nonrecovery Estimate

MFW	0.12	Failure was recoverable from the control room but was not a routine action because of the flow oscillations and confusion from the control power failures
Secondary-side release terminated	0.12	MSRVs were reseated from the control room after main steam pressure was reduced from the control room, a non-routine action
Secondary-side release terminated; given MFW success	0.12	Same rationale as above

Plant Models Utilized

PWR plant Class D

Event Identifier: 269/85-007

CONDITIONAL CORE DAMAGE CALCULATIONS

LER Number: 269/85-007
Event Description: LOFW and Stuck Open Relief Valves
Event Date: 4/25/85
Plant: Oconee 1

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.000E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CV	
TRANS	2.094E-05
Total	2.094E-05
CD	
TRANS	2.098E-06
Total	2.098E-06
ATWS	
TRANS	3.000E-05
Total	3.000E-05

DOMINANT SEQUENCES

End State: CV Conditional Probability: 1.722E-05

109 TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI

End State: CD Conditional Probability: 1.075E-06

103 TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HPR/-HPI -SS.DEPRESS LPR/-HPI.HPR

End State: ATWS Conditional Probability: 3.000E-05

128 TRANS RT

Event Identifier: 269/85-007

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	1.496E-06	6.240E-02
102	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI -SS.DEPRESS -LPR/-HPI.HPR	CV	5.293E-07	2.964E-03
103	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI -SS.DEPRESS LPR/-HPI.HPR	CD	1.075E-06 *	2.964E-03
104	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI SS.DEPRESS	CD	5.989E-08	2.964E-03
109	TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI	CV	1.722E-05 *	6.240E-02
122	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS -COND/MFW	CV	8.397E-07	1.217E-03
123	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS COND/MFW	CD	4.326E-07	6.269E-04
124	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI SS.DEPRESS	CD	4.751E-08	1.844E-03
125	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW	CV	8.441E-07	8.920E-04
126	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW	CD	4.348E-07	4.595E-04
127	TRANS -RT AFW MFW HPI(F/B) SS.DEPRESS	CD	4.776E-08	1.351E-03
128	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 failures associated with an event.
Parenthetical values indicate a reduction in risk compared to a similar period without the existing failures.

MODEL: b:pwrdtree.cmp
DATA: b:oconprob.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	4.170E-06	3.400E-01	
RT	2.500E-04	1.200E-01	
RT/LOOP	0.000E+00	1.000E+00	
EMERG.POWER	1.000E-03	1.000E+00	
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 > 1.200E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	2.000E-01 > Failed		

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PORV.OR.SRV.CHALL	8.000E-02	1.000E+00	
PORV.OR.SRV.RESEAT	1.000E-02	5.000E-02	
PORV.OR.SRV.RESEAT/EMERG.POWER	1.000E-02	5.000E-02	
SS.RELEAS.TERM	1.500E-02 > 1.000E+00	3.400E-01 > 1.200E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.500E-02 > Failed		
SS.RELEAS.TERM/-MFW	1.500E-02 > 1.000E+00	3.400E-01 > 1.200E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.500E-02 > Failed		
HPI	3.000E-04	5.200E-01	
HPI(F/B)	3.000E-04	5.200E-01	4.000E-02
HPR/-HPI	3.000E-03	5.600E-01	4.000E-02
SS.DEPRESS	3.600E-02	1.000E+00	
COND/MFW	1.000E+00	3.400E-01	
LPI/HPI	2.000E-03	3.400E-01	
LPR/-HPI.HPR	6.700E-01	1.000E+00	
LPR/HPI	1.000E-03	1.000E+00	

*** forced

Austin
08-11-1986
17:52:25

Event Identifier: 269/85-007