

B.38-1

B.38 LER Nos. 346/83-038 and -040

Event Description: Inoperability of One Auxiliary Feedwater Pump and Reactor Trip Due to Trip of Two Steam and Feedwater Rupture Control System Logic Channels

Date of Event: July 25, 1983

Plant: Davis-Besse 1

B.38.1 Summary

On July 25, 1983, the reactor was tripped by a spurious steam and feedwater rupture control system signal. After the reactor trip, auxiliary feedwater (AFW) pump 1-1 was discovered to be inoperable. The conditional core damage probability estimated for this event is 8.2×10^{-5} .

B.38.2 Event Description

On July 25, 1983, a trip alarm was received on steam and feedwater rupture control system (SFRCS) Logic Channel 3, causing a half trip of Actuation Channel 1. The failure was traced to a failed 48V dc/dc power supply that apparently caused the overvoltage trip device to actuate. While the power supply was being replaced, SFRCS Logic Channel 1 spuriously tripped. This caused a full trip of Actuation Channel 1, resulting in a reactor trip. The cause of this failure was believed to be a momentary failure of the 48-V power supply in Logic Channel 1. The root cause of both failures was overheating of the power supplies due to improper design of the SFRCS cabinets. Fans were installed in the cabinets to ensure adequate cooling.

Following the reactor trip, AFW pump 1-1 was declared inoperable due to its failure to respond to speed change signals from both automatic and manual control. The problem was found to be due to a slipping clutch between the speed changer motor and the governor; attempts to adjust the clutch were unsuccessful. During this event, AFW pump 1-2 and the startup motor driven feed pump were operable. The unit was shut down and a refueling outage was initiated.

B.38.3 Additional Event-Related Information

Failures similar to those documented in LER 346/83-038 were reported in LERs 346/82-051 and 346/83-019. Previous occurrences involving the inoperability of AFW pumps due to defective governors were reported in LERs 346/81-037 and 346/81-045.

B.38.4 Modeling Assumptions

These events are modeled as a reactor trip with one AFW pump inoperable. The redundant train of the AFW system was assumed to be vulnerable to a similar type of failure. The potential for common cause failure

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exists, even when a component is failed. Therefore, the conditional probability of a common cause failure was included in the analysis for those components that were assumed to have been failed as part of the postulated event.

The actuation of SFRCS was assumed to have isolated the main feedwater pumps. A nonrecovery probability of 0.1 was assumed for the main feedwater (MFW) pumps. In addition, the startup feed pump could have been locally aligned to provide water to the steam generators (SGs). A failure probability of 0.55 (see Appendix A) was employed here to recognize the local actions that would have been required for the alignment and the dependency between the recovery of MFW and the use of the startup feed pump.

B.38.5 Analysis Results

The conditional core damage probability estimated for this event is 8.2×10^{-5} . The dominant core damage sequence, shown in Figure B.38.1, involves the initiating transient, a successful reactor trip, failure of AFW, loss of MFW, and failure of feed and bleed.

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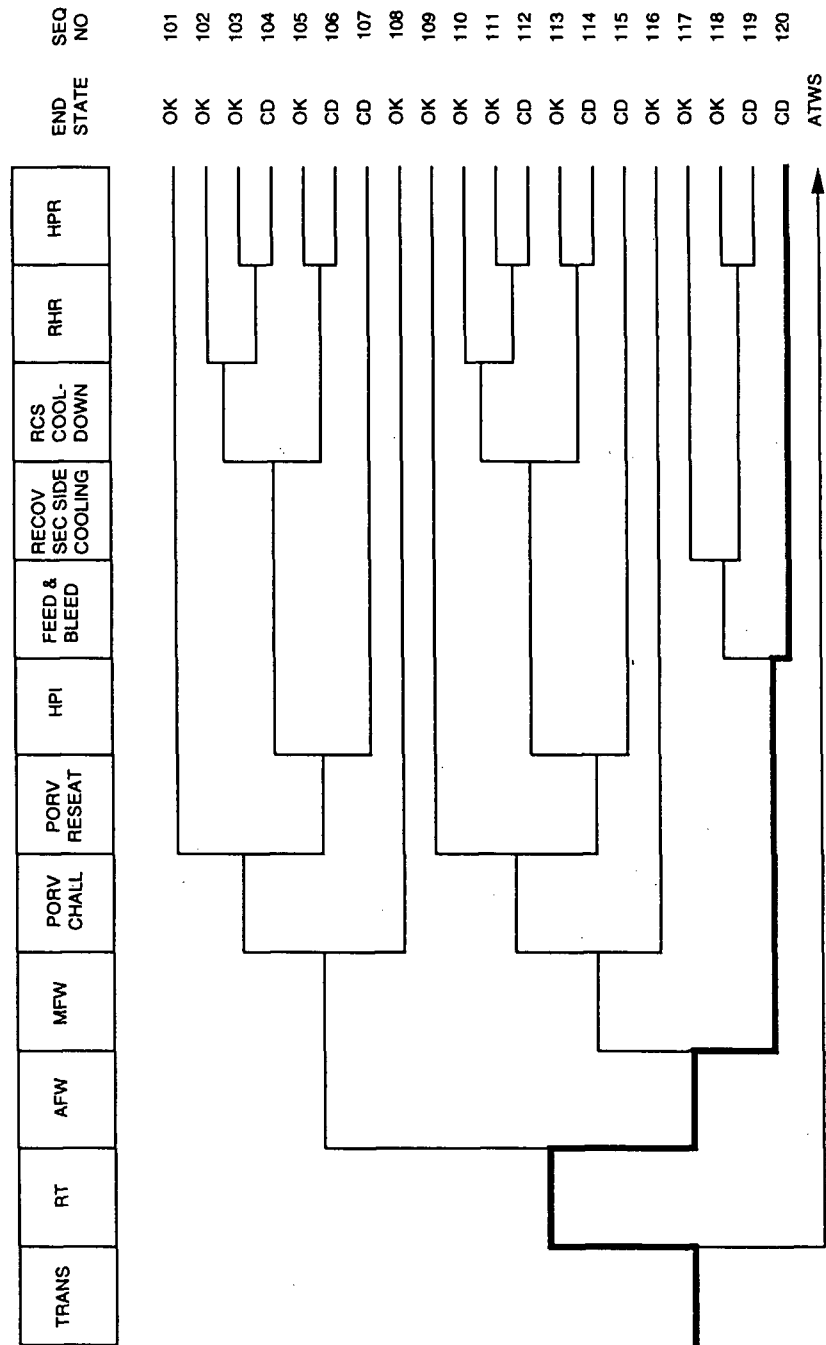


Figure B.38.1 Dominant core damage sequence for LER Nos. 346/83-038 and -040

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 346/83-038
 Event Description: Reactor trip with one AFW pump inoperable
 Event Date: July 25, 1983
 Plant: Davis Besse

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.0E+00
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SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	8.2E-05
Total	8.2E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
120 trans -rt AFW MFW feed.bleed	CD	5.2E-05	2.5E-02
508 trans rt -prim.press.limited AFW/ATWS	CD	2.8E-05	1.0E-01
119 trans -rt AFW MFW -feed.bleed recov.sec.cool hpr	CD	2.4E-06	2.5E-02

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
119 trans -rt AFW MFW -feed.bleed recov.sec.cool hpr	CD	2.4E-06	2.5E-02
120 trans -rt AFW MFW feed.bleed	CD	5.2E-05	2.5E-02
508 trans rt -prim.press.limited AFW/ATWS	CD	2.8E-05	1.0E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1982-83\pwr8283.cmp
 BRANCH MODEL: c:\asp\1982-83\dbesse.82
 PROBABILITY FILE: c:\asp\1982-83\pwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.2E-03	1.0E+00	
loop	1.6E-05	2.4E-01	
loca	2.4E-06	5.4E-01	
sgtr	1.6E-06	1.0E+00	
rt	2.8E-04	1.0E-01	
rt(loop)	0.0E+00	1.0E+00	

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AFW	5.0E-03 > 1.0E-01	4.5E-01	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01		
AFW/ATWS	9.5E-02 > 1.0E+00	1.0E+00	
Branch Model: 2.OF.2			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01		
AFW/EP	5.0E-03 > 1.0E-01	4.5E-01	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01		
MFV	2.0E-01 > 1.0E+00	3.4E-01 > 5.5E-02	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	2.0E-01 > Unavailable		
porv.chall	8.0E-02	1.0E+00	
porv.chall/afw	1.0E+00	1.0E+00	
porv.chall/loop	1.0E-01	1.0E+00	
porv.chall/sbo	1.0E+00	1.0E+00	
porv.reseat	1.0E-02	1.1E-02	
porv.reseat/ep	1.0E-02	1.0E+00	
srv.reseat(atws)	1.0E-01	1.0E+00	
hpi	1.0E-03	8.9E-01	
feed.bleed	1.1E-02	1.0E+00	1.0E-02
emrg.boration	0.0E+00	1.0E+00	1.0E-02
recov.sec.cool	2.0E-01	1.0E+00	
recov.sec.cool/offsite.pwr	3.4E-01	1.0E+00	
rscs.cooldown	3.0E-03	1.0E+00	1.0E-03
rhr	2.2E-02	5.7E-02	1.0E-03
rhr.and.hpr	1.0E-03	1.0E+00	1.0E-03
hpr	4.0E-03	1.0E+00	1.0E-03
ep	2.9E-03	8.9E-01	
seal.loca	0.0E+00	1.0E+00	
offsite.pwr.rec/-ep.and.-afw	2.7E-01	1.0E+00	
offsite.pwr.rec/-ep.and.afw	1.6E-01	1.0E+00	
offsite.pwr.rec/seal.loca	0.0E+00	1.0E+00	
offsite.pwr.rec/-seal.loca	4.5E-01	1.0E+00	
sg.iso.and.rscs.cooldown	1.0E-02	1.0E-01	
rscs.cool.below.rhr	3.0E-03	1.0E+00	3.0E-03
prim.press.limited	8.8E-03	1.0E+00	

* branch model file

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