PRECURSOR DESCRIPTION SHEET

LER No.: 293/87-014 R1
Event Description: LOOP and one DG removed from service for inspection
Date of Event: 11/12/87
Plant: Pilgrim 1

EVENT DESCRIPTION

Sequence

During a severe winter storm, the startup transformer was feeding the plant electrical distribution systems through the normal outage configuration except that bus B2 was tied to Bus B4. The A and B DGs were in standby. The shutdown transformer was unavailable due to modification work in progress on the new blackout DG tie-in. The unit auxiliary transformer was ready for partial operation; several post-maintenance tests needed to be completed. The RHRS A pump was in shutdown cooling mode; the C pump was secured. The RHRS B and D pumps were in standby. The A core spray train was in standby also; the B train was in maintenance. Two of five air compressors were also in maintenance. Of the remaining three compressors, one was operable but shut down. Backwashing of the main condenser was in progress.

At 0205 h offsite line 342 developed a phase A to phase C ground fault that tripped open two switchyard air circuit breakers (ACBs 103 & 104). ACB 104 opened too slowly and actuated the stuck breaker logic, which caused ACB 105 to trip. When ACB 105 tripped, it initiated a transfer sequence that tripped ACBs at the opposite end of line 342. ACB 102 was still supplying power to the startup transformer via line 355. Then line 355 developed a phase B to C fault, which tripped its ACBs. Line 355 was reenergized in 0.5 s from the Bridgewater Station, but the ACB had already tripped. All ACBs in the switchyard were now open (0206 h), and a LOOP condition existed. Both DGs autostarted and supplied the vital buses. PCIS and scram occurred. Between 02 06 and 0215 h line 355 experienced multiple faults due to the high winds. The dispatcher ordered the Bridgewater breaker to be opened to prevent cycling and thereby preventing a short-term recovery of offsite power. RHR A was briefly isolated when four fuses blew out, but SDC was restarted using pumps A and C. CRD pump A was shut down to prevent seal damage.

At 1135 h DG B was removed from service to investigate an ammeter problem. A prelube pump failure had also occurred. The restoration of offsite power was in progress but had not yet been accomplished. With DG B off, bus A-6 deenergized, disabling the air compressor supplying instrument air. Valves A0220-46 and -47 shut; they were providing a vent path from the vessel. A manual vent valve was opened. Thirty minutes later a second vent valve was opened. Power was restored to lines 342 and 355 at 1 415 h.

Corrective Action

Repairs were made and a backup air supply will be installed.

Plant/Event Data

Systems Involved:

Electrical
Emergency power

Components and Failure Modes Involved:

Offsite power lines fail on storm
A DG is out for maintenance

Component Unavailability Duration: 14 h
Plant Operating Mode: 6 (0%)
Discovery Method: Operational event
Reactor Age: 15.4 y
Plant Type: BWR

Comments

For analysis purposes it has been assumed that the LOOP could have occurred at power. Removal of DG B for inspection has not been addressed in the at-power postulated event.

MODELING CONSIDERATION AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

LOOP	1.0	No short-term recovery assumed possible

Branches Impacted and Branch Nonrecovery Estimate

None.

Plant Models Utilized

BWR plant Class C

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 293/87-014R1
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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	3.9E-04
Total	3.9E-04
CV	
LOOP	1.6E-05
Total	1.6E-05
ATWS	
LOOP	7.7E-06
Total	7.7E-06

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
274	LOOP emerg.power -scram ep.rec	CD	3.9E-04	1.4E-01
201	LOOP -emerg.power -scram srv.chall/loop.-scram -srv.close -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	1.3E-05	2.9E-01
202	LOOP -emerg.power -scram srv.chall/loop.-scram -srv.close -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CV	2.6E-06	1.1E-01
846	LOOP -emerg.power scram slc.or.rods	ATWS	6.9E-06	1.0E+00
841	LOOP emerg.power scram	ATWS	8.0E-07	8.0E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
201	LOOP -emerg.power -scram srv.chall/loop.-scram -srv.close -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	1.3E-05	2.9E-01
202	LOOP -emerg.power -scram srv.chall/loop.-scram -srv.close -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CV	2.6E-06	1.1E-01
846	LOOP -emerg.power scram slc.or.rods	ATWS	6.9E-06	1.0E+00
274	LOOP emerg.power -scram ep.rec	CD	3.9E-04	1.4E-01
841	LOOP emerg.power scram	ATWS	8.0E-07	8.0E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\newmodel\bwr_cnew.cmp
BRANCH MODEL: c:\asp\newmodel\pilgrim.new

PROBABILITY FILE: c:\asp\newmodel\bwr_cnew.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	8.6E-04	1.0E+00	
LOOP	1.7E-05 > 1.7E-05	3.2E-01 > 1.0E+00	
Branch Model: INITOR			
Initiator Freq:	1.7E-05		
loca	3.3E-06	5.0E-01	
scram	3.5E-04	1.0E+00	
slc.or.rods	1.0E-02	1.0E+00	1.0E-02
pcs/trans	1.7E-01	1.0E+00	
srv.chall/trans.-scram	1.0E+00	1.0E+00	
srv.chall/loop.-scram	1.0E+00	1.0E+00	
srv.close	1.3E-02	1.0E+00	
emerg.power	2.9E-03	8.0E-01	
ep.rec	1.0E+00	1.7E-01	
fw/pcs.trans	2.9E-01	3.4E-01	
fw/pcs.loca	4.0E-02	3.4E-01	
hpci	2.9E-02	7.0E-01	
rcic	6.0E-02	7.0E-01	
crd	1.0E-02	1.0E+00	1.0E-02
srv.ads	3.7E-03	7.1E-01	1.0E-02
cond/fw.pcs	1.0E+00	3.4E-01	1.0E-03
lpcs	3.0E-03	3.4E-01	
lpci(rhr)/lpcs	1.0E-03	7.1E-01	
rhr(sdc)	2.1E-02	3.4E-01	1.0E-03
rhr(sdc)/-lpci	2.0E-02	3.4E-01	1.0E-03
rhr(sdc)/lpci	1.0E+00	1.0E+00	1.0E-03
rhr(spcool)/-lpci.rhr(sdc)	2.0E-03	1.0E+00	
rhr(spcool)/lpci.rhr(sdc)	5.2E-01	1.0E+00	
c.i.and.v	1.0E-03	1.0E+00	1.0E-02
rhrsw	2.0E-02	3.4E-01	2.0E-03
rhrsw(c.i.and.v)	5.0E-01	3.4E-01	

* branch model file
** forced

Minarick
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