PRECURSOR DESCRIPTION SHEET

LER No.: 397/87-002
Event Description: Trip with subsequent main steam line flooding
Date of Event: 3/22/87
Plant: WNP 2

EVENT DESCRIPTION

Sequence

While at 71% power, a fuse blew in the feedwater level control system and caused rapid reactor feed pump acceleration and subsequent trip on low suction pressure. Upon observing feedwater flow reduction, the operators manually tripped the reactor. When the vessel level dropped to the Level-2 set point (-50 in.), both high-pressure core spray and reactor core isolation cooling initiated as designed. The Level-2 set point further caused nuclear steam shutoff supply isolation, an ATWS reactor recirculation pump trip, and the auto start of the support systems required for HPCS and RCIC. NSSS isolation required manual vessel pressure control using the main steam safety relief valves. The trip was complicated when the operators failed to complete the valving sequence required to establish shutdown level control due to the significant attention and effort operators were giving to re-establish containment cooling. This led to overfilling of the vessel and flooding of the main steam lines. The operators were diverted by the need to establish containment cooling to prevent a drywell isolation on high pressure. Recovery from drywell isolation would require resetting the isolation circuit after the level is recovered, starting both the plant service water and reactor closed cooling pumps and opening the cooling water containment isolation valves. The operators were further distracted when an equipment operator errantly informed control room operators that the RCIC pump had tripped on overspeed, thereby leading operators to rely solely on the safety relief valves for pressure control and the condensate/feedwater system for makeup. This required vessel depressurization so that the condensate/feedwater system could be used.

Corrective Action

Several procedures were reviewed and/or revised. Additional training was provided to operators specific to recovery from a Level-2 occurrence. Further training included review and re-emphasis of main steam isolation to prevent recurrence of main steam line flooding. As a precautionary measure, the MSRV-4D valve was disassembled and inspected. The TSW load shedding will be evaluated for modification to shed loads only upon loss of offsite power.

Plant/Event Data

Systems Involved:

Reactor feedwater system
Main steam
RCIC

Components and Failure Modes Involved:

Reactor feedwater system – tripped on spurious zero flow signal
Main steam – lines flooded due to improper valve lineup
RCIC – not failed, though reported failed (and assumed failed once main steam lines flooded)

Component Unavailability Duration: N/A
Plant Operating Mode: 1(71% power)
Discovery Method: Operational event
Reactor Age: 3.2 y
Plant Type: BWR

Comments

None.

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	No recovery assumed possible

Branches Impacted and Branch Nonrecovery Estimate

RCIC	1.0	Assumed faulted (reported faulted although actually operable – assumed unavailable once main steam line flooded)
PCS	1.0	Unavailable
MFW	1.0	Unavailable

Plant Models Utilized

BWR plant Class C

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 397/87-002
Event Description: Trip with subsequent main steam line flooding
Event Date: 03/22/87
Plant: WNPSS 2

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	6.5E-06
Total	6.5E-06
CV	
TRANS	1.7E-05
Total	1.7E-05
ATWS	
TRANS	7.0E-06
Total	7.0E-06

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
105	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CD	2.8E-06	1.2E-01
145	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close fw/pcs.loca hpci srv.ads	CD	1.7E-06	8.2E-02
125	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS hpci RCIC crd srv.ads	CD	1.6E-06	2.4E-01
106	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) c.i.and.v	CD	1.8E-07	3.4E-01
127	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close -fw/pcs.loca rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CD	1.2E-07	7.6E-02
104	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	1.3E-05	2.9E-01
913	trans scram -slc.or.rods PCS/TRANS -srv.close FW/PCS.TRANS hpci RCIC -srv.ads -cond/fw.pcs -rhr(sdc)	CV	1.4E-06	2.2E-01
917	trans scram -slc.or.rods PCS/TRANS -srv.close FW/PCS.TRANS hpci RCIC -srv.ads cond/fw.pcs -lpcs -rhr(sdc)	CV	7.3E-07	1.1E-01
126	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close -fw/pcs.loca rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	5.7E-07	1.9E-01
963	trans scram slc.or.rods	ATWS	7.0E-06	1.0E+00

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**

104	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	1.3E-05	2.9E-01
105	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CD	2.8E-06	1.2E-01
106	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS -hpci rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) c.i.and.v	CD	1.8E-07	3.4E-01
125	trans -scram PCS/TRANS srv.chall/trans.-scram -srv.close FW/PCS.TRANS hpci RCIC crd srv.ads	CD	1.6E-06	2.4E-01
126	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close -fw/pcs.loca rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v -rhrsw(c.i.and.v)	CV	5.7E-07	1.9E-01
127	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close -fw/pcs.loca rhr(sdc) rhr(spcool)/-lpci.rhr(sdc) -c.i.and.v rhrsw(c.i.and.v)	CD	1.2E-07	7.6E-02
145	trans -scram PCS/TRANS srv.chall/trans.-scram srv.close -w/pcs.loca hpci srv.ads	CD	1.7E-06	8.2E-02
913	trans scram -slc.or.rods PCS/TRANS -srv.close FW/PCS.TRANS hpci RCIC -srv.ads -cond/fw.pcs -rhr(sdc)	CV	1.4E-06	2.2E-01
917	trans scram -slc.or.rods PCS/TRANS -srv.close FW/PCS.TRANS hpci RCIC -srv.ads cond/fw.pcs -lpcs -rhr(sdc)	CV	7.3E-07	1.1E-01
963	trans scram slc.or.rods	ATWS	7.0E-06	1.0E+00

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\newmodel\bwr_cnew.cmp
BRANCH MODEL: c:\asp\newmodel\wnp2.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	3.2E-01	
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	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.7E-01 > Unavailable		
srv.chall/trans.-scram	1.0E+00	1.0E+00	
srv.chall/loop.-scram	1.0E+00	1.0E+00	
srv.close	5.9E-02	1.0E+00	
emerg.power	2.9E-03	8.0E-01	
ep.rec	1.0E+00	1.7E-01	
FW/PCS.TRANS	4.6E-01 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	4.6E-01 > Unavailable		
fw/pcs.loca	1.0E+00	3.4E-01	
hpci	2.0E-02	3.4E-01	
RCIC	6.0E-02 > 1.0E+00	7.0E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	6.0E-02 > Unavailable		
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	2.0E-02	3.4E-01	
lpci(rhr)/lpcs	6.0E-04	7.1E-01	
rhr(sdc)	2.3E-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

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