

PRECURSOR DESCRIPTION SHEET

LER No.: 388/84-006, -008
Event Description: Trip and LOFW with "B" LPCI Train Unavailable
Date of Event: May 27, 1984
Plant: Susquehanna 2

EVENT DESCRIPTION

Sequence

At 0530 h, on May 27, 1984, shutdown of the reactor commenced from low-power testing due to the inoperability of the "B" Loop of the LPCI system, which had occurred 7 d earlier. The shutdown was being accomplished by inserting control rods individually into the reactor's core by utilizing the rod pull sheet until all of the control rods were at the full-in position. Shutdown proceeded normally until at 0605 h, when it was observed that TBV 1 would not close below the 18% open position. Shutdown of the Unit 2 reactor was halted, and control rods in Group 5 were pulled sequentially to maintain reactor pressure with the TBV 1 controlling at a position slightly greater than 18%.

Instrumentation and Control and Mechanical Maintenance personnel were sent to investigate the valve's failure to close. These investigations determined that TBV 1 could not be closed below 18%. It was then determined that the best means available for shutting down the reactor would be with an reactor protection system manual scram. At 1346 h, the Unit 2 reactor was manually scrammed, and at RV pressure of 700 psig all inboard MSIVs were closed, thus isolating the TBV.

Subsequent investigations of the EHC pressure control and TBV control logic indicated that all control functions were operating normally. Investigation of TBV 1 revealed that a chipping hammer was wedged between the valve seat and the valve disk, preventing TBV 1 from fully closing.

Although a sizeable portion of the handle and the head of the hammer itself remained intact, a spring portion, small in comparison to the overall dimensions of the hammer, is believed to have been severed from the handle. This severed portion would most likely be deposited in the TBS's sparger into the main condenser, posing no threat to components in other parts of the system.

Corrective Action

Disassembly of TBV 1 showed small dents on the disk and the seat of the valve. The valve's seat was machined to remove the dents, the disk was replaced due to the difficulties in removing the old disk, and the valve was returned to service.

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A review of unit work documents indicates TBV system was one of the last systems worked on prior to startup for preoperational testing. Based on this review and the fact that system flushes are performed as part of the Preoperational Test Program, it is concluded that the occurrence of this loose tool in the unit's piping is an isolated event.

Plant/Event Data

Systems Involved:

LPCI, TBV

Components and Failure Modes Involved:

LPCI injection valve — failed during operation

TBV — stuck open in operation

Component Unavailability Duration: NA

Plant Operating Mode: 2 (2% power)

Discovery Method: Operational event

Reactor Age: 0.1 year

Plant Type: BWR

Comments

None

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	Nonrecoverable
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Branches Impacted and Branch Nonrecovery Estimate

PCS	1.0	Unavailable because of MSIV closure
MFW	1.0	Unavailable because of MSIV closure
LPCI	Base case	Degraded; one train failed
RHR (SDC)	Base case	Degraded; one train failed

Plant Models Utilized

BWR plant Class C

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

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INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CV	
TRANS	1.1E-06
Total	1.1E-06
CD	
TRANS	3.3E-04
Total	3.3E-04
ATWS	
TRANS	2.0E-05
Total	2.0E-05

DOMINANT SEQUENCES

End State: CV Conditional Probability: 4.9E-07

134 TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS
 -COND/FW.PCS -RHR(SDC)

End State: CD Conditional Probability: 2.4E-04

102 TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM -SRV.CLOSE FW/PCS.TRANS -HPCI RHR(SDC) RHR(SPCOOL)
)/-LPCI.RHR(SDC) C.I.AND.V/RHR(SDC),RHR(SPCOOL)

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End State: ATWS

Conditional Probability: 2.0E-05

173 TRANS SCRAM SLC.OR.RODS

SEQUENCE CONDITIONAL PROBABILITIES

	Sequence	End State	Prob	N Rec**
102	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM -SRV.CLOSE FW /PCS.TRANS -HPCI RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	2.4E-04 *	1.1E-01
103	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM -SRV.CLOSE FW /PCS.TRANS HPCI -RCIC/TRANS.OR.LOOP RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	1.4E-05	6.5E-02
111	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM SRV.CLOSE -FW /PCS.LOCA RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V /RHR(SDC).RHR(SPCOOL)	CD	9.5E-06	7.6E-02
119	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM SRV.CLOSE FW /PCS.LOCA HPCI RCIC/LOCA SRV.ADS	CD	4.8E-05	1.9E-01
134	TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS -COND/FW.PCS -RHR(SDC)	CV	4.9E-07 *	2.1E-01
135	TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS -COND/FW.PCS RHR(SDC) - RHR(SPCOOL)/-LPCI.RHR(SDC)	CV	2.0E-08	7.3E-02
138	TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS COND/FW.PCS -LPCS -RHR(SDC)	CV	2.5E-07	1.1E-01
155	TRANS SCRAM -SLC.OR.RODS PCS/TRANS SRV.CLOSE FW/PCS.LOCA HPCI RCIC/LOCA -SRV.ADS -COND/FW.PCS -RHR(SDC)	CV	2.4E-07	1.2E-01
159	TRANS SCRAM -SLC.OR.RODS PCS/TRANS SRV.CLOSE FW/PCS.LOCA HPCI RCIC/LOCA -SRV.ADS COND/FW.PCS -LPCS -RHR(SDC)	CV	1.2E-07	6.4E-02
173	TRANS SCRAM SLC.OR.RODS	ATWS	2.0E-05 *	1.0E+00

* dominant sequence for end state

** non-recovery credit for edited case

MODEL: b:\bwrctree.cmp

DATA: b:\susqprob.cmp

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.1E-03	1.0E+00	
LOOP	1.3E-05	3.4E-01	
LOCA	3.3E-06	3.4E-01	
SCRAM	4.1E-04	1.0E+00	

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SLC.OR.RODS	1.0E-02	1.0E+00	4.0E-02
PCS/TRANS	1.7E-01 > 1.0E+00	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.7E-01 > Unavailable		
PCS/LOCA	1.0E+00	1.0E+00	
SRV.CHALL/TRANS.-SCRAM	1.0E+00	1.0E+00	
SRV.CHALL/TRANS.SCRAM	1.0E+00	1.0E+00	
SRV.CHALL/LOOP.-SCRAM	1.0E+00	1.0E+00	
SRV.CHALL/LOOP.SCRAM	1.0E+00	1.0E+00	
SRV.CLOSE	5.3E-02	1.0E+00	
EMERG.POWER	5.4E-04	5.1E-01	
FW/PCS.TRANS	4.6E-01 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	4.6E-01 > Unavailable		
FW/PCS.LOCA	1.0E+00	3.4E-01	
HPCI	1.0E-01	5.7E-01	
RCIC/TRANS.OR.LOOP	6.7E-02	5.7E-01	
RCIC/LOCA	1.0E+00	1.0E+00	
CRD	1.0E-02	1.0E+00	4.0E-02
SRV.ADS	6.7E-03	1.0E+00	4.0E-02
COND/FW.PCS	1.0E+00	3.4E-01	
LPCS	3.0E-03	3.4E-01	
LPCI(RHR)/LPCS	4.0E-04 > 1.0E-01	3.4E-01	
Branch Model: 1.0F.2			
Train 1 Cond Prob:	4.0E-03 > Failed		
Train 2 Cond Prob:	1.0E-01		
RHRSW/LPCS.LPCI.TRANS	5.0E-01	1.0E+00	4.0E-02
RHRSW/LPCS.LPCI.LOOP	5.0E-01	1.0E+00	4.0E-02
RHRSW/LPCS.LPCI.LOCA	5.0E-01	1.0E+00	4.0E-02
RHR(SDC)	2.0E-02 > 1.2E-01	3.4E-01	
Branch Model: 1.0F.2+ser			
Train 1 Cond Prob:	4.0E-03 > Failed		
Train 2 Cond Prob:	1.0E-01		
Serial Component Prob:	2.0E-02		
RHR(SDC)/-LPCI	2.0E-02	3.4E-01	
RHR(SDC)/LPCI	1.0E+00	1.0E+00	
RHR(SPCOOL)/-LPCI.RHR(SDC)	2.0E-02	1.0E+00	
RHR(SPCOOL)/LPCI.RHR(SDC)	5.2E-01	1.0E+00	
C.I.AND.V/RHR(SDC).RHR(SPCOOL)	1.0E+00	3.4E-01	

*** forced

Minarick
04-12-1987
12:26:50

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