

B.3-1

B.3 LER No. 250/83-007

Event Description: Three Auxiliary Feedwater Pumps Unavailable

Date of Event: April 14, 1983 through April 19, 1983

Plant: Turkey Point 3

B.3.1 Summary

Manual valves in the steam supply lines to the B and C auxiliary feedwater (AFW) pump turbines were found to be closed on April 19, 1983. Since AFW pump A was out of service at the time, all of the AFW pumps were unavailable. The increase in core damage probability, or importance, over the duration of the event is 5.5×10^{-5} . The base-case core damage probability (CDP) over the duration of the event is 1.5×10^{-6} , resulting in an estimated conditional core damage probability (CCDP) of 5.6×10^{-5} .

B.3.2 Event Description

On April 19, 1983 with the unit at full power, manual valves 3-084A and 3-086B on the steam supply lines to the B and C auxiliary feedwater pump turbines, respectively, were found to be closed. This rendered the B and C pumps inoperable. Since AFW pump A was out of service at the time, all of the AFW pumps were unavailable. The cause of the event was determined to be human error in tagging the valves and lack of independent verification of the tag locations and valve positions. The two manual valves were immediately locked open and AFW pumps B and C were returned to service within an hour.

B.3.3 Additional Event-Related Information

Because of modifications to the A AFW pump and the common redundant steam supply piping, manual valves 001B, 002B, 001C, and 002C in the AFW pump turbine steam supply lines were closed on March 26, 1983. Valves 001B and 002B are in series in the steam supply line from steam generator 3A to the AFW pump B turbine. Valves 001C and 002C supply the AFW pump C turbine. On April 11, 1983, valves 001B and 001C were opened to perform a hydro test, and they were supposed to be reclosed on April 14. On April 19, valve 001B was found closed, but with its clearance tag removed. The tag was found on valve 3-084A, which was also closed. Valve 001C was found open and its tag was located on valve 3-086B, which was closed. Thus, steam supplies were isolated to all AFW pump turbines.

The plant has a standby steam generator feedwater (SSGFW) system consisting of two 100% capacity motor-driven pumps. This system is shared with Turkey Point 4. Although the SSGFW system is not safety related, it is powered from multiple onsite and offsite sources.

B.3.4 Modeling Assumptions

It is assumed that valves 3-084A and 3-086B were mistakenly closed on April 14, 1983. With valves 001B, 002B, 001C, and 002C closed continuously since April 14, and Unit 4 in refueling, there was no steam available for AFW pumps B and C for at least five days or 120 hours. AFW pump A was out of service during

B.3-2

this period so all three AFW pumps were unavailable. Therefore, all three trains of AFW were modeled as unavailable for five days. The errors which caused the steam supply valves to be incorrectly closed would have to have been restored locally. This restoration would be complicated by the mislocated tags. To reflect this situation the AFW nonrecovery probability was increased to 0.55.

The failure probability for the SSGFW system was estimated as described in the analysis of LER 251/92-007 in *Precursors To Potential Severe Core Damage Accidents: 1992 A Status Report*, NUREG/CR-4674, ORNL/NOAC-232, Vol. 18. This system requires one of the two pumps to operate and realignment of one valve to be successful. An operator failure rate of 0.01 was assumed. Since the SSGFW system is placed into service prior to attempting feed and bleed, the operator failure rate for initiating feed-and-bleed was increased to 0.2, consistent with the Turkey Point probabilistic risk assessment (PRA). The SSGFW system failure probability, 0.011, was calculated as:

$$\begin{aligned} & (\text{PMPA} \times \text{PMPB}) + \text{VLV1} + \text{OPR} \\ &= (0.01 \times 0.01) + 0.0004 + 0.01 \\ &= 0.011 \end{aligned}$$

This value was incorporated into the model by modifying the nonrecovery probability of the main feedwater (MFW). Transient, loss-of-offsite power (LOOP), loss-of-coolant accident (LOCA), and steam generator tube rupture (SGTR) were used as potential initiators in the unavailability analysis.

B.3.5 Analysis Results

The increase in core damage probability over the duration of the event is 5.5×10^{-5} . The base-case CDP (not shown in calculation) is 1.5×10^{-6} , resulting in an estimated CCDP of 5.6×10^{-5} . The contributions of the postulated LOCA and SGTR initiators are negligible compared to those due to a transient or LOOP. The dominant core damage sequence, shown in Figure B.3.1, involves a transient, successful reactor trip, failure of AFW, failure of main feedwater, and failure of feed and bleed.

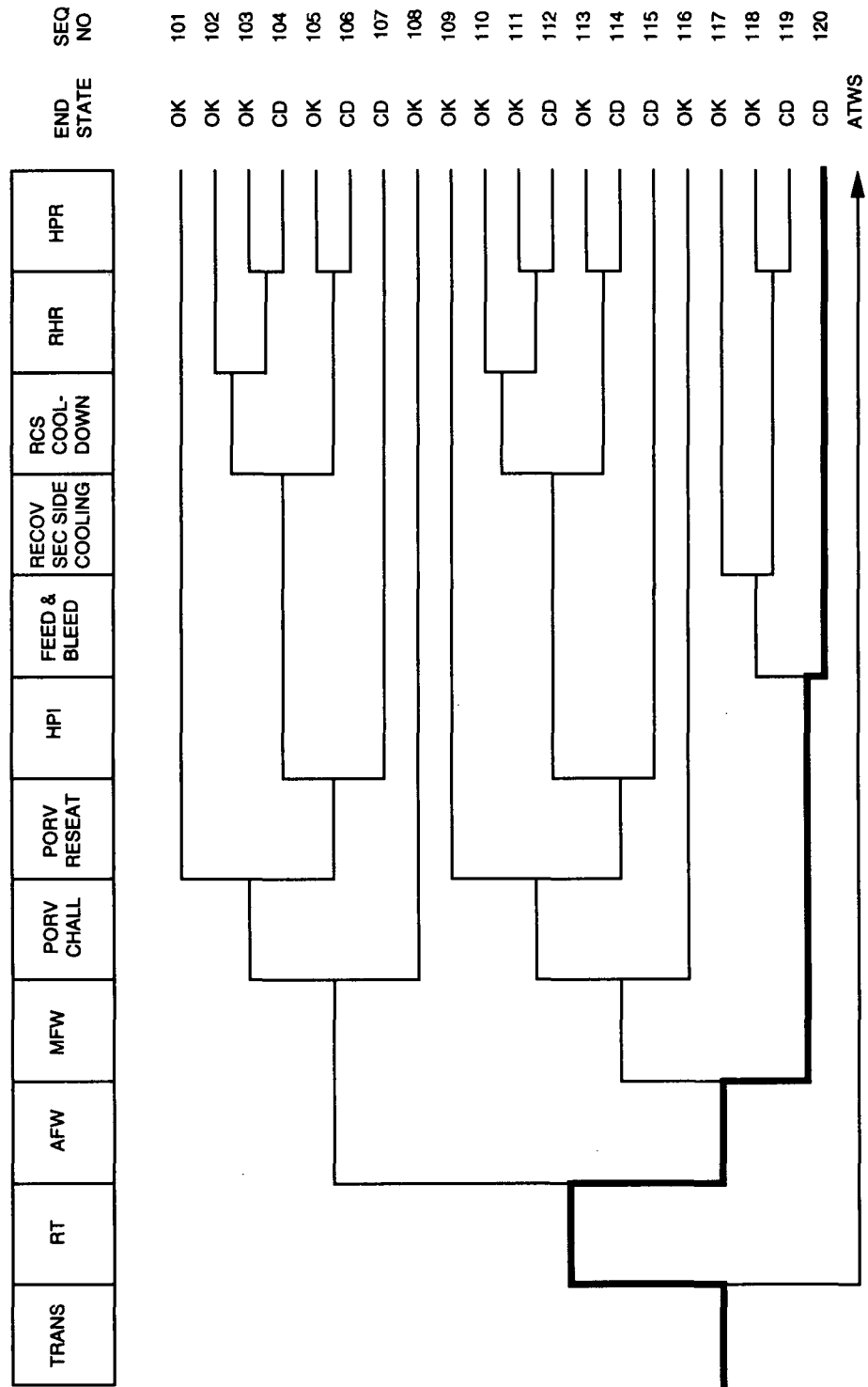


Figure B.3.1 Dominant core damage sequence for LER 250/83-007

B.3-4

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 250/83-007
Event Description: Three AFW pumps unavailable due to tagging error
Event Date: 4/14/83 - 4/19/83
Plant: Turkey Point 3

UNAVAILABILITY, DURATION= 120

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.1E-01
LOOP	1.4E-03
LOCA	1.6E-04
SGTR	2.0E-04

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	3.0E-05
LOOP	2.5E-05
LOCA	3.9E-08
SGTR	2.2E-07
Total	5.5E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
120	trans -rt AFW mfw feed.bleed	CD	2.7E-05	6.0E-03
215	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw feed.bleed /loop	CD	2.1E-05	9.3E-02
508	trans rt -prim.press.limited AFW/ATWS	CD	3.0E-06	1.0E-01
239	loop -rt(loop) ep AFW/EP	CD	1.9E-06	8.3E-02
219	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw feed.bleed /loop	CD	1.6E-06	9.3E-02
214	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw -feed.bleed /loop recov.sec.cool hpr	CD	6.7E-07	9.3E-02
226	loop -rt(loop) ep -AFW/EP porv.chall/sbo -porv.reseat/ep seal .loca offsite.pwr.rec/seal.loca	CD	(3.0E-07)	6.8E-02

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
120	trans -rt AFW mfw feed.bleed	CD	2.7E-05	6.0E-03
508	trans rt -prim.press.limited AFW/ATWS	CD	3.0E-06	1.0E-01
214	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw -feed.bleed /loop recov.sec.cool hpr	CD	6.7E-07	9.3E-02
215	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw feed.bleed /loop	CD	2.1E-05	9.3E-02
219	loop -rt(loop) -ep AFW -offsite.pwr.rec/-ep.and.afw feed.bleed	CD	1.6E-06	9.3E-02

B.3-5

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/loop
226 loop -rt(loop) ep -AFW/EP porv.chall/sbo -porv.reseat/ep seal CD ( 3.0E-07 ) 6.8E-02
    .loca offsite.pwr.rec/seal.loca
239 loop -rt(loop) ep AFW/EP CD 1.9E-06 8.3E-02
** non-recovery credit for edited case

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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.

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SEQUENCE MODEL: c:\asp\models\tpoint82.cmp
BRANCH MODEL: c:\asp\models\tpoint3.82
PROBABILITY FILE: c:\asp\models\pwr8283.pro

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No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	9.5E-04	1.0E+00	
loop	6.7E-05	1.7E-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	
AFW	1.5E-03 > 1.0E+00	4.5E-01 > 5.5E-01	
Branch Model: 1.0F.3			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Train 3 Cond Prob:	3.0E-01 > Unavailable		
AFW/ATWS	1.2E-02 > 1.0E+00	1.0E+00	
Branch Model: 2.0F.3			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Train 3 Cond Prob:	3.0E-01 > Unavailable		
AFW/EP	1.5E-03 > 1.0E+00	4.5E-01 > 5.5E-01	
Branch Model: 1.0F.3			
Train 1 Cond Prob:	5.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Train 3 Cond Prob:	3.0E-01 > Unavailable		
mfw	1.9E-01	1.1E-02	
porv.chall	4.0E-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	2.0E-02	1.1E-02	
porv.reseat/ep	2.0E-02	1.0E+00	
srv.reseat(atws)	1.0E-01	1.0E+00	
hpi	7.5E-04	8.9E-01	
feed.bleed	2.1E-02	1.0E+00	2.0E-01
feed.bleed/loop	2.1E-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
rrh	2.2E-02	7.0E-02	1.0E-03
rrh.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	2.6E-01	1.0E+00	

B.3-6

offsite.pwr.rec/-ep.and.-afw	2.4E-01	1.0E+00	
offsite.pwr.rec/-ep.and.afw	7.1E-02	1.0E+00	
offsite.pwr.rec/seal.loca	6.2E-01	1.0E+00	
offsite.pwr.rec/-seal.loca	7.6E-02	1.0E+00	
sg.iso.and.rcs.cooldown	1.0E-02	1.0E-01	
rsc.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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