

PRECURSOR DESCRIPTION SHEET

LER No.: 325/84-014
Event Description: Trip and LOFW with HPCI Unavailable
Date of Event: August 1, 1984
Plant: Brunswick 1

EVENT DESCRIPTION

Sequence

At 1417 h while the reactor was at 95% power, an instrument upscale trip of the reactor average power range monitor (APRM) system caused the reactor protection system to automatically initiate a reactor scram. In addition, the HPCI system was out of service, pending periodic testing.

A scram recovery was carried out. Reactor level, with the lowest recorded value of 142.8 in., was controlled through the RCIC system. A Group 1 isolation occurred, as per design, when the reactor pressure decreased to the low-pressure set point while the mode switch was in mode 1. Reactor pressure, which peaked at 997 psig, was controlled by manual opening of the unit reactor SRVs A, B, E, and J. Following the isolation, the control operator discovered that inboard MSIV 1-B21-F022A did not automatically close. An attempt to close the valve manually proved unsuccessful. The MSIV failed when its ac/dc, three-way, air-operated solenoid valve failed.

The subject APRM system upscale trip resulted from the reactor's recirculation-loop-flow instrumentation's receiving erroneous input signals. These signals caused the instruments to sense simultaneous decreasing flow spikes in each reactor recirculation loop (A and B). This resulted in an automatic reduction of the APRM system high-reactor-power scram set point to less than the actual reactor power, thereby causing the APRM system upscale trip. The cause of the erroneous input signals to the recirculation-loop-flow instrumentation was electronic keying of two-way radios in use in the immediate vicinity of the subject instrumentation in the unit reactor building. Plant auxiliary operators were using the two-way radios in the performance of an annual periodic test of the reactor building fire protection sprinkler systems.

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Corrective Action

The F022A three-way ac/dc solenoid pilot valve was replaced, and the removed component was subsequently bench tested. No evident signs of failure were noted during testing of the three-way solenoid pilot valve.

As a result of this event, various types of communication radios utilized in both units will be electronically keyed in the vicinity of the Unit 2 instrumentation racks in the reactor building to determine if control room instrumentation is adversely affected. This testing of plant communication radios was planned to be complete by September 14, 1984. Following this testing, signs prohibiting the use of plant communication radios within specific identified plant areas were to be appropriately posted in those areas. In addition, plant Engineering was to be requested to evaluate the apparent failure of the MSIV F022A solenoid pilot valve to determine applicable corrective action.

Plant/Event Data

Systems Involved:

HPCI

Components and Failure Modes Involved:

HPCI — out of service for testing

MFW — failed by Group I isolation

Component Unavailability Duration: NA

Plant Operating Mode: 1 (94% power)

Discovery Method: Operational event

Reactor Age: 7.8 years

Plant Type: BWR

Comments

None

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient	1.0	No recovery
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Branches Impacted and Branch Nonrecovery Estimate

PCS	1.0	Unavailable following Group I isolation
HPCI	0.34	Assume potential recovery from testing status
MFW	1.0	Unavailable following Group I isolation

Plant Models Utilized

BWR plant Class C

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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	5.9E-06
Total	5.9E-06
CD	
TRANS	1.2E-04
Total	1.2E-04
ATWS	
TRANS	2.0E-05
Total	2.0E-05

DOMINANT SEQUENCES

End State: CV	Conditional Probability: 3.1E-06
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134 TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS
 -COND/FW.PCS -RHR(SDC)

End State: CD	Conditional Probability: 4.3E-05
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119 TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM SRV.CLOSE FW/PCS.LOCA HPCI RCIC/LOCA SRV.ADS

End State: ATWS	Conditional Probability: 2.0E-05
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173 TRANS SCRAM SLC.OR.RODS

SEQUENCE CONDITIONAL PROBABILITIES

	Sequence	End State	Prob	N Rec**
102	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/RHR(SDC).RHR(SPCOOL)	CD	9.1E-06	7.6E-02
103	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM -SRV.CLOSE FW /PCS.TRANS HPCI -RCIC/TRANS.OR.LOOP RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	4.5E-06	3.9E-02
110	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM -SRV.CLOSE FW /PCS.TRANS HPCI RCIC/TRANS.OR.LOOP CRD SRV.ADS	CD	8.7E-06	1.9E-01
119	TRANS -SCRAM PCS/TRANS SRV.CHALL/TRANS.-SCRAM SRV.CLOSE FW /PCS.LOCA HPCI RCIC/LOCA SRV.ADS	CD	4.3E-05 *	1.2E-01
121	TRANS -SCRAM PCS/TRANS -SRV.CHALL/TRANS.-SCRAM FW/PCS.TRANS -HPCI RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V/RHR (SDC).RHR(SPCOOL)	CD	2.2E-05	7.6E-02
122	TRANS -SCRAM PCS/TRANS -SRV.CHALL/TRANS.-SCRAM FW/PCS.TRANS HPCI -RCIC/TRANS.OR.LOOP RHR(SDC) RHR(SPCOOL)/-LPCI.RHR(SDC) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	1.1E-05	3.9E-02
129	TRANS -SCRAM PCS/TRANS -SRV.CHALL/TRANS.-SCRAM FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP CRD SRV.ADS	CD	2.1E-05	1.9E-01
134	TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS -COND/FW.PCS -RHR(SDC)	CV	3.1E-06 *	1.3E-01
138	TRANS SCRAM -SLC.OR.RODS PCS/TRANS -SRV.CLOSE FW/PCS.TRANS HPCI RCIC/TRANS.OR.LOOP -SRV.ADS COND/FW.PCS -LPCS -RHR(SDC)	CV	1.6E-06	6.6E-02
155	TRANS SCRAM -SLC.OR.RODS PCS/TRANS SRV.CLOSE FW/PCS.LOCA HPCI RCIC/LOCA -SRV.ADS -COND/FW.PCS -RHR(SDC)	CV	7.6E-07	7.6E-02
159	TRANS SCRAM -SLC.OR.RODS PCS/TRANS SRV.CLOSE FW/PCS.LOCA HPCI RCIC/LOCA -SRV.ADS COND/FW.PCS -LPCS -RHR(SDC)	CV	3.9E-07	3.9E-02
173	TRANS SCRAM SLC.OR.RODS	ATWS	2.0E-05 *	1.0E+00

* dominant sequence for end state

** non-recovery credit for edited case

MODEL: b:\bwrctree.cmp

DATA: b:\brunprob.cmp

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.1E-03	1.0E+00	

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LOOP	1.3E-05	3.4E-01	
LOCA	3.3E-06	3.4E-01	
SCRAM	4.1E-04	1.0E+00	
SLC.OR.RODS	1.0E-02	1.0E+00	4.0E-02
PCS/TRANS	1.7E-01 > 1.0E+00	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.7E-01 > Failed		
PCS/LOCA	1.0E+00	1.0E+00	
SRV.CHALL/TRANS.-SCRAM	3.0E-01	1.0E+00	
SRV.CHALL/TRANS.SCRAM	1.0E+00	1.0E+00	
SRV.CHALL/LOOP.-SCRAM	3.0E-01	1.0E+00	
SRV.CHALL/LOOP.SCRAM	1.0E+00	1.0E+00	
SRV.CLOSE	2.7E-02	1.0E+00	
EMERG.POWER	2.9E-03	5.1E-01	
FW/PCS.TRANS	4.6E-01 > 1.0E+00	3.4E-01 > 1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	4.6E-01 > Unavailable		
FW/PCS.LOCA	1.0E+00	3.4E-01	
HPCI	1.0E-01 > 1.0E+00	5.7E-01 > 3.4E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	1.0E-01 > Failed		
RCIC/TRANS.OR.LOOP	6.7E-02	5.7E-01	
RCIC/LOCA	1.0E+00	1.0E+00	
CRD	1.0E-02	1.0E+00	4.0E-02
SRV.ADS	6.7E-03	1.0E+00	4.0E-02
COND/FW.PCS	1.0E+00	3.4E-01	
LPCS	3.0E-03	3.4E-01	
LPCI (RHR) /LPCS	4.0E-04	3.4E-01	
RHRSW/LPCS.LPCI.TRANS	5.0E-01	1.0E+00	4.0E-02
RHRSW/LPCS.LPCI.LOOP	5.0E-01	1.0E+00	4.0E-02
RHRSW/LPCS.LPCI.LOCA	5.0E-01	1.0E+00	4.0E-02
RHR (SDC)	2.0E-02	3.4E-01	
RHR (SDC) /-LPCI	2.0E-02	3.4E-01	
RHR (SDC) /LPCI	1.0E+00	1.0E+00	
RHR (SPCOOL) /-LPCI.RHR (SDC)	2.0E-02	1.0E+00	
RHR (SPCOOL) /LPCI.RHR (SDC)	5.2E-01	1.0E+00	
C.I.AND.V/RHR (SDC) .RHR (SPCOOL)	1.0E+00	3.4E-01	

*** forced

Minarick
04-11-1987
17:12:32

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