

B.28-1

B.28 LER No. 325/82-041

Event Description: Both RHRSW Loops Simultaneously Inoperable

Date of Event: March 25, 1982

Plant: Brunswick 1

B.28.1 Summary

Loop B of the residual heat removal (RHR) service water (SW) system was found to be inoperable during a period when loop A was tagged out for maintenance. The estimated increase in core damage probability, or importance, over the duration of the event is 4.7×10^{-5} . The base-case core damage probability (CDP) over the duration of the event is 2.9×10^{-7} , resulting in an estimated conditional core damage probability (CCDP) of 4.7×10^{-5} .

B.28.2 Event Description

During power operations, an auxiliary operator discovered that the motor cooler isolation valves to 1B and 1D pumps were open with the pumps not running. Investigating, he found that the breaker which supplied the motor cooler isolation valves had tripped, de-energizing the valves as well as the B loop RHRSW low-suction header pressure switches. In turn, this rendered the B loop of RHRSW inoperable. At the same time, loop A RHRSW was tagged out for maintenance.

B.28.3 Additional Event-Related Information

Loop B of RHRSW had been flushed approximately two days prior to the event, which entailed manipulation of the breaker in question.

B.28.4 Modeling Assumptions

It was assumed that RHRSW loop B was unavailable from the time of the system flush until discovery of the mispositioned breaker. Loop A was assumed to have been unavailable throughout this period as well. This event was modeled as a two-day unavailability of RHRSW and, accordingly, of RHR. The RHRSW pumps at Brunswick maintain a positive pressure differential between the tube and shell side of the RHR heat exchangers, which prevents primary coolant leakage into the service water (SW) system. Adequate decay heat removal can be provided using the SW pump if valves FO68A and B are locally opened. This action is addressed in the Brunswick individual plant examination (IPE), and an operator error probability of 0.01 was estimated. To address this section, the nonrecovery probability for RHR was revised to 0.01 to reflect the probability of the operators failing to open FO68A and B. For sequences involving potential RHR and PCS recovery, the nonrecovery estimate was revised to 0.01×0.52 (see Appendix A), or 5.2×10^{-3} .

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B.28.5 Analysis Results

The estimated increase in core damage probability over the duration of the event is 4.7×10^{-5} . The base-case CDP (not shown in calculation) is 2.9×10^{-7} , resulting in an estimated CCDP of 4.7×10^{-5} . The dominant core damage sequence, highlighted on the event tree in Figure B.28.1, involves a transient with failure of the power conversion system, main feedwater success, and RHR failure.

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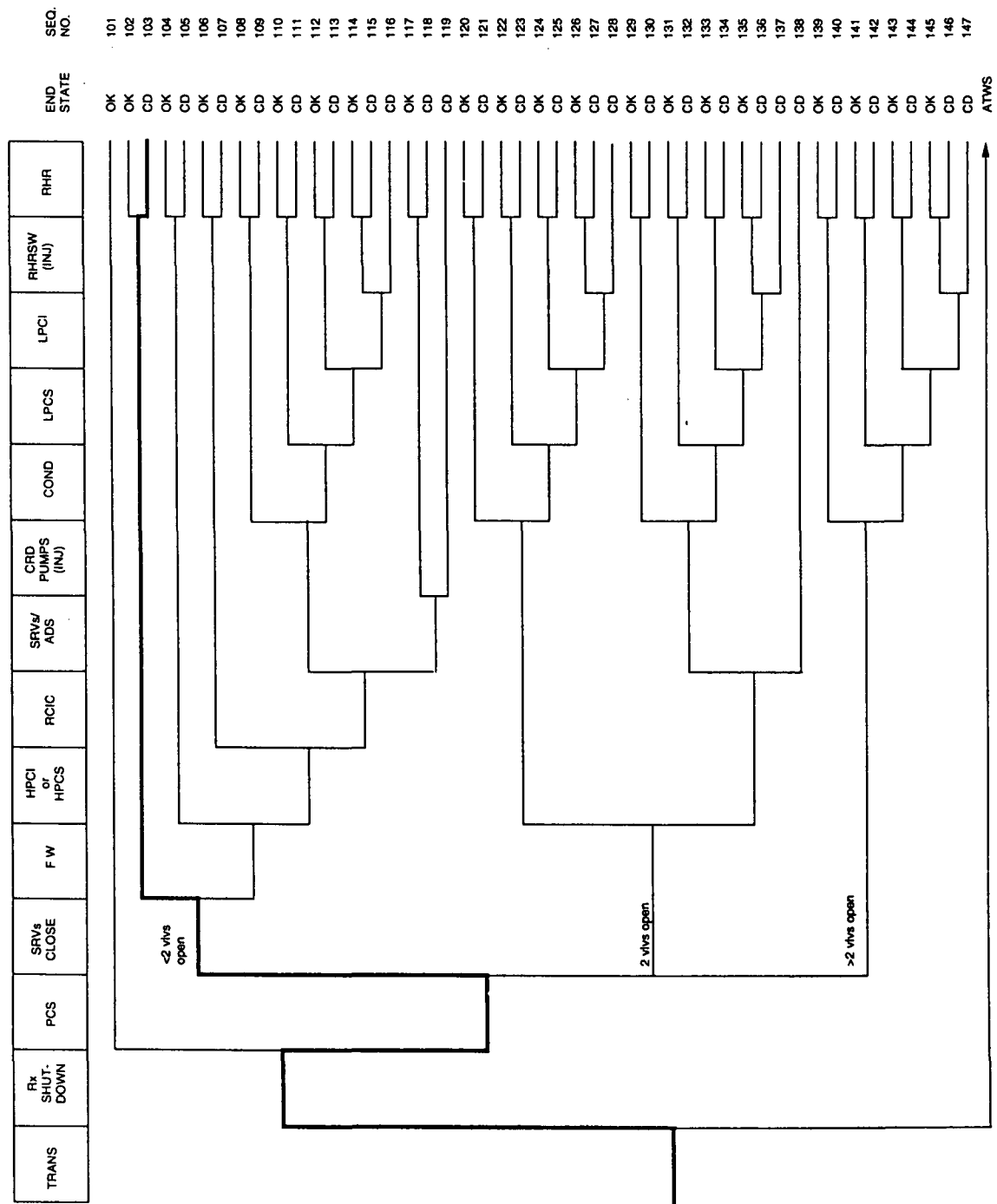


Figure B.28.1 Dominant core damage sequence for LER 325/82-041

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 325/82-041
Event Description: Both RHRSW loops simultaneously inoperable
Event Date: March 25, 1982
Plant: Brunswick 1

UNAVAILABILITY, DURATION= 48

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	5.0E-02
LOOP	2.8E-04
LOCA	1.1E-04

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	4.4E-05
LOOP	2.8E-06
LOCA	1.8E-07
Total	4.7E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
103 trans -rx.shutdown pcs srv.ftc.<2 -mfw RHR.AND.PCS.NREC	CD	3.7E-05	4.6E-03
105 trans -rx.shutdown pcs srv.ftc.<2 mfwdhpci RHR.AND.PCS.NREC	CD	6.6E-06	1.8E-03
202 loop -rx.shutdown -ep srv.ftc.<2 -hpci RHR	CD	2.7E-06	3.6E-03

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
103 trans -rx.shutdown pcs srv.ftc.<2 -mfw RHR.AND.PCS.NREC	CD	3.7E-05	4.6E-03
105 trans -rx.shutdown pcs srv.ftc.<2 mfwdhpci RHR.AND.PCS.NREC	CD	6.6E-06	1.8E-03
202 loop -rx.shutdown -ep srv.ftc.<2 -hpci RHR	CD	2.7E-06	3.6E-03

** non-recovery credit for edited case

Note: For unavailabilities, 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.

SEQUENCE MODEL: c:\asp\1982-83\bwr8283.cmp
BRANCH MODEL: c:\asp\1982-83\bruns1.82
PROBABILITY FILE: c:\asp\1982-83\bwr8283.pro

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No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.0E-03	1.0E+00	
loop	1.6E-05	3.6E-01	
loca	3.3E-06	6.7E-01	
rx.shutdown	3.5E-04	1.0E-01	
pcs	1.7E-01	1.0E+00	
srv.ftc.<2	1.0E+00	1.0E+00	
srv.ftc.2	1.3E-03	1.0E+00	
srv.ftc.>2	2.2E-04	1.0E+00	
mfw	4.6E-01	3.4E-01	
hpci	2.9E-02	7.0E-01	
rcic	6.0E-02	7.0E-01	
srv.ads	3.7E-03	7.0E-01	1.0E-02
crd(inj)	1.0E-02	1.0E+00	1.0E-02
cond	1.0E+00	3.4E-01	1.0E-03
lpcs	2.0E-03	1.0E+00	
lpci	1.1E-03	1.0E+00	
RHRSW(INJ)	2.0E-02 > 1.0E+00	1.0E+00	1.0E-02
Branch Model: 1.0F.1+opr			
Train 1 Cond Prob:	2.0E-02 > 1.0E+00		
RHR	1.5E-04 > 1.0E+00	1.6E-02 > 1.0E-02	1.0E-05
Branch Model: 1.0F.4+opr			
Train 1 Cond Prob:	1.0E-02 > 1.0E+00		
Train 2 Cond Prob:	1.0E-01 > 1.0E+00		
Train 3 Cond Prob:	3.0E-01 > 1.0E+00		
Train 4 Cond Prob:	5.0E-01 > 1.0E+00		
RHR.AND.PCS.NREC	1.5E-04 > 1.0E+00	8.3E-03 > 5.2E-03	1.0E-05
Branch Model: 1.0F.4+opr			
Train 1 Cond Prob:	1.0E-02 > 1.0E+00		
Train 2 Cond Prob:	1.0E-01 > 1.0E+00		
Train 3 Cond Prob:	3.0E-01 > 1.0E+00		
Train 4 Cond Prob:	5.0E-01 > 1.0E+00		
RHR/-LPCI	0.0E+00 > 1.0E+00	1.0E+00 > 1.0E-02	1.0E-05
Branch Model: 1.0F.1+opr			
Train 1 Cond Prob:	0.0E+00 > 1.0E+00		
rhr/lpci	1.0E+00	1.0E+00	1.0E-05
RHR(SPCOOL)	2.1E-03 > 1.0E+00	1.0E+00	1.0E-03
Branch Model: 1.0F.4+ser+opr			
Train 1 Cond Prob:	1.0E-02 > 1.0E+00		
Train 2 Cond Prob:	1.0E-01 > 1.0E+00		
Train 3 Cond Prob:	3.0E-01 > 1.0E+00		
Train 4 Cond Prob:	5.0E-01 > 1.0E+00		
Serial Component Prob:	2.0E-03		
RHR(SPCOOL)/-LPCI	2.0E-03 > 1.0E+00	1.0E+00	1.0E-03
Branch Model: 1.0F.1+ser+opr			
Train 1 Cond Prob:	0.0E+00 > 1.0E+00		
Serial Component Prob:	2.0E-03		
ep	2.9E-03	8.7E-01	
ep.rec	1.6E-01	1.0E+00	
rpt	1.9E-02	1.0E+00	
slcs	2.0E-03	1.0E+00	1.0E-02
ads.inhibit	0.0E+00	1.0E+00	1.0E-02

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man.depress	3.7E-03	1.0E+00	1.0E-02
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* branch model file

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