PRECURSOR DESCRIPTION SHEET

LER No.:   311/85-018
Event Description: Component Cooling Water System Unavailable
Date of Event: August 27, 1985
Plant: Salem 2

EVENT DESCRIPTION

Sequence

On August 26, 1985, the No. 21 CCW system heat exchanger was removed from service to repair a flange leak on 21SW127 (the regulating valve for the No. 21 component-cooling heat exchanger). On August 27, 1985, the outlet valve (22SW356) transferred closed on the redundant No. 22 component-cooling heat exchanger. Attempts to manually open the outlet valve failed to restore adequate service water flow through the heat exchanger.

Only 4,400 gal/min could be supplied (10,000 gal/min was required). At 0310 h, a controlled shutdown was initiated. Mode 3 (hot standby) was achieved at 0430 h. The No. 21 component-cooling heat exchanger was restored to an operable status, and the cooldown was terminated at 0820 h. The malfunction of the outlet valve actuator (22SW356) on the No. 22 component-cooling heat exchanger was attributed to a vibration-induced failure that caused the valve actuator to separate from the valve stem. The Salem Unit 2 plant was restarted on August 28, 1985, and criticality was achieved at 0503 h.

The CCW provides cooling for the following systems - safety and non-safety related.

1. residual heat exchangers;
2. reactor coolant pump motor bearing oil coolers and thermal barriers;
3. letdown heat exchanger;
4. excess letdown heat exchanger;
5. seal water heat exchanger;
6. spent fuel pool heat exchanger;
7. Sample heat exchangers (Unit 1 CCW system serves the sample heat exchangers for both units);
8. boric acid evaporator condenser and condensate cooler;
9. cooling for RHR, safety injection, and charging pumps; and
10. waste disposal system components.

Design flow rates under various conditions are tabulated in undated FSAR Table 9.2-3 (Table E.3).

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E-139

Although the 4400-gal/min flow would be sufficient for the large LOCA situation with sump-recirculation only, it is inadequate for other initiating events in which a cooldown is required. The CCW flow for the more frequent initiators is therefore inadequate.

Corrective Action

The outlet valve actuator (22SW356) on the No. 22 component-cooling heat exchanger was replaced and tested, and the No. 22 component-cooling heat exchanger was restored to operable status before the plant was restarted.

Plant/Event Data

Systems Involved:
   Service water and CCW

Components and Failure Modes Involved:
   Outlet valve (22SW356) on No. 22 component-cooling heat
    exchanger — transferred closed

Component Unavailability Duration: CCW system, 5 h
Plant Operating Mode: 1 (100% power)
Discovery Method: Operational event
Reactor Age: 5.1 years
Plant Type: PWR

Comments

It may be possible to reduce the heat loads on the CCW so that it can function acceptably for the cooldown requirements; this possibility, however, cannot be clearly identified from the data available. For this reason, operability is assumed inadequate.

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient, LOOP,   Base case
 small LOCA
 (postulated
 events)

Branches Impacted and Branch Nonrecovery Estimate

HPI	Base case	One train assumed unavailable
HPR/-HPI	1.0	Assumed failed
LPI	Base case	One train assumed unavailable
LPR	1.0	One train assumed unavailable

Plant Models Utilized

PWR plant Class B

LER Number: 311/85-018
Event Description: Component Cooling Water System Unavailable
Event Date: 8/27/85
Plant: Salem 2

UNAVAILABILITY, DURATION= 5

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS   5.150E-03
LOOP   3.876E-05
LOCA   7.089E-06

SEQUENCE CONDITIONAL PROBABILITY SUMS

         End State/Initiator   Probability

CV

      TRANS   1.765E-07
      LOOP   2.300E-11
      LOCA   (6.236E-08)

      Total   1.142E-07

CD

      TRANS   2.305E-07
      LOOP   1.121E-08
      LOCA   6.856E-06

      Total   7.098E-06

ATWS

      TRANS   0.000E+00
      LOOP   0.000E+00
      LOCA   0.000E+00

      Total   0.000E+00

DOMINANT SEQUENCES

End State: CV   Conditional Probability: 1.177E-07

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

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End State: CD   Conditional Probability: 6.609E-06

302   LOCA -RT -AFW -HPI HPR/-HPI -SS.DEPRESS LPR/-HPI.HPR

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	4.898E-09	1.766E-01
109	TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI	CV	1.177E-07 *	1.768E-01
122	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS -COND/MFW	CV	5.600E-08	5.356E-02
302	LOCA -RT -AFW -HPI HPR/-HPI -SS.DEPRESS LPR/-HPI.HPR	CD	6.609E-06 *	3.139E-01
303	LOCA -RT -AFW -HPI HPR/-HPI SS.DEPRESS	CD	2.433E-07	3.139E-01
304	LOCA -RT -AFW HPI -SS.DEPRESS -LPI/HPI -LPR/HPI	CV	3.152E-08	1.768E-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:pwrbtree.cmp
DATA: b:salempro.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	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	3.400E-01	
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	3.400E-01	
SS.RELEAS.TERM/-MFW	1.500E-02	3.400E-01	
HPI	1.000E-03 > 1.000E-02	5.200E-01	

   Branch Model: 1.OF.2

Event Identifier: 311/85-018

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        Train 1  Cond Prob:        1.000E-02
        Train 2  Cond Prob:        1.000E-01 > Unavailable
HPI(F/B)                           1.000E-03 > 1.000E-02         5.200E-01                        4.000E-02
        Branch Model: 1.OF.2+opr
        Train 1  Cond Prob:        1.000E-02
        Train 2  Cond Prob:        1.000E-01 > Unavailable
HPR/-HPI                           3.000E-03 > 1.000E+00         5.600E-01 > 1.000E+00   4.000E-02
        Branch Model: 1.OF.2+opr
        Train 1  Cond Prob:        3.000E-02 > Unavailable
        Train 2  Cond Prob:        1.000E-01 > Unavailable
PORV.OPEN                          1.000E-02                     1.000E+00
SS.DEPRESS                         3.600E-02                     1.000E+00
COND/MFW                           1.000E+00                     3.400E-01
LPI/HPI                            1.000E-03 > 1.000E-02         3.400E-01
        Branch Model: 1.OF.2
        Train 1  Cond Prob:        1.000E-02
        Train 2  Cond Prob:        1.000E-01 > Unavailable
LPR/-HPI.HPR                       6.700E-01 > 1.000E+00         1.000E+00
        Branch Model: 1.OF.1
        Train 1  Cond Prob:        6.700E-01 > 1.000E+00
LPR/HPI                            1.000E-03 > 1.000E-02         1.000E+00
        Branch Model: 1.OF.2
        Train 1  Cond Prob:        1.000E-02
        Train 2  Cond Prob:        1.000E-01 > Unavailable


111  forced



JD HARRIS
10-07-1986
15:09:49
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Event Identifier: 311/85-018