

## **B.25-1**

### **B.25 LER No. 324/82-029**

Event Description: Scram with RHRSW System Degradations

Date of Event: February 3, 1982

Plant: Brunswick 2

#### **B.25.1 Summary**

Brunswick Unit 2 was operating at approximately 73% power when an unsuccessful attempt was made to start "A" residual heat removal (RHR) service water (SW) pump. At the same time that A RHRSW pump was inoperable, the emergency power supply for RHRSW pump B was out of service for maintenance. A scram occurred the same day that the RHRSW system degradations were detected. The conditional core damage probability estimated for the event is  $3.4 \times 10^{-5}$ .

#### **B.25.2 Event Description**

On February 3, 1982, Brunswick 2 personnel were investigating a signal regarding A RHRSW pump when they unsuccessfully attempted to start the pump. They determined that an RHRSW loop I low-suction header pressure lockout signal had been generated by a failed pressure switch, rendering loop I inoperable. At the same time, the No. 4 emergency diesel generator (EDG) was out of service due to maintenance. As a result, RHRSW pump 1B did not have an emergency power supply, and RHRSW loop II was declared inoperable.

A high main steamline radiation indication resulted in a scram on the same date.

#### **B.25.3 Additional Event-Related Information**

None.

#### **B.25.4 Modeling Assumptions**

It was assumed that the RHRSW failure existed at the time of the scram, which occurred on the same day. This event was modeled as a transient with one loop of RHRSW inoperable. Failure of the RHRSW train II low suction pressure switch prevented automatic or manual start of the train II RHRSW pumps. 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 pumps once one valve (FO68A/B) in each train is locally opened. An operator error probability of 0.01 was estimated for this action in the Brunswick individual plant examination (IPE). Because of the unavailability of RHRSW train II, one train of RHR was modeled as failed in all modes except low-pressure coolant injection (LPCI). Although the specific failure discovered was apparently not present in the other train at the same time, other common cause modes remained and could have affected

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system performance. A common cause failure probability of 0.1 was assumed for train I and, as this value dominates the component failure probabilities in the system, the probability of RHR failure was set to 0.1 in the model.

The licensee event report indicates that a high main steamline radiation signal was received during the event. It was assumed that this signal caused an automatic isolation of the main steam isolation valves, resulting in power conversion system (PCS) and main feedwater unavailabilities (PCS was assumed to be recoverable in the long term). The probability of RHR nonrecovery was revised to 0.01 to reflect the potential failure of the operators to open FO68A and B. For sequences involving potential RHR or PCS recovery, the nonrecovery estimate was revised to  $0.01 \times 0.17$  [PCS long-term nonrecovery given main steam isolation valve (MSIV) closure (see Appendix A)], or  $1.7\text{E-}4$ .

### **B.25.5 Analysis Results**

The conditional core damage probability estimated for this event is  $3.4 \times 10^{-5}$ . The dominant core damage sequence, highlighted on the event tree in Figure B.25.1, involves the observed scram, failure of the power conversion system, main feedwater success, and RHR failure.

# B.25-3

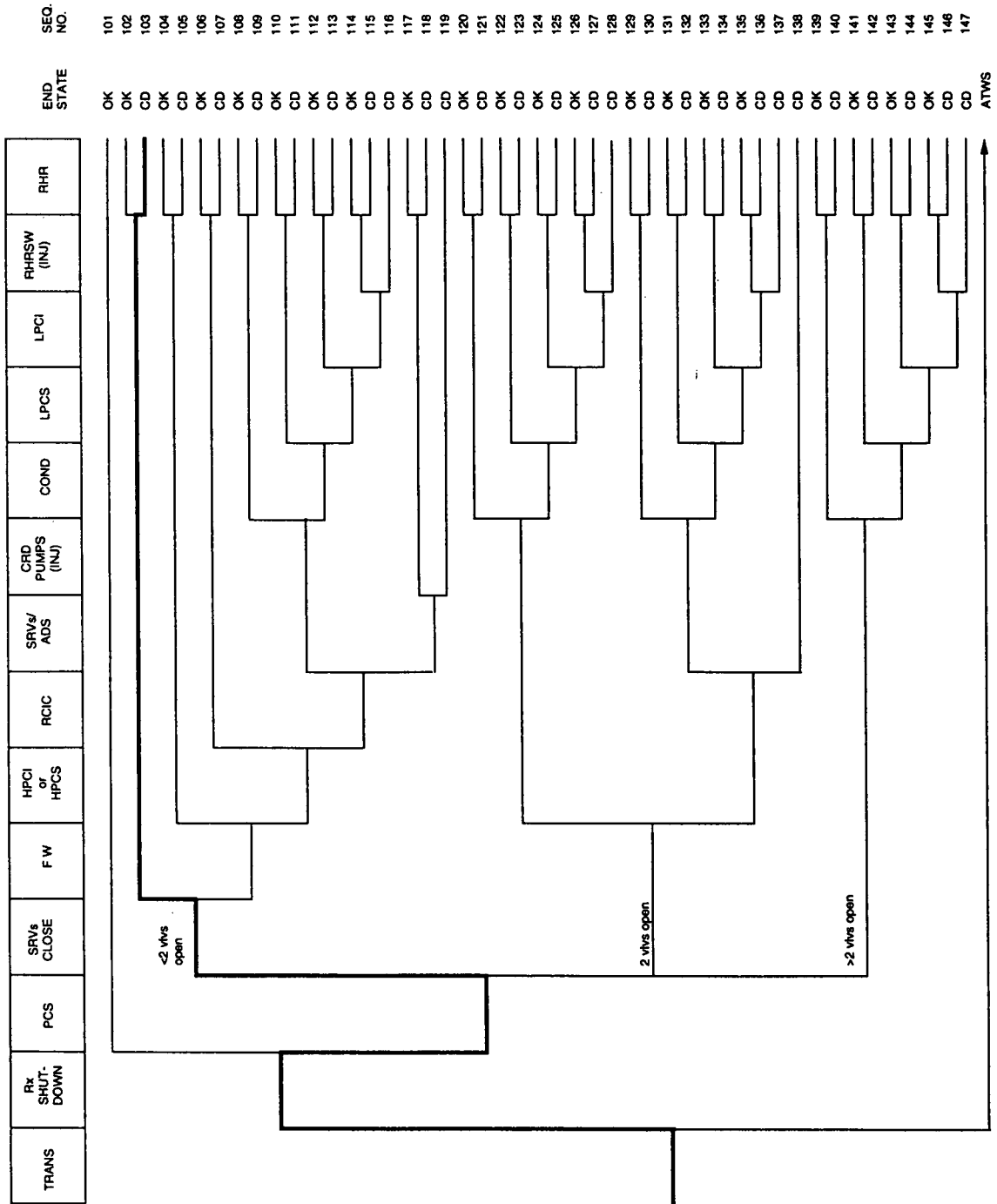


Figure B.25.1 Dominant core damage sequence for LER 324/82-029

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## CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 324/82-029  
 Event Description: Scram and RHRSW degradations  
 Event Date: February 3, 1982  
 Plant: Brunswick 2

### INITIATING EVENT

#### NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

#### SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	3.4E-05
Total	3.4E-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	1.8E-05	1.1E-04
105	trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci RHR.AND.PCS.NREC	CD	9.0E-06	5.7E-05
403	trans rx.shutdown -rpt -slcs PCS -ads.inhibit -hpci RHR(SPCOO L)	CD	3.3E-06	9.9E-02
121	trans -rx.shutdown PCS srv.ftc.2 -hpci -cond RHR	CD	8.5E-07	6.6E-03
414	trans rx.shutdown rpt	CD	6.7E-07	1.0E-01

\*\* 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	1.8E-05	1.1E-04
105	trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci RHR.AND.PCS.NREC	CD	9.0E-06	5.7E-05
121	trans -rx.shutdown PCS srv.ftc.2 -hpci -cond RHR	CD	8.5E-07	6.6E-03
403	trans rx.shutdown -rpt -slcs PCS -ads.inhibit -hpci RHR(SPCOO L)	CD	3.3E-06	9.9E-02
414	trans rx.shutdown rpt	CD	6.7E-07	1.0E-01

\*\* non-recovery credit for edited case

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SEQUENCE MODEL: c:\asp\1982-83\bwrc8283.cmp  
 BRANCH MODEL: c:\asp\1982-83\bruns2.82  
 PROBABILITY FILE: c:\asp\1982-83\bwr8283.pro

No Recovery Limit

## BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.1E-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	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	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 > 1.0E+00	3.4E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	4.6E-01 > 1.0E+00		
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	
rhrrsw(inj)	2.0E-02	1.0E+00	1.0E-02
RHR	1.5E-04 > 1.0E-01 **	1.6E-02 > 1.0E-02	1.0E-05
Branch Model: 1.0F.4+opr			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	3.0E-01		
Train 4 Cond Prob:	5.0E-01		
RHR.AND.PCS.NREC	1.5E-04 > 1.0E-01 **	8.3E-03 > 1.7E-04	1.0E-05
Branch Model: 1.0F.4+opr			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	3.0E-01		
Train 4 Cond Prob:	5.0E-01		
RHR/-LPCI	0.0E+00 > 1.0E-01 **	1.0E+00 > 1.0E-02	1.0E-05
Branch Model: 1.0F.1+opr			
Train 1 Cond Prob:	0.0E+00		
rhrr/lpci	1.0E+00	1.0E+00	1.0E-05
RHR(SPCQOL)	2.1E-03 > 1.0E-01 **	1.0E+00	1.0E-03
Branch Model: 1.0F.4+ser+opr			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	3.0E-01		
Train 4 Cond Prob:	5.0E-01		

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Serial Component Prob:	2.0E-03		
RHR(SPCOOL)/-LPCI	2.0E-03 > 1.0E-01 **	1.0E+00	1.0E-03
Branch Model: 1.0F.1+ser+opr			
Train 1 Cond Prob:	0.0E+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	
sics	2.0E-03	1.0E+00	1.0E-02
ads.inhibit	0.0E+00	1.0E+00	1.0E-02
man.depress	3.7E-03	1.0E+00	1.0E-02

\* branch model file

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