PRECURSOR DESCRIPTION AND ANALYSIS

LER No.:   346/85-002
Event Description: Reactor Trip, Loss of Feedwater, and AFW Train
                    Failure
Date of Event: January 15, 1985
Plant: Davis-Besse 1

EVENT DESCRIPTION

Sequence

During zero power physics testing with the reactor in a critical
condition, it was discovered that the Integrated Control System (ICS)
was not controlling SG 1 level at the desired set point. The MFW valves
were placed in manual control to allow adjustments in the ICS low-level
limit control. SG 1 level continued to decrease to the low level set
point of the Steam and Feedwater Rupture Control System (SFRCS), which
initiated a reactor trip and MFW isolation.

AFW initiated; however, the No. 1 AFW pump became unavailable when the
pump suction transferred to the SW system 30 s after the SFRCS
actuation, and the operator subsequently isolated the SW supply. The
transfer had occurred because of the low suction pressure switch
actuated isolating the condensate storage tank, which also caused
isolation of steam to the No. 1 AFW pump turbine. The No. 2 AFW pump
operated properly and maintained proper levels in SG2 throughout the
event. The pressure switch is located upstream of the two AFW pumps and
downstream of the condensate storage tank strainer.

Corrective Action

See LER, p. 3.

Plant/Event Data

Systems Involved
    ICS, SFRCS, AFW, and MFW

Components and Failure Modes Involved:
    AFW pump — failed to deliver flow on demand
    One ICS function level control in SG 1 — failed on demand

Component Unavailability Duration: NA
Plant Operating Mode: Startup mode (0% power)
Discovery Method: During startup testing
Reactor Age: 7.43 years
Plant Type: PWR

Event Identifier: 346/85-002

Comments:

The reactor had been shut down in a refueling outage for over four months.

MODELING CONSIDERATIONS AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

Transient   1.0   Nonrecoverable

Branches Impacted and Branch Nonrecovery Estimate

One AFW train   Base case

MFW   Base case   Recovery would require reset of the
                                 SFRCS-trip, a nonroutine but possible
                                 action under the circumstances of the
                                 transient

Bleed and feed,   See calcu-   Branch tailoring was done to reflect
  HPR, and LPR   lations   the bleed-and-feed procedures in
                                 effect and the use of LPI as a suction
                                 source for HPR

Plant Models Utilized

PWR plant Class B

CONDITIONAL CORE DAMAGE CALCULATIONS

LER Number: 346/85-002
Event Description: Reactor Trip, LOFW, and AFW Train Failure
Event Date: 1/15/85
Plant: Davis-Besse

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS   1.000E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

        End State/Initiator   Probability

CV

    TRANS   5.308E-04

    Total   5.308E-04

CD

    TRANS   3.036E-04

    Total   3.036E-04

ATWS

    TRANS   3.000E-05

    Total   3.000E-05

DOMINANT SEQUENCES

End State: CV   Conditional Probability: 2.453E-04

125   TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW

End State: CD   Conditional Probability: 1.264E-04

126   TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW

End State: ATWS   Conditional Probability: 3.000E-05

128   TRANS RT

Event Identifier: 346/85-002

SEQUENCE CONDITIONAL PROBABILITIES

	Sequence							End State	Seq. Prob	Non-Recov**
119	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI PORV.OPEN -SS.DEPRESS -COND/MFW							CV	5.366E-05	5.578E-02
120	TRANS -RT AFW MFW -HPI(F/B) -HPR/-HPI PORV.OPEN -SS.DEPRESS COND/MFW							CD	2.764E-05	2.874E-02
122	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS -COND/MFW							CV	2.292E-04	3.577E-03
123	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI -SS.DEPRESS COND/MFW							CD	1.181E-04	1.843E-03
124	TRANS -RT AFW MFW -HPI(F/B) HPR/-HPI SS.DEPRESS							CD	1.297E-05	5.420E-03
125	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS -COND/MFW							CV	2.453E-04 *	3.746E-03
126	TRANS -RT AFW MFW HPI(F/B) -SS.DEPRESS COND/MFW							CD	1.264E-04 *	1.930E-03
127	TRANS -RT AFW MFW HPI(F/B) SS.DEPRESS							CD	1.388E-05	5.676E-03
128	TRANS RT							ATWS	3.000E-05 *	1.200E-01

* dominant sequence for end state
** non-recovery credit for edited case

Note:

Conditional probability values are differential values which reflect the added risk due to observed failures. Parenthetical values indicate a reduction in risk compared to a similar period without the existing failures.

MODEL: b:pwrbtree.cmp
DATA: b:davispro.cmp

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	1.030E-03	1.000E+00	
LOOP	2.280E-05	3.400E-01	
LOCA	4.170E-06	3.400E-01	
RT	2.500E-04	1.200E-01	
RT/LOOP	0.000E+00	1.000E+00	
EMERG.POWER	2.850E-03	5.100E-01	
AFW	5.000E-03 > 1.000E-01	2.700E-01	
Branch Model: 1.0F.2			
Train 1 Cond Prob:	5.000E-02 > Failed		
Train 2 Cond Prob:	1.000E-01		
AFW/EMERG.POWER	5.000E-03	2.700E-01	
MFW	2.000E-01 > 1.000E+00	3.400E-01	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	2.000E-01 > Failed		
PORV.OR.SRV.CHALL	8.000E-02	1.000E+00	
PORV.OR.SRV.RESEAT	1.000E-02	5.000E-02	

Event Identifier: 346/85-002

```
PORV.OR.SRV.RESEAT/EMERG.POWER   1.000E-02                    5.000E-02
SS.RELEAS.TERM                   1.500E-02                    3.400E-01
SS.RELEAS.TERM/-MFW              1.500E-02                    3.400E-01
HPI                              1.000E-03                    5.200E-01
HPI(F/B)                         1.000E-03 > 4.000E-03        5.200E-01            4.000E-02
   Branch Model:  1.0F.2+opr
   Train 1  Cond Prob:           1.000E-02 > 4.000E-02
   Train 2  Cond Prob:           1.000E-01
HPR/-HPI                         3.000E-03 > 1.000E-03        5.600E-01 > 1.000E+00   4.000E-02
   Branch Model:  1.0F.2+opr
   Train 1  Cond Prob:           3.000E-02 > 1.000E-02
   Train 2  Cond Prob:           1.000E-01
PORV.OPEN                        1.000E-02                    1.000E+00
SS.DEPRESS                       3.600E-02                    1.000E+00
COND/MFW                         1.000E+00                    3.400E-01
LPI/HPI                          1.000E-03                    3.400E-01
LPR/-HPI.HPR                     6.700E-01 > 1.000E+00        1.000E+00
   Branch Model:  1.0F.1
   Train 1  Cond Prob:           6.700E-01 > 1.000E+00
LPR/HPI                          1.000E-03                    1.000E+00

*** forced



Austin
08-13-1986
05:58:26
```

Event Identifier: 346/85-002