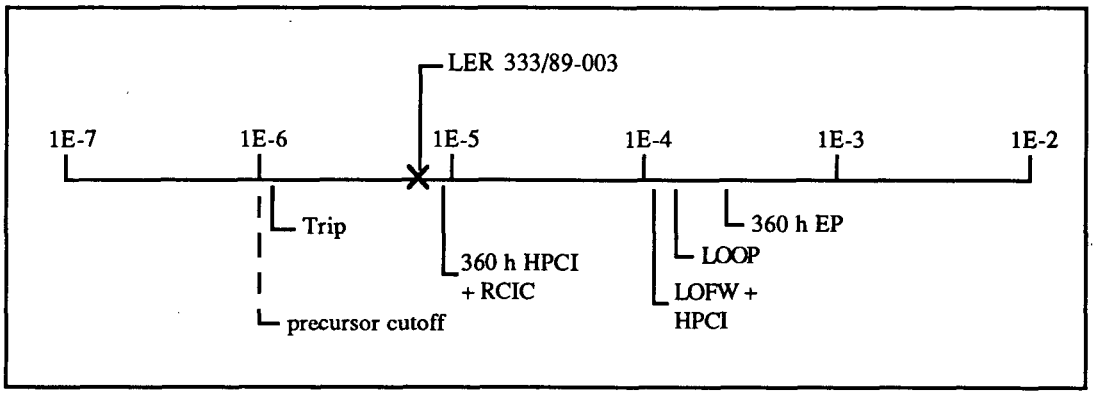
ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No: 333/89-003
Event Description: Inadvertent safety relief valve actuation with HPCI inoperable
Date of Event: March 6, 1989
Plant: Fitzpatrick

Summary

A reactor safety relief valve was inadvertently opened during testing required because of HPCI inoperability at Fitzpatrick. The plant was at 100% power at the time of the event. The operator performing the test realized his mistake and quickly closed the valve. The event has been evaluated as a potential scram with open SRV had the inadvertent valve opening not been detected. The conditional probability of core damage associated with this event is estimated to be 6.5 x 10^{-6}. The relative significance of this event compared with other potential events at Fitzpatrick is shown below.



Event Description

Fitzpatrick was performing required plant Technical Specification surveillances when an operator accidently turned the wrong switch and opened an SRV. The operator recognized his error and closed the valve. The valve was open for a total of 5 s. The surveillance was a safety system logic functional test required because the high-pressure coolant injection (HPCI) system was inoperable. HPCI had been declared inoperable on March 2, 1989, following a routine in-service surveillance test on the turbine stop valve. The valve opening stroke time had exceeded allowable limits, and the system start time was greater than that allowed by Tech Specs. Extensive testing was performed to determine the time required to achieve rated flow and valve stroke times. The HPCI ramp

generator was found to be miswired.

Additional Event-Related Information

There are 11 SRVs, 7 of which are designated for automatic depressurization system (ADS) service, at Fitzpatrick. The ADS serves to back up the HPCI system under LOCA conditions, in the event that the HPCI is inoperable. The HPCI system is a high-pressure injection system designed for small-break LOCAs that do not depressurize the reactor. The HPCI system is independent, uses a turbine-driven pump, and automatically initiates on reactor low water level.

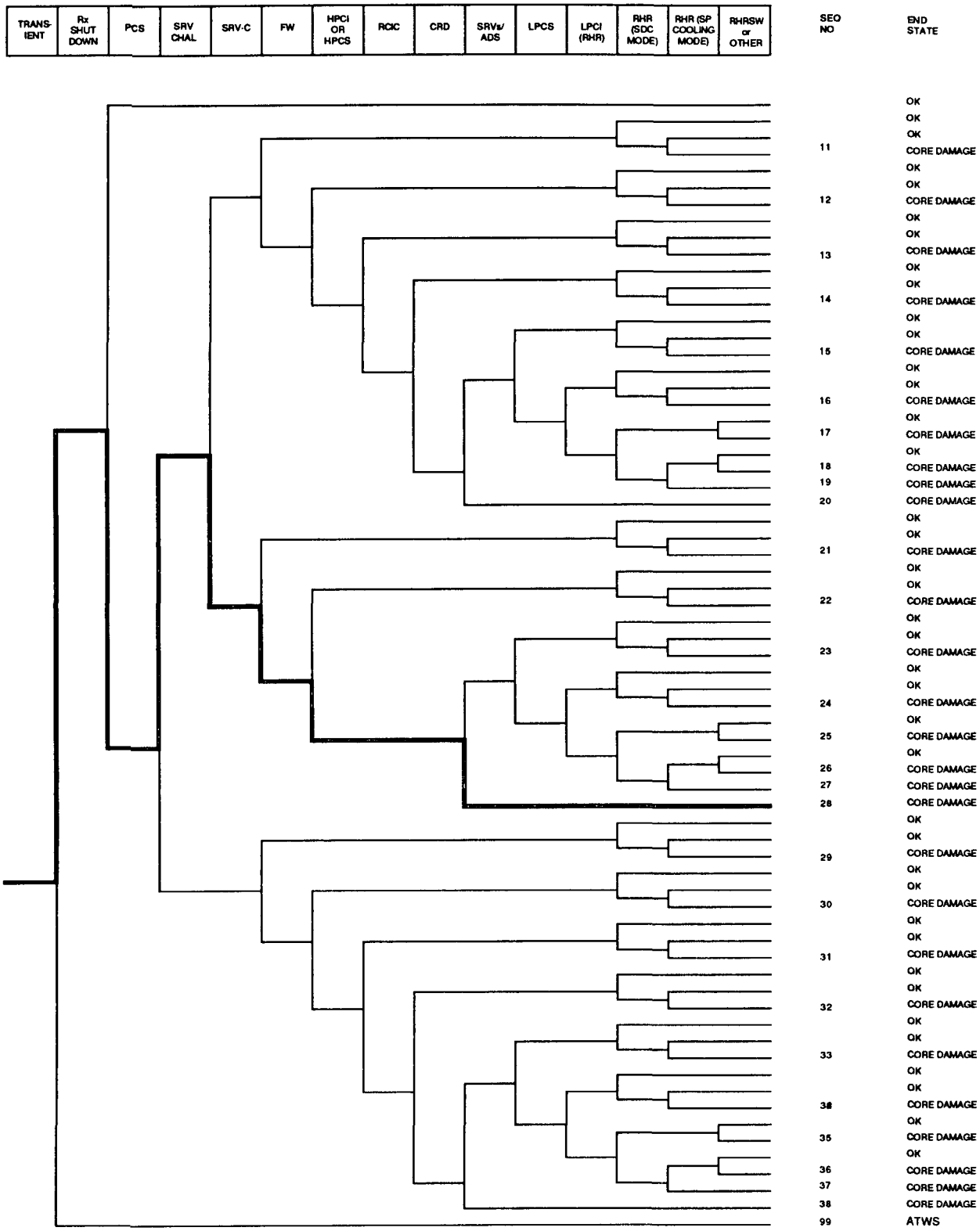
ASP Modeling Assumptions and Approach

The event has been modeled as a potential trip with open SRV and HPCI unavailable. The likelihood that flow through the open SRV would not be terminated was assumed to be 3.3×10^{-3}. This is the failure to close probability for BWR relief valves used in ASP analyses. Because of the plant response following the open SRV, it has been assumed that the operators will attempt to close the valve, and no additional operator error contribution has been added to the valve failure to close probability. In addition, reactor vessel isolation was assumed to occur.

Analysis Results

The conditional probability of severe core damage estimated for this event is 6.5×10^{-6}. The dominant sequence for the event, highlighted on the following event tree, involves the postulated trip with unavailable PCS, open SRV and unavailable HPCI, and failure of automatic depressurization.

Other LERs that involved HPCI and/or RCIC inoperability in conjunction with power operations are: 333/89-002, -005, -014, -019, -020, -021, and -023. See the event description for LER 333/89-020 for more information.



Dominant core damage sequence for LER 333/89-003

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 333/89-003
Event Description: Inadvertant SRV actuation with HPCI unavailable
Event Date: 03/06/89
Plant: Fitzpatrick

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	3.3E-03

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	6.5E-06
Total	6.5E-06
ATWS	
TRANS	9.9E-08
Total	9.9E-08

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
28	TRANS -rx.shutdown PCS/TRANS srv.chall/trans.-scram SRV.CLOSE fw/pcs.trans HPCI srv.ads	CD	6.5E-06	8.0E-04
99	TRANS rx.shutdown	ATWS	9.9E-08	3.3E-03

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
28	TRANS -rx.shutdown PCS/TRANS srv.chall/trans.-scram SRV.CLOSE fw/pcs.trans HPCI srv.ads	CD	6.5E-06	8.0E-04
99	TRANS rx.shutdown	ATWS	9.9E-08	3.3E-03

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1989\bwrcseal.cmp
BRANCH MODEL: c:\asp\1989\fitzpatr.sll
PROBABILITY FILE: c:\asp\1989\bwr_csll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
TRANS	3.4E-04 > 3.4E-04	1.0E+00 > 3.3E-03	
Branch Model: INITOR			
Initiator Freq:	3.4E-04		
loop	1.6E-05	3.6E-01	
loca	3.3E-06	5.0E-01	
rx.shutdown	3.0E-05	1.0E+00	
rx.shutdown/ep	3.5E-04	1.0E+00	
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	3.6E-02 > 1.0E+00 **	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	3.6E-02		
emerg.power	2.9E-03	8.0E-01	
ep.rec	1.6E-01	1.0E+00	
fw/pcs.trans	4.6E-01	3.4E-01	
fw/pcs.loca	1.0E+00	3.4E-01	
HPCI	2.9E-02 > 1.0E+00	7.0E-01 > 1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	2.9E-02 > Unavailable		
rcic	6.0E-02	7.0E-01	
crd	1.0E-02	1.0E+00	1.0E-02
srv.ads	3.7E-03	7.1E-01	1.0E-02
lpcs	3.0E-03	3.4E-01	
lpci(rhr)/lpcs	1.0E-03	7.1E-01	
rhr(sdc)	2.1E-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)/rhr(sdc)	2.0E-03	3.4E-01	
rhr(spcool)/-lpci.rhr(sdc)	2.0E-03	3.4E-01	
rhr(spcool)/lpci.rhr(sdc)	9.3E-02	1.0E+00	
rhrsw	2.0E-02	3.4E-01	2.0E-03

* branch model file
** forced

Minarick
06-14-1990
12:20:11

Event Identifier: 333/89-003