

## B.7 LER Number 251/92-007

Event Description: Main Feedwater Pump Trip with One Auxiliary Feedwater Pump Out of Service

Date of Event: September 29, 1992

Plant: Turkey Point 4

### B.7.1 Summary

Turkey Point 4 was in startup at 2% power on September 29, 1992 when an operating main feedwater (MFW) pump tripped. This resulted in automatic actuation of the auxiliary feedwater (AFW) system. However, one AFW pump was out of service for post-maintenance testing. The remaining AFW pumps started and operated as designed. The conditional probability of subsequent core damage estimated for this event is  $3.1 \times 10^{-6}$ . The relative significance of the event compared to other postulated events at Turkey Point 4 is shown in Fig. B.7.

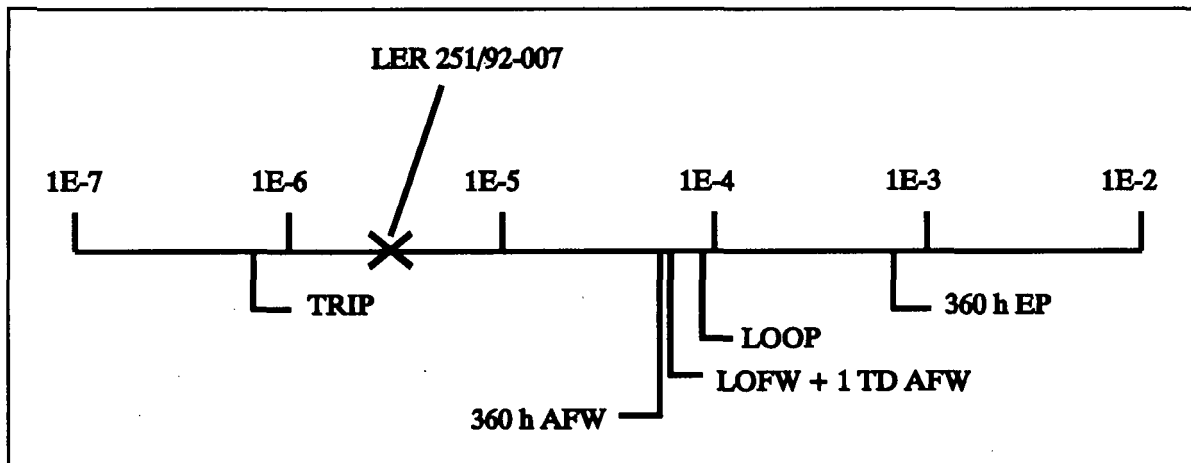


Fig. B.7. Relative event significance for LER 251/92-007 compared with other potential events at Turkey Point 4.

### B.7.2 Event Description

On September 29, 1992, Turkey Point 4 was in startup at 2% power. During performance of a condensate polisher backwash evolution, the inlet valve on the 4D condensate polisher opened. This allowed the running 4A MFW pump suction pressure to be relieved through the 4D polisher vent valve to the backwash receiver tank. As a result, the 4A MFW pump suction decreased below the trip setpoint, and the pump tripped. The trip of the 4A MFW pump resulted in an automatic AFW start and isolation

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of the steam generator blowdown. The B AFW pump was out of service for post-maintenance testing at the time of the MFW pump trip. The A and C AFW pumps started as designed and provided feedwater flow to the steam generators. The reactor did not trip, since it was operating below the 10% power trip setpoint. Approximately 30 min after the trip of the MFW pump, the A motor-driven standby steam generator feedwater (SSGFW) pump was started, and the running AFW pumps were secured.

### B.7.3 Additional Event-Related Information

The Turkey Point 4 AFW system consists of three 100% capacity steam-driven AFW pumps that are shared with Turkey Point 3. In addition, the plant has a standby steam generator feedwater system consisting of two 100% capacity motor-driven pumps. The AFW system is safety-related. Although the SSGFW system is not safety-related, it is provided power from multiple on-site and off-site power sources.

### B.7.4 Modeling Assumptions

This event has been modeled as a nonrecoverable loss of feedwater with one turbine-driven AFW pump unavailable. The SSGFW system was included in the modeling of the MFW system. The MFW system failed and was not recoverable. Therefore, it has a failure probability of 1.0. The SSGFW system success requires one of the two pumps and realignment of one valve. An operator failure rate of 0.01 was assigned. Usually this operator failure rate is assigned to HPI feed-and-bleed since it is usually the first proceduralized response to a loss of MFW and AFW. However, for Turkey Point, the SSGFW system is placed into service prior to attempting feed and bleed. The probability assigned to the SSGFW system is as follows.

System Failure Probability	= (PMPA × PMPB) + VLV1
	= (0.01 × 0.1) + 0.0004
	= 0.001
Operator Failure Probability	= 0.01
Total System Failure Probability	= 0.011

Since the operators will attempt to use the SSGFW system prior to feed-and-bleed, the operator failure rate for initiating feed-and-bleed is increased. The failure rate used by the licensee in the Turkey Point PRA is 0.2. This value was also used in this analysis. This accounts for the time delay in attempting to use feed-and-bleed caused by attempting to use the SSGFW system first.

The event was conservatively analyzed with the assumption that it had occurred at power, although it actually occurred at low-power startup conditions when decay heat loads are lower.

### B.7.5 Analysis Results

The conditional core damage probability for this event is estimated at  $3.1 \times 10^{-6}$ . The dominant core damage sequence, highlighted on the event tree shown in Fig. B.8, involves a reactor trip with unavailability of secondary side cooling and failure of feed and bleed.

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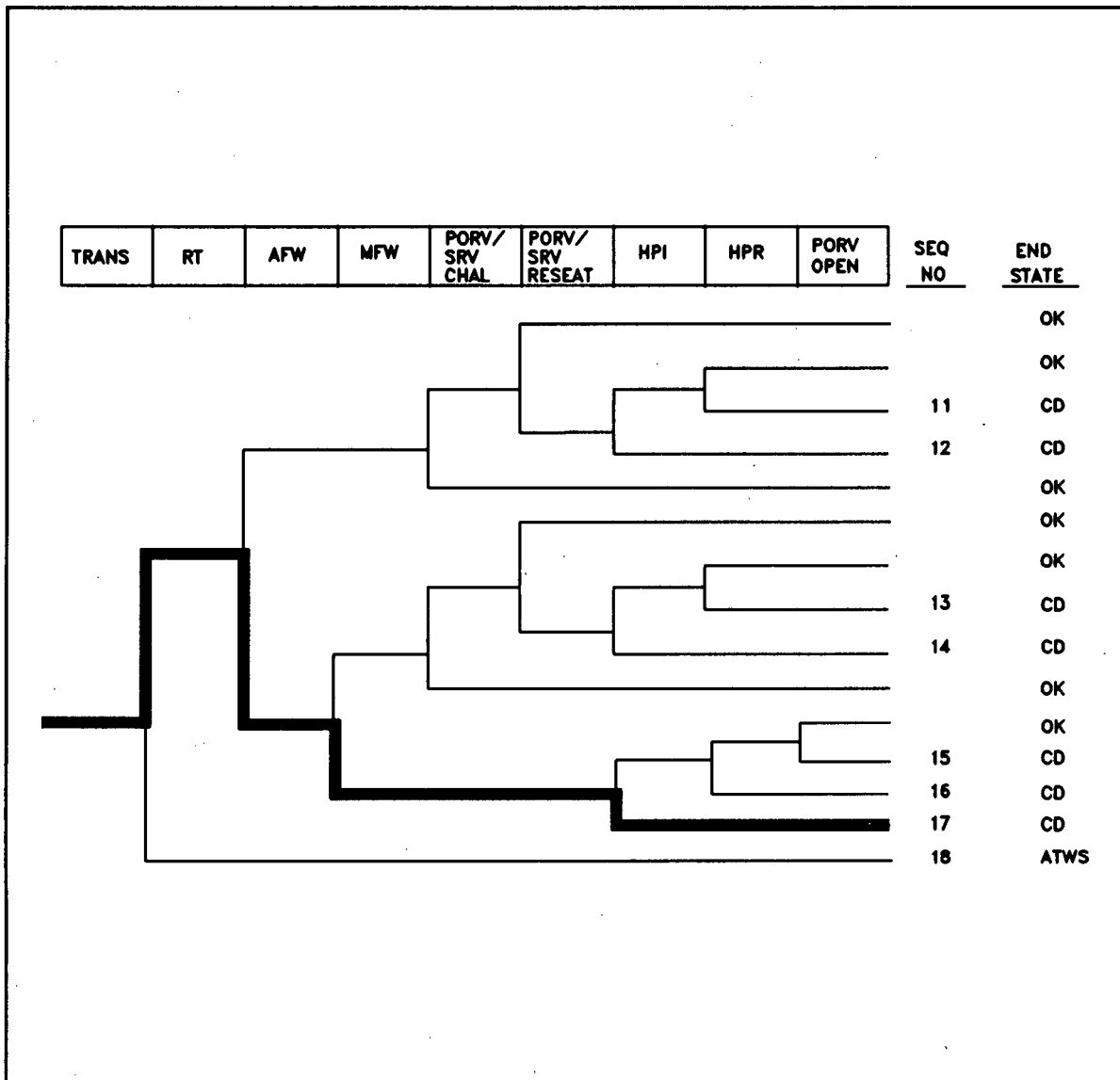


Fig. B.8. Dominant core damage sequence for LER 251/92-007.

## CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 251/92-007  
 Event Description: MFW Pump Trip with one AFW pump OOS  
 Event Date: 09/29/92  
 Plant: Turkey Point 4

## INITIATING EVENT

## NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

## SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	3.1E-06
Total	3.1E-06
ATWS	
TRANS	3.4E-05
Total	3.4E-05

## SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
17 trans -rt AFW MFW HPI(F/B)	CD	3.0E-06	2.3E-01
15 trans -rt AFW MFW -HPI(F/B) -hpr/-hpi porv.open	CD	1.2E-07	2.7E-01
18 trans rt	ATWS	3.4E-05	1.2E-01

\*\* non-recovery credit for edited case

## SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
15 trans -rt AFW MFW -HPI(F/B) -hpr/-hpi porv.open	CD	1.2E-07	2.7E-01
17 trans -rt AFW MFW HPI(F/B)	CD	3.0E-06	2.3E-01
18 trans rt	ATWS	3.4E-05	1.2E-01

\*\* non-recovery credit for edited case

SEQUENCE MODEL: s:\asp\prog\models\pwrbaseal.cmp  
 BRANCH MODEL: s:\asp\prog\models\turkey.sl1  
 PROBABILITY FILE: s:\asp\prog\models\pwr\_bsl1.pro

No Recovery Limit

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## BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.7E-04	1.0E+00	
loop	6.7E-05	1.7E-01	
loca	2.4E-06	4.3E-01	
rt	2.8E-04	1.2E-01	
rt/loop	0.0E+00	1.0E+00	
emerg.power	2.9E-03	8.0E-01	
AFW	1.5E-03 > 5.0E-03	2.7E-01	
Branch Model: 1.OF.3			
Train 1 Cond Prob:	5.0E-02		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	3.0E-01 > Failed		
afw/emerg.power	1.5E-03	2.7E-01	
MFW	1.9E-01 > 1.1E-02 <sup>1</sup> **	3.4E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.9E-01		
porv.or.srv.chall	4.0E-02	1.0E+00	
porv.or.srv.reset	2.0E-02	1.1E-02	
porv.or.srv.reset/emerg.power	2.0E-02	1.0E+00	
seal.loca	2.6E-01	1.0E+00	
ep.rec(sl)	6.2E-01	1.0E+00	
ep.rec	7.6E-02	1.0E+00	
HPI	1.0E-03	8.4E-01	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01		
HPI(F/B)	1.0E-03	8.4E-01	1.0E-02 > 2.0E-01 <sup>2</sup>
Branch Model: 1.OF.2+opr			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01		
hpr/-hpi	1.5E-04	1.0E+00	1.0E-03
porv.open	1.0E-02	1.0E+00	4.0E-04

\* branch model file

\*\* forced

## NOTES:

<sup>1</sup> Value modified to incorporate the SSGFW system. See Modeling Assumptions section for a description of the modifications.

<sup>2</sup> Value modified to account for use of SSGFW system prior to use of feed-and-bleed. See Modeling Assumptions section for a description of basis for this value.

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