

DESCRIPTION SHEET

LER No.: 317/87-012 R1
 Event Description: LOOP and one AFW train fails
 Date of Event: 7/23/87
 Plant: Calvert Cliffs 1 and 2

EVENT DESCRIPTION

Sequence

While at 100% power, a phase to ground fault developed on phase C' on one of two 500-kV transmission lines (line 5052) connecting the station to the Waugh Chapel power grid. Breakers tripped open as designed to isolate the fault. The second 500-kV line breakers (line 5051) tripped spuriously on sensing the fault due to a failed relay circuit card. A loss of station offsite power occurred. The units tripped. All three station DGs started and loaded. The LOOP lasted ~2 h until partial offsite power was restored.

Trouble was experienced in attempting to manually start the No. 11 TD AFW pump. It failed to start on the first two attempts due to an out-of-adjustment trip linkage. It started on the third attempt. There was no attempt to start the motor-driven AFW pump. The operators employed manual start to minimize diesel generator loading.

The initial line 5052 fault was caused by a tree making contact with the line.

Corrective Action

All trees in the area were cut down. The TD AFW pump's trip linkage was adjusted.

Plant/Event Data

Systems Involved:
 Electrical

Components and Failure Modes Involved:

Relays fail in operation
 Turbine AFW pump No. 11 twice failed to start on high vibration

Component Unavailability Duration: N/A
 Plant Operating Mode: 1 (100%)
 Discovery Method: Operational event
 Reactor Age: 12.8 and 10.6 y, respectively
 Plant Type: PWR

Event Identifier: 317/87-012 R1

Comments

This event was modeled assuming one TD AFW pump failed to initially start. The LER employs the word "pumps" when referring to the attempted start but does not explicitly mention the second TD AFW pump nor the motor-driven AFW pump (See LER p. 3 of 3P).

MODELING CONSIDERATION AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

LOOP	No recovery
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Branches Impacted and Branch Nonrecovery Estimate

AFW	Base case	One of three trains fails on demand
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AFW/EP	Failed	0.04 (0.12 for first turbine-driven AFW pump * 0.34 for local start of second turbine-driven pump).
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Plant Models Utilized

PWR plant Class G

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

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INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

LOOP 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
LOOP	4.8E-04
Total	4.8E-04
CV	
LOOP	1.1E-05
Total	1.1E-05
ATWS	
LOOP	0.0E+00
Total	0.0E+00

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
217	LOOP -rt/loop emerg.power ep.rec	CD	3.9E-04	1.4E-01
216	LOOP -rt/loop emerg.power -ep.rec AFW/EMERG.POWER	CD	7.8E-05	2.7E-02
215	LOOP -rt/loop emerg.power -ep.rec -AFW/EMERG.POWER -porv.or.srv .chall ss.releas.term	CV	8.9E-06	2.2E-01
209	LOOP -rt/loop -emerg.power -AFW -porv.or.srv.chall ss.releas.te rm hpi	CV	1.2E-06	2.9E-01
213	LOOP -rt/loop emerg.power -ep.rec -AFW/EMERG.POWER porv.or.srv .chall -porv.or.srv.reseat/emerg.power ss.releas.term	CV	3.6E-07	2.2E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
209	LOOP -rt/loop -emerg.power -AFW -porv.or.srv.chall ss.releas.te rm hpi	CV	1.2E-06	2.9E-01
213	LOOP -rt/loop emerg.power -ep.rec -AFW/EMERG.POWER porv.or.srv .chall -porv.or.srv.reseat/emerg.power ss.releas.term	CV	3.6E-07	2.2E-01
215	LOOP -rt/loop emerg.power -ep.rec -AFW/EMERG.POWER -porv.or.srv .chall ss.releas.term	CV	8.9E-06	2.2E-01
216	LOOP -rt/loop emerg.power -ep.rec AFW/EMERG.POWER	CD	7.8E-05	2.7E-02
217	LOOP -rt/loop emerg.power ep.rec	CD	3.9E-04	1.4E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\newmodel\pwr_gnew.cmp
 BRANCH MODEL: c:\asp\newmodel\calvert.new
 PROBABILITY FILE: c:\asp\newmodel\pwr_bnew.pro

Event Identifier: 317/87-012R1

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	4.8E-04	1.0E+00	
LOOP	4.6E-06 > 4.6E-06	3.9E-01 > 1.0E+00	
Branch Model: INITOR			
Initiator Freq:	4.6E-06		
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	
ep.rec	1.0E+00	1.7E-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 > 4.1E-02	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	5.0E-02 > Failed		
mfw	2.0E-01	3.4E-01	
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	
ss.releas.term	1.5E-02	3.4E-01	
ss.depress	3.6E-02	1.0E+00	
cond/mfw	1.0E+00	3.4E-01	1.0E-02
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
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