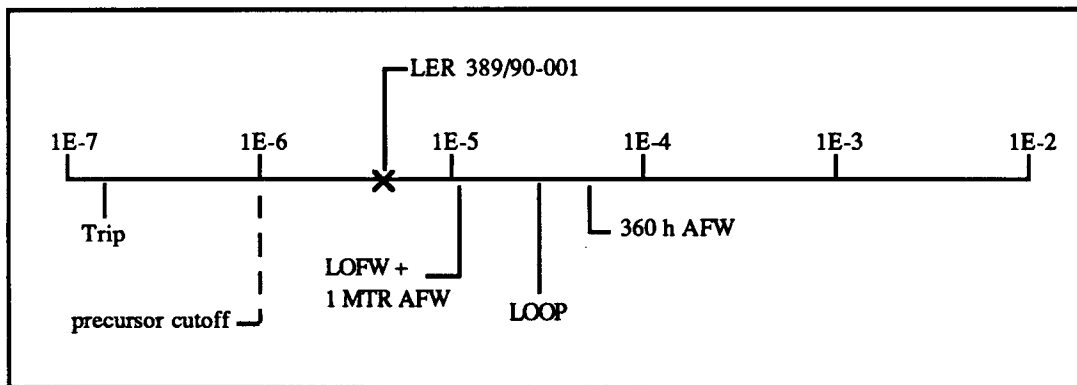


ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No.: 389/90-001
 Event Description: Loss of feedwater with one train of AFW unavailable
 Date of Event: January 14, 1990
 Plant: St. Lucie 2

Summary

The reactor tripped on a steam generator (SG) low-low level. Shortly after the automatic initiation of the auxiliary feedwater system (AFW), the turbine-driven AFW pump tripped off due to an overspeed trip signal. Thus, one of three trains of AFW was lost during this event. The conditional core damage probability estimated for this event is 4.7×10^{-6} . The relative significance of this event compared to other postulated events at St. Lucie 2 is shown below.



Event Description

On January 14, 1990, St. Lucie 2 was at 50% power with one SG feed pump and one condensate pump running; however, this is the upper power limit for this configuration, and as the operators attempted to increase power, the feed pump tripped off on low suction pressure. The second condensate pump failed to start because its control power fuses had not been re-installed following maintenance. While the operators were trying to re-establish feed and condensate flow, the reactor tripped on low SG level. This was followed almost immediately by a turbine trip. AFW automatically initiated and all three AFW pumps started, but the turbine-driven AFW pump tripped off shortly after it had started due to an overspeed signal from the turbine tachometer. The motor-driven AFW pumps continued supplying water to the SGs until the plant was stabilized in hot

standby. It was determined later that the turbine governor hydraulic oil contained foreign matter and caused the AFW pump turbine overspeed.

Additional Event-Related Information

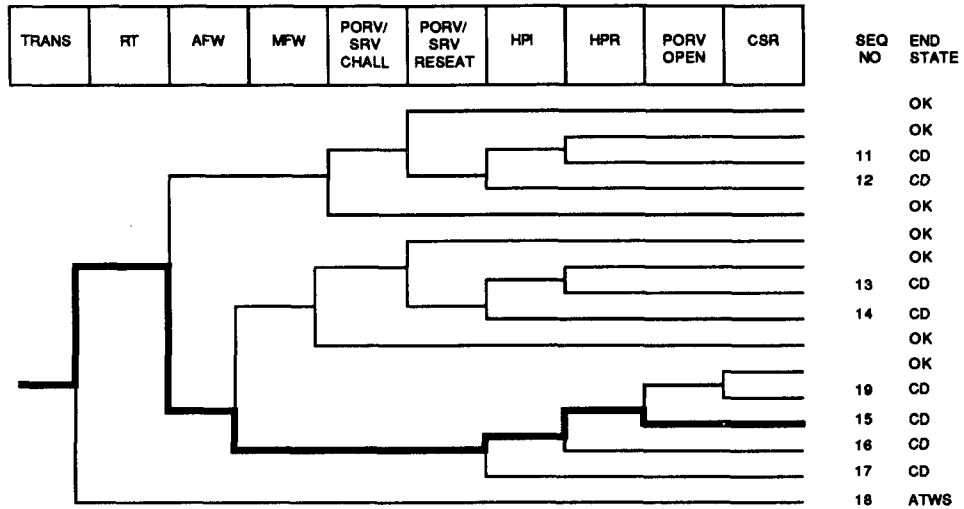
St. Lucie's AFW system consists of two 100% capacity motor-driven pumps and one 100% capacity turbine-driven pump. All three pumps share a common normal suction from the condensate storage tank. The turbine-driven pump supplies both SGs while each motor-driven pump can supply one SG. The discharges of the motor-driven pumps can be cross connected.

ASP Modeling Assumptions and Approach

This event has been modeled as a reactor scram with a recoverable loss of feedwater and one of three trains of AFW unavailable.

Analysis Results

The conditional probability of severe core damage estimated for this event is 4.7×10^{-6} . The dominant core damage sequences, highlighted on the following event tree, involve failure of secondary-side cooling and failure of feed and bleed.



Dominant core damage sequence for LER 389/90-001

B-325

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 389/90-001
 Event Description: LOFW with one train of AFW unavailable
 Event Date: 01/14/90
 Plant: St Lucie 2

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
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CD

TRANS	4.7E-06
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Total	4.7E-06
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ATWS

TRANS	3.4E-05
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Total	3.4E-05
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SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
15 trans -rt AFW MFW -hpl(f/b) -hpr/-hpl porv.open	CD	2.1E-06	8.8E-02
17 trans -rt AFW MFW hpl(f/b)	CD	2.1E-06	7.4E-02
19 trans -rt AFW MFW -hpl(f/b) -hpr/-hpl -porv.open csr	CD	3.3E-07	3.0E-02
16 trans -rt AFW MFW -hpl(f/b) hpr/-hpl	CD	2.3E-07	8.8E-02
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**
19 trans -rt AFW MFW -hpl(f/b) -hpr/-hpl -porv.open csr	CD	3.3E-07	3.0E-02
15 trans -rt AFW MFW -hpl(f/b) -hpr/-hpl porv.open	CD	2.1E-06	8.8E-02
16 trans -rt AFW MFW -hpl(f/b) hpr/-hpl	CD	2.3E-07	8.8E-02
17 trans -rt AFW MFW hpl(f/b)	CD	2.1E-06	7.4E-02
18 trans rt	ATWS	3.4E-05	1.2E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1989\pwrqseal.cmp
 BRANCH MODEL: c:\asp\1989\lucie2.sll
 PROBABILITY FILE: c:\asp\1989\pwr_bsll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Event Identifier: 389/90-001

B-326

Branch	System	Non-Recov	Opr Fail
trans	1.4E-04	1.0E+00	
loop	6.7E-05	2.1E-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	3.8E-04 > 2.3E-03	2.6E-01	
Branch Model: 1.OF.3+ser			
Train 1 Cond Prob:	2.0E-02		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	5.0E-02 > Failed		
Serial Component Prob:	2.8E-04		
AFW/EMERG.POWER	5.0E-02 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	5.0E-02 > Failed		
MPW	1.9E-01 > 1.0E+00	3.4E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.9E-01 > Failed		
porv.or.srv.chall	4.0E-02	1.0E+00	
porv.or.srv.reseat	2.0E-02	1.1E-02	
porv.or.srv.reseat/emerg.power	2.0E-02	1.0E+00	
seal.loca	4.8E-02	1.0E+00	
ep.rec(sl)	6.0E-01	1.0E+00	
ep.rec	1.1E-02	1.0E+00	
hpi	3.0E-04	8.4E-01	
hpi(f/b)	3.0E-04	8.4E-01	1.0E-02
porv.open	1.0E-02	1.0E+00	4.0E-04
hpr/-hpi	1.5E-04	1.0E+00	
csr	2.0E-03	3.4E-01	
* branch model file			
** forced			

Minarick
08-06-1991
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