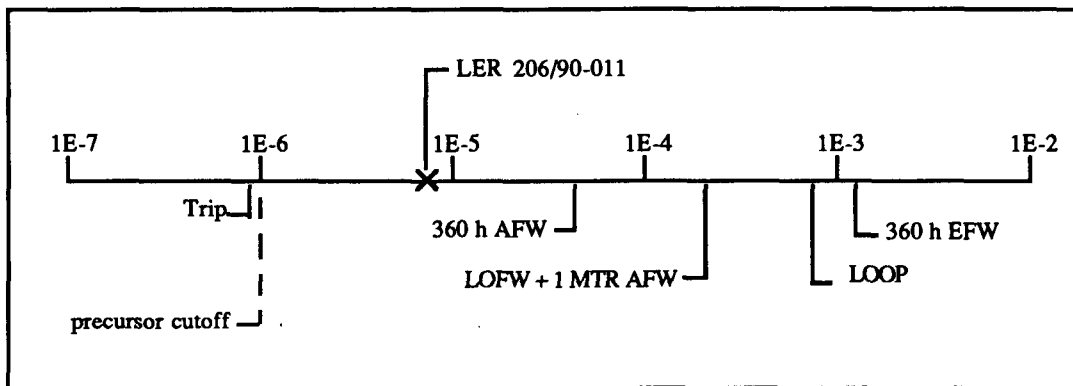


ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No.: 206/90-011
 Event Description: Reactor trip with one train of auxiliary feedwater autostart disabled
 Date of Event: May 15, 1990
 Plant: San Onofre 1

Summary

The reactor was manually tripped from 91.5% power due to a low and decreasing level in one of three steam generators (SGs). The automatic start for one train of auxiliary feedwater (AFW) was disabled to prevent automatic start of that train's pump while corrective maintenance on the pump's valve control circuit was being performed. An inadvertent short caused the closure of the main feedwater (MFW) regulating valve for "C" steam generator. Manual control of the valve was not obtained before a manual scram was required by procedure. The conditional core damage probability estimated for this event is 7.6×10^{-6} . The relative significance of this event compared to other postulated events at San Onofre 1 is shown below.



Event Description

San Onofre 1 was operating at 91.5% power when the reactor was tripped due to a low and decreasing level in steam generator "C" resulting from a loss of feedwater flow in loop "C". The loss of feedwater flow occurred during corrective maintenance on an auxiliary feedwater (AFW) train A pump G-10 valve control circuit, which resulted in an inadvertent short circuit. The short caused a brief voltage reduction, which resulted in the transfer of the 120 Vital Buses 3 and 3A from their normal inverter power source to their backup power source. The brief power interruption which occurred during the

transfer resulted in a spurious SG "C" high level actuation signal, which initiated closure of SG "C" main feedwater regulating valve FCV-458. In accordance with procedures, the control room operator then reset the FCV-458 controls to control the valve manually. However, the operator was unable to reestablish feedwater flow before SG "C" reached the level at that procedures require the reactor to be manually tripped.

Following the trip, AFW train "A" did not automatically actuate because the channel had been placed in manual to preclude automatic pump start during maintenance.

Additional Event-Related Information

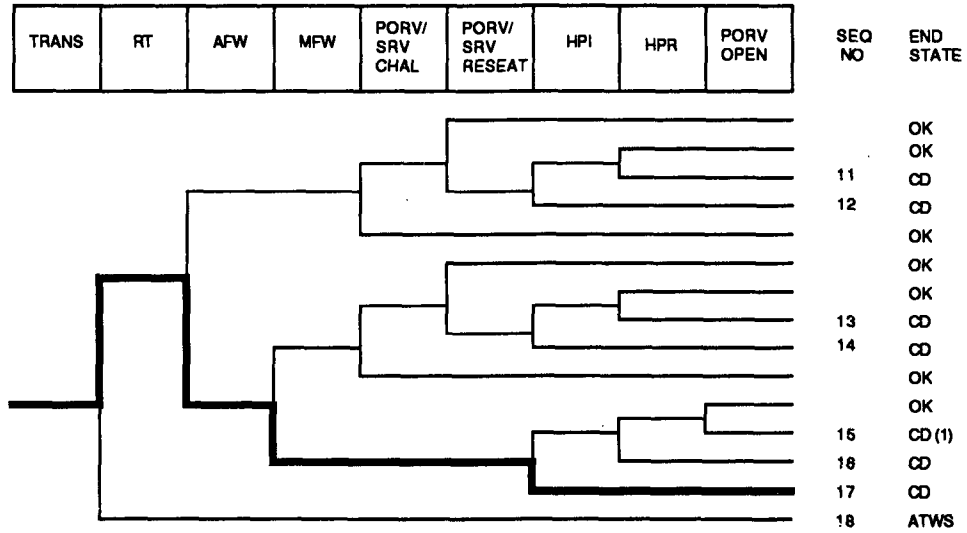
The auxiliary feedwater system for this plant consists of two separate trains. Train "A" is provided with a turbine and motor in series to turn a single pump (either motive source will supply 100% of the necessary flow). Train "B" contains a single motor-driven pump (100% capacity).

ASP Modeling Assumptions and Approach

The event has been modeled as a reactor trip with degraded AFW. Consistent with other events modeled in the ASP Program, a nominal non-recovery value for AFW was assumed (since the postulated failure mode for the other pump is unknown).

Analysis Results

The conditional core damage probability estimated for this event is 7.6×10^{-6} . The dominant core damage sequence, highlighted on the following event tree, involves the observed trip with subsequent failure of secondary-side cooling and bleed and feed.



(1) OK for Class D

Dominant core damage sequence for LER 206/90-011

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 206/90-011
 Event Description: Reactor trip with one train of AFW autostart disabled
 Event Date: 05/15/90
 Plant: San Onofre 1

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	7.6E-06
Total	7.6E-06

ATWS

TRANS	3.4E-05
Total	3.4E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
17 trans -rt AFW mfw hpi(f/b)	CD	3.7E-06	7.4E-02
15 trans -rt AFW mfw -hpi(f/b) -hpr/-hpi porv.open	CD	3.5E-06	8.8E-02
16 trans -rt AFW mfw -hpi(f/b) hpr/-hpi	CD	3.9E-07	8.8E-02
18 trans rt	ATWS	3.4E-05	1.2E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
15 trans -rt AFW mfw -hpi(f/b) -hpr/-hpi porv.open	CD	3.5E-06	8.8E-02
16 trans -rt AFW mfw -hpi(f/b) hpr/-hpi	CD	3.9E-07	8.8E-02
17 trans -rt AFW mfw hpi(f/b)	CD	3.7E-06	7.4E-02
18 trans rt	ATWS	3.4E-05	1.2E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1989\pwrbaseal.cmp
 BRANCH MODEL: c:\asp\1989\sanono1.sll
 PROBABILITY FILE: c:\asp\1989\pwr_bsll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
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Event Identifier: 206/90-011

B-30

trans	1.2E-04	1.0E+00	
loop	2.0E-05	5.8E-01	
loca	2.4E-06	4.3E-01	
rt	2.8E-04	1.2E-01	
rt/loop	0.0E+00	1.0E+00	
emerg.power	2.9E-03	8.0E-01	1.0E-03
AFW	2.3E-03 > 2.0E-02	2.6E-01	
Branch Model: 1.OF.2+ser			
Train 1 Cond Prob:	2.0E-02		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Serial Component Prob:	2.8E-04		
afw/emerg.power	5.0E-02	3.4E-01	
mfw	1.9E-01	3.4E-01	
porv.or.srv.chall	4.0E-02	1.0E+00	
porv.or.srv.reseat	2.0E-02	1.1E-02	
porv.or.srv.reseat/emerg.power	2.0E-02	1.0E+00	
seal.loca	3.2E-01	1.0E+00	
ep.rec(s1)	7.6E-01	1.0E+00	
ep.rec	1.6E-01	1.0E+00	
hpi	1.0E-03	8.4E-01	
hpi(f/b)	1.0E-03	8.4E-01	1.0E-02
hpr/~hpi	1.5E-04	1.0E+00	1.0E-03
porv.open	1.0E-02	1.0E+00	4.0E-04

* branch model file
 ** forced

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