

PRECURSOR DESCRIPTION SHEET

LER No.: 338/84-019
Event Description: Trip and One AFW Train Fails
Date of Event: November 14, 1984
Plant: North Anna 1

EVENT DESCRIPTION

Sequence

At 0640 h a vital bus inverter failure caused Unit 1 to trip from 100% power. The inverter was supplying power to the 125-V ac vital bus 1-III. The inverter failure caused this bus and its associated equipment to become deenergized. Loss of power to the relay that senses "C" RCP breaker position caused the reactor trip on loss of RCS flow coincident with reactor power >30%. The "C" RCP never stopped running during this event.

Vital bus 1-III was deenergized for <2 min. The inverter had damaged SCRs and a blown fuse which prevented it from being reenergized. The bus was subsequently powered from its backup regulating transformer. All equipment power from vital bus 1-III responded as expected during loss and restoration of the bus. The most significant equipment response involved "B" SG. The "B" main feed valve (FCV-1488) and "B" feed bypass valve (FCV-1489) both failed closed. "B" wide-range SG level indication (LI-1487) failed low. The AFW pump (1-FW-P-3B) that supplies "B" SG failed to autostart and was manually started by the control room operator. These actions caused "B" SG level to drop below the narrow range indication while no-wide range level indication was available. Level was restored to "B" SG within a few minutes.

Loss of vital bus 1-III also deenergized all four water boxes' vacuum breakers, which caused all circulating water pumps to trip. This has been assumed to have resulted in an LOFW.

Vital bus 1-III also supplies power to many containment isolation trip valves, including CC to the RCPs. Other significant equipment powered from the 1-III vital bus included 1 power range detector (N43), 26 incore thermocouples, SSPS channel III inputs, SSPS train B output relays, train B RV-level instrumentation, radiation monitor cabinet 1-2, and other equipment.

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One of the blowdown-containment isolation trip valves did not close automatically and would not close manually during this event. A solenoid-operated valve for this trip valve would not change position. Maintenance personnel agitated the solenoid valve, and the trip valve was subsequently cycled satisfactorily. Blowdown containment isolation trip valves are cycled every three months during a periodic test to verify valve-stroke time.

The source range excore detectors had to be manually reinstated because one intermediate-range detector was undercompensated. This detector had its compensation voltage adjusted before the reactor was taken critical.

The unit was placed in mode 2 on November 17, 1984, and returned to 100% power on November 19, 1984.

Corrective Action

Repairs were made.

Plant/Event Data

Systems Involved:
AFW, electrical

Components and Failure Modes Involved:
AFW pump — failed on demand

Component Unavailability Duration: NA
Plant Operating Mode: 1 (100% power)
Discovery Method: Operational event
Reactor Age: 6.6 years
Plant Type: PWR

Comments

None

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MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	Not recoverable
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Branches Impacted and Branch Nonrecovery Estimate

AFW	Base case	One train unavailable
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MFW	0.34	Assumed recoverable locally at the equipment
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Plant Models Utilized

PWR plant Class A

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CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

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INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.0E+00
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SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CV	
TRANS	2.1E-05
Total	2.1E-05
CD	
TRANS	1.0E-05
Total	1.0E-05
ATWS	
TRANS	3.0E-05
Total	3.0E-05

DOMINANT SEQUENCES

End State: CV	Conditional Probability:	5.9E-06
112 TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI		
End State: CD	Conditional Probability:	2.4E-06
135 TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW		
End State: ATWS	Conditional Probability:	3.0E-05

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137 TRANS RT

SEQUENCE CONDITIONAL PROBABILITIES

	Sequence	End State	Prob	N Rec**
101	TRANS -RT -AFW PORV.OR.SRV.CHALL -PORV.OR.SRV.RESEAT SS.RELE AS.TERM HPI	CV	2.4E-07	1.8E-01
102	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI -HP R/-HPI CSR -SS.DEPRESS -LPR/-HPI	CV	5.0E-07	1.7E-02
103	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI -HP R/-HPI CSR -SS.DEPRESS LPR/-HPI	CD	1.0E-06	1.7E-02
105	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI -SS.DEPRESS -LPR/-HPI	CV	5.3E-07	2.8E-02
106	TRANS -RT -AFW PORV.OR.SRV.CHALL PORV.OR.SRV.RESEAT -HPI HP R/-HPI -SS.DEPRESS LPR/-HPI	CD	1.1E-06	2.8E-02
112	TRANS -RT -AFW -PORV.OR.SRV.CHALL SS.RELEAS.TERM HPI	CV	5.9E-06 *	1.8E-01
125	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI -CSR PORV.OPEN -SS.DE PRESS -COND/MFW	CV	9.9E-07	6.0E-02
126	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI -CSR PORV.OPEN -SS.DE PRESS COND/MFW	CD	5.1E-07	3.1E-02
128	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI CSR -SS.DEPRESS -COND /MFW	CV	4.2E-06	2.1E-02
129	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI CSR -SS.DEPRESS COND /MFW	CD	2.2E-06	1.1E-02
130	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI CSR SS.DEPRESS	CD	2.4E-07	3.1E-02
131	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS -COND/MFW	CV	4.5E-06	3.4E-02
132	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS COND/MFW	CD	2.3E-06	1.7E-02
133	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI SS.DEPRESS	CD	2.5E-07	5.1E-02
134	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW	CV	4.6E-06	3.2E-02
135	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW	CD	2.4E-06 *	1.6E-02
136	TRANS -RT AFW MFW HPI(F/B) SS.DEPRESS	CD	2.6E-07	4.8E-02
137	TRANS RT	ATWS	3.0E-05 *	1.2E-01

* dominant sequence for end state

** non-recovery credit for edited case

MODEL: b:\PWRATREE.CMP

DATA: b:\NANNAPRO.CMP

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.0E-03	1.0E+00	
LOOP	2.3E-05	3.4E-01	
LOCA	4.2E-06	3.4E-01	

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RT	2.5E-04	1.2E-01	
RT/LOOP	0.0E+00	1.0E+00	
EP	2.9E-03	5.1E-01	
AFW	1.0E-03 > 1.9E-03	2.7E-01	
Branch Model: 1.OF.3+ser			
Train 1 Cond Prob:	2.0E-02		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Train 3 Cond Prob:	5.0E-02		
Serial Component Prob:	9.2E-04		
AFW/EP	5.0E-02	3.4E-01	
MFW	1.9E-01 > 1.0E+00	3.4E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	1.9E-01 > Unavailable		
PORV.OR.SRV.CHALL	4.0E-02	1.0E+00	
PORV.OR.SRV.RESEAT	2.0E-02	5.0E-02	
SS.RELEAS.TERM	1.5E-02	3.4E-01	
SS.RELEAS.TERM/-MFW	1.5E-02	3.4E-01	
SS.DEPRESS	3.6E-02	1.0E+00	
COND/MFW	1.0E+00	3.4E-01	
HPI	2.3E-03	5.2E-01	
HPI(F/B)	2.3E-03	5.2E-01	4.0E-02
PORV.OPEN	1.0E-02	1.0E+00	
HPR/-HPI	3.0E-03	5.6E-01	4.0E-02
CSR	3.0E-03	3.4E-01	4.0E-02
LPI/HPI	1.0E-03	3.4E-01	
LPR/-HPI	6.7E-01	1.0E+00	
LPR/HPI	2.0E-03	1.0E+00	

*** forced

Minarick
04-12-1987
10:25:50

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