B.16 LER No. 293/83-007

Event Description: LOOP During Shutdown

Date of Event: February 13, 1983

Plant: Pilgrim

B.16.1 Summary

On February 13, 1983, a loss of offsite power (LOOP) occurred following a load rejection and scram caused by salt buildup on insulators in the switchyard. The LOOP occurred during the process of washing down portions of the switchyard to remove the salt deposits that had accumulated during a heavy ocean storm. The conditional core damage probability estimated for the event is 9.7×10^{-5}.

B.16.2 Event Description

On February 13, 1983, during a shutdown condition resulting from a load reject, a LOOP occurred. The load reject occurred when a heavy ocean storm caused a salt buildup on switchyard insulators, creating arcing to ground and the subsequent opening of breakers. During the process of washing down the isolated portion of the switchyard, melting ice and salt deposits on the remaining inservice portion of the switchyard created a separate ground that caused the inservice breakers to open, resulting in a LOOP. The emergency diesel generators (EDGs) started and other safety-related equipment functioned as designed. A secondary offsite power source was available as backup to the EDGs. After completion of the washdown, power was restored to the startup transformer and preparations for startup commenced.

B.16.3 Additional Event-Related Information

Pilgrim has two safety-related 4160 V ac buses. Both of these buses can be powered from the unit auxiliary transformer (UAT) or the startup transformer (SUT). Upon loss of the UAT following a reactor trip, the safety-related buses are transferred to the SUT. If the SUT is lost, the EDGs are started to power safety-related loads. If an EDG fails, the 23-kV secondary offsite source automatically powers the bus.

B.16.4 Modeling Assumptions

This event was modeled as a severe weather-induced loss of offsite power with all equipment available to respond to the event. The probabilities of failing to recover offsite power in the short term and before battery depletion were modified using the models described in *Revised LOOP Frequency and PWR Seal LOCA Models,* ORNL/CRC/LTR-89/11, August 1989.

The 23-kV line is unusual because it is used following the failure of the EDGs to start. The Pilgrim IPE indicates that 18 failures of the 345-kV lines occurred between September 13, 1975, and February 21, 1989. Of these 18 LOOPs, 7 were caused by severe weather. In three of these severe-weather-induced LOOPs, the 23-kV line was also lost. Therefore, the conditional probability that the 23-kV line is lost, given that the 235-kV lines are lost due to a severe-weather-induced LOOP, was set to 0.43 (3/7). Because the 23-kV line would close in automatically following the failure of the EDGs, the EDG nonrecovery value was modified to include the probability that the 23-kV line would be unavailable. Breaker failures and control system failures were assumed to be not significant, given the high unavailability of the line under these conditions.

The probabilities of failing to recover offsite power in the short term and before battery depletion were set to 0.9 and 5.5E-2, respectively.

B.16.5 Analysis Results

The estimated conditional core damage probability for the severe weather-induced LOOP is 9.7×10^{-5}. The dominant sequence, highlighted on the event tree in Figure B.16.1, involves a LOOP initiating event, successful reactor shutdown, failure of the emergency power system, and failure to restore offsite power before battery depletion.

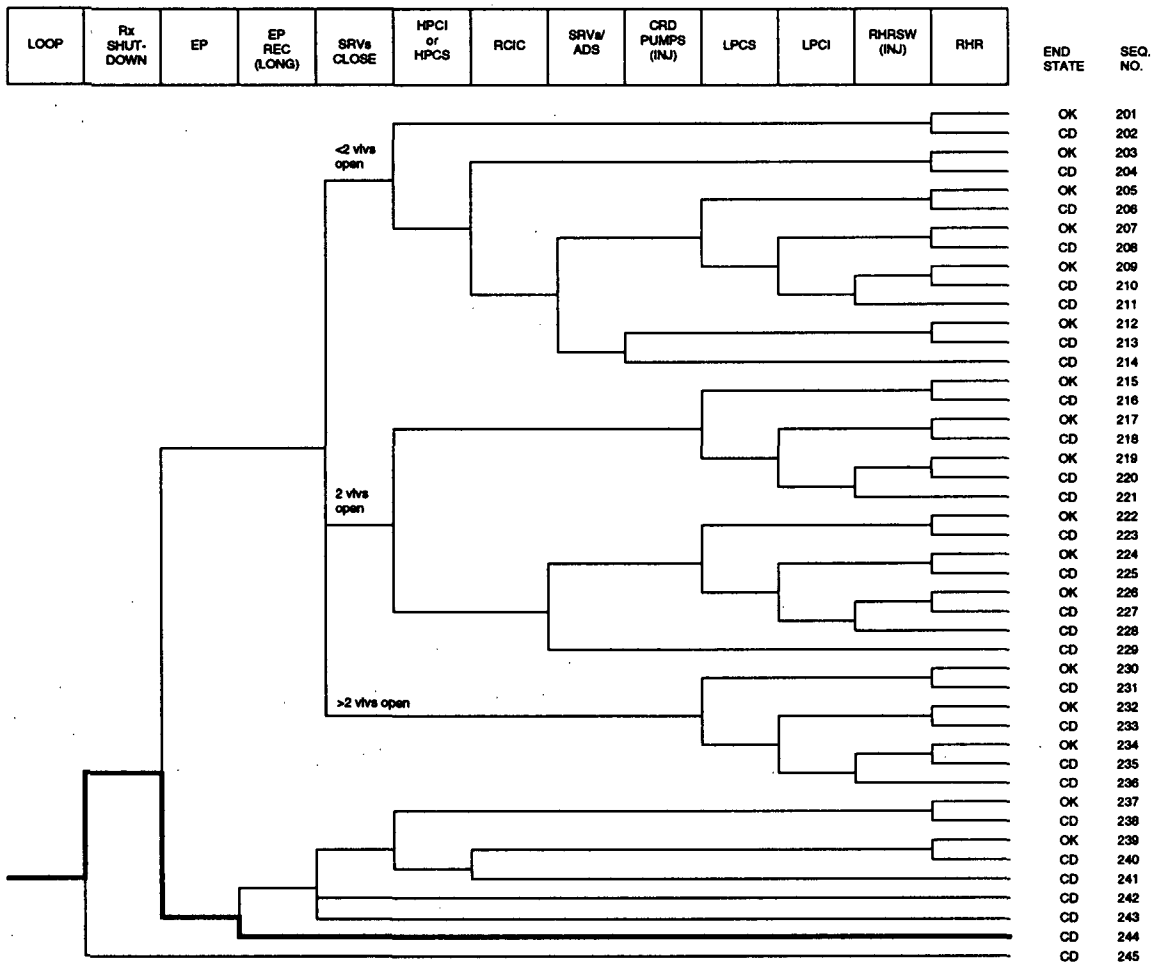

Figure B.16.1 Dominant core damage sequence for LER 293/83-007

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 293/83-007
Event Description: Loop during shutdown
Event Date: February 13, 1983
Plant: Pilgrim

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

LOOP	9.0E-01

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
LOOP	9.7E-05
Total	9.7E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
244	LOOP -rx.shutdown EP EP.REC	CD	5.2E-05	3.3E-01
245	LOOP rx.shutdown	CD	3.1E-05	9.0E-02
202	LOOP -rx.shutdown -EP srv.ftc.<2 -hpci rhr	CD	1.1E-05	1.4E-02

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
202	LOOP -rx.shutdown -EP srv.ftc.<2 -hpci rhr	CD	1.1E-05	1.4E-02
244	LOOP -rx.shutdown EP EP.REC	CD	5.2E-05	3.3E-01
245	LOOP rx.shutdown	CD	3.1E-05	9.0E-02

** non-recovery credit for edited case

SEQUENCE MODEL: d:\asp\models\bwrc8283.cmp
BRANCH MODEL: d:\asp\models\pilgrim.82
PROBABILITY FILE: d:\asp\models\bwr8283.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail

trans	1.2E-03	1.0E+00	
LOOP	2.0E-05 > 2.0E-05	4.3E-01 > 9.0E-01	
Branch Model: INITOR			
Initiator Freq:	2.0E-05		
loca	3.3E-06	6.7E-01	
rx.shutdown	3.5E-04	1.0E-01	
pcs	1.7E-01	1.0E+00	
srv.ftc.<2	1.0E+00	1.0E+00	
srv.ftc.2	1.3E-03	1.0E+00	
srv.ftc.>2	2.2E-04	1.0E+00	
mfw	2.9E-01	3.4E-01	
hpci	2.9E-02	7.0E-01	
rcic	6.0E-02	7.0E-01	
srv.ads	3.7E-03	7.0E-01	1.0E-02
crd(inj)	1.0E-02	1.0E+00	1.0E-02
cond	1.0E+00	3.4E-01	1.0E-03
lpcs	2.0E-03	1.0E+00	
lpci	1.1E-03	1.0E+00	
rhrsw(inj)	2.0E-02	1.0E+00	1.0E-02
rhr	1.5E-04	1.6E-02	1.0E-05
rhr.and.pcs.nrec	1.5E-04	8.3E-03	1.0E-05
rhr/-lpci	0.0E+00	1.0E+00	1.0E-05
rhr/lpci	1.0E+00	1.0E+00	1.0E-05
rhr(spcool)	2.1E-03	1.0E+00	1.0E-03
rhr(spcool)/-lpci	2.0E-03	1.0E+00	1.0E-03
EP	2.9E-03 > 2.9E-03	8.7E-01 > 3.7E-01	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	5.0E-02		
Train 2 Cond Prob:	5.7E-02		
EP.REC	3.1E-02 > 5.5E-02	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	3.1E-02 > 5.5E-02		
rpt	1.9E-02	1.0E+00	
slcs	2.0E-03	1.0E+00	1.0E-02
ads.inhibit	0.0E+00	1.0E+00	1.0E-02
man.depress	3.7E-03	1.0E+00	1.0E-02

* branch model file
** forced