

B.51-1

B.51 LER No. 387/83-103

Event Description: RCIC System Unavailable Owing to Governor Valve Problem

Date of Event: July 7, 1983

Plant: Susquehanna 1

B.51.1 Summary

On July 7, 1983, during testing to demonstrate the operability of the reactor core isolation cooling (RCIC) system, the RCIC turbine tripped. RCIC had also tripped two days earlier, during response to a scram. The conditional core damage probability estimated for the event is 1.4×10^{-5} .

B.51.2 Event Description

On July 7, 1983, during testing to demonstrate the operability of the RCIC system, the RCIC turbine tripped. Prior to the test, on July 5, a plant trip had occurred, RCIC was demanded, and subsequently tripped. Based on vendor recommendations, clearances between the governor valve and bonnet guide sleeve were measured and found restrictive. The governor valve was reworked to updated vendor specifications and the system successfully retested.

The scram on July 5, 1983 was caused by main steam line radiation spikes associated with placing condensate demineralizers in service.

B.51.3 Additional Event-Related Information

The RCIC system consists of a single turbine-driven pump that can provide primary coolant makeup at a maximum rate of 600 gpm. The RCIC pump is provided with two suction sources. The primary source is the condensate storage tank (CST), with the suppression pool providing the secondary source. The system is designed to swap from the CST to the suppression pool on low CST level.

B.51.4 Modeling Assumptions

Given that a plant trip had occurred on July 5 with a demand for RCIC, this event was modeled as a transient initiator. The main steam isolation valves (MSIVs) are assumed to have closed as a result of the radiation spikes. This will result in unavailability of the power conversion system (PCS) and the feedwater (FW) system since Susquehanna uses turbine-driven FW pumps. In addition, Susquehanna's IPE submittal states that flow through the MSIVs is needed for the turbine-driven FW pumps; thus, it is assumed that the use of the MSIV bypass valves to supply steam for the FW pumps is not appropriate. RCIC was assumed failed, owing to the governor valve problem. Short-term recovery of PCS or FW was not considered since the MSIVs had closed. Recovery of RCIC was not considered since RCIC had tripped twice in two days. The nonrecovery probability

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for PCS was revised to 0.017 to reflect the MSIV closure (see Appendix A). Combining this value with the estimated long-term RHR nonrecovery probability of 0.016 results in a combined probability for RHR and PCS of 2.7E-4.

B.51.5 Analysis Results

The estimated conditional core damage probability for the event is 1.4×10^{-5} . The dominant sequence, highlighted on the event tree in Figure B.51.1, involves a transient initiator followed by successful reactor shutdown, failure of the power conversion system, failure of the feedwater system, and failure of the residual heat removal system.

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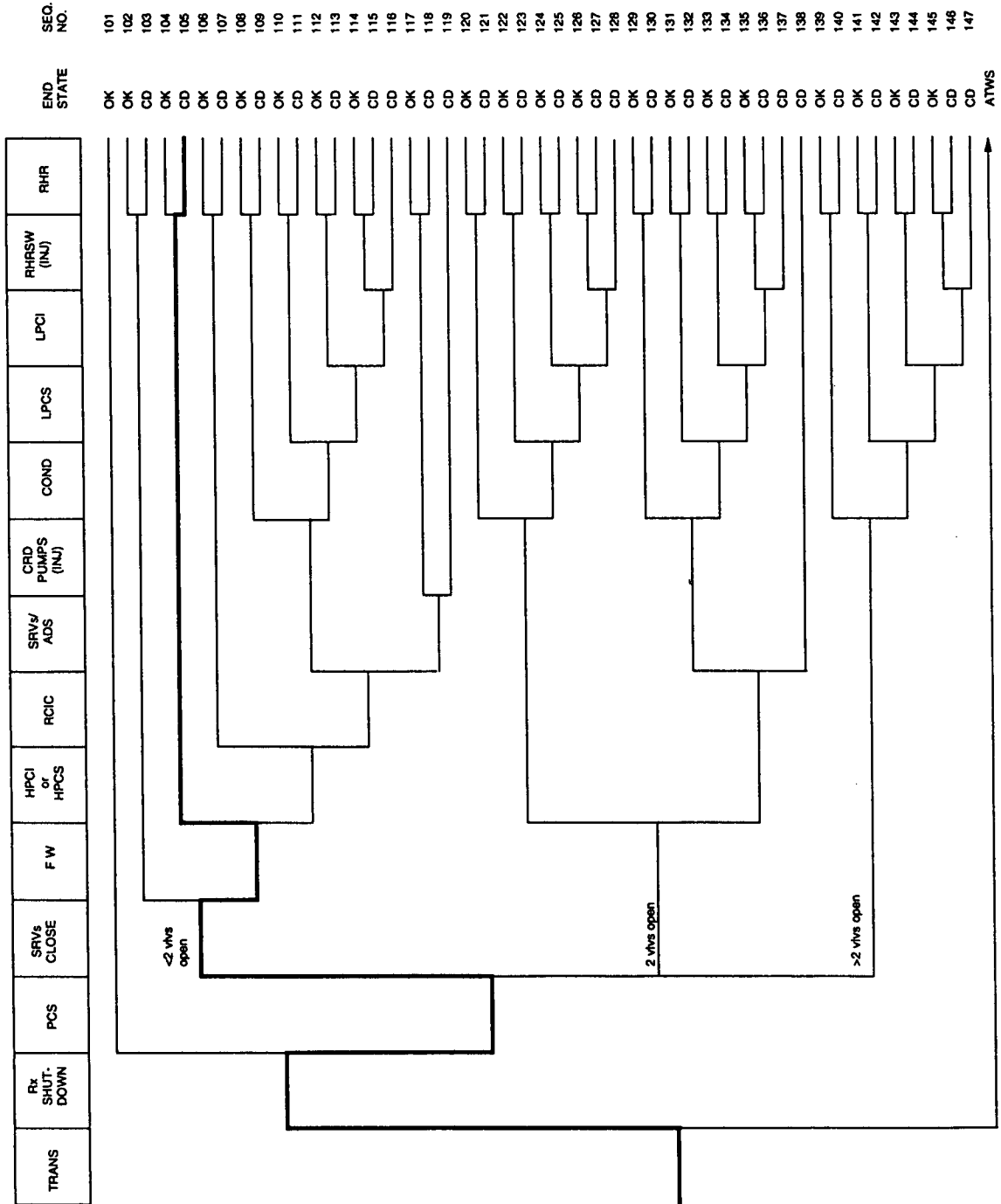


Figure B.51.1 Dominant core damage sequence for LER 387/83-103

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 387/83-103
Event Description: Scram, MSIV isolation and RCIC failure
Event Date: July 7, 1983
Plant: Susquehanna 1

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	1.4E-05
Total	1.4E-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	6.6E-06	1.8E-04
105 trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci RHR.AND.PCS.NREC	CD	3.3E-06	9.1E-05
119 trans -rx.shutdown PCS srv.ftc.<2 MFW hpci RCIC srv.ads c rd(inj)	CD	1.7E-06	1.7E-01
414 trans rx.shutdown rpt	CD	6.7E-07	1.0E-01
413 trans rx.shutdown -rpt slcs	CD	4.1E-07	1.0E-01
412 trans rx.shutdown -rpt -slcs PCS ads.inhibit	CD	3.4E-07	1.0E-01
138 trans -rx.shutdown PCS srv.ftc.2 hpci srv.ads	CD	3.3E-07	4.9E-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	6.6E-06	1.8E-04
105 trans -rx.shutdown PCS srv.ftc.<2 MFW -hpci RHR.AND.PCS.NREC	CD	3.3E-06	9.1E-05
119 trans -rx.shutdown PCS srv.ftc.<2 MFW hpci RCIC srv.ads c rd(inj)	CD	1.7E-06	1.7E-01
138 trans -rx.shutdown PCS srv.ftc.2 hpci srv.ads	CD	3.3E-07	4.9E-01
412 trans rx.shutdown -rpt -slcs PCS ads.inhibit	CD	3.4E-07	1.0E-01
413 trans rx.shutdown -rpt slcs	CD	4.1E-07	1.0E-01
414 trans rx.shutdown rpt	CD	6.7E-07	1.0E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1982-83\bwrc8283.cmp
BRANCH MODEL: c:\asp\1982-83\susque.82

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PROBABILITY FILE: c:\asp\1982-83\bwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.5E-03	1.0E+00	
loop	1.6E-05	2.4E-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.OF.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.OF.1			
Train 1 Cond Prob:	4.6E-01 > 1.0E+00		
hpci	2.9E-02	7.0E-01	
RCIC	6.0E-02 > 1.0E+00	7.0E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	6.0E-02 > 1.0E+00		
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	1.7E-03	1.0E+00	
lpci	1.1E-03	1.0E+00	
rhrsw(inj)	2.0E-02	1.0E+00	1.0E-02
rhr	1.5E-04	1.6E-02	1.0E-05
RHR.AND.PCS.NREC	1.5E-04 > 1.5E-04	8.3E-03 > 2.7E-04	1.0E-05
Branch Model: 1.OF.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+00	1.0E-05
rhr/lpci	1.0E+00	1.0E+00	1.0E-05
rhr(spcool)	2.1E-03	1.0E+00	1.0E-03
rhr(spcool)/-lpci	2.0E-03	1.0E+00	1.0E-03
ep	1.4E-03	8.7E-01	
ep.rec	2.1E-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
man.depress	3.7E-03	1.0E+00	1.0E-02

* branch model file

** forced

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