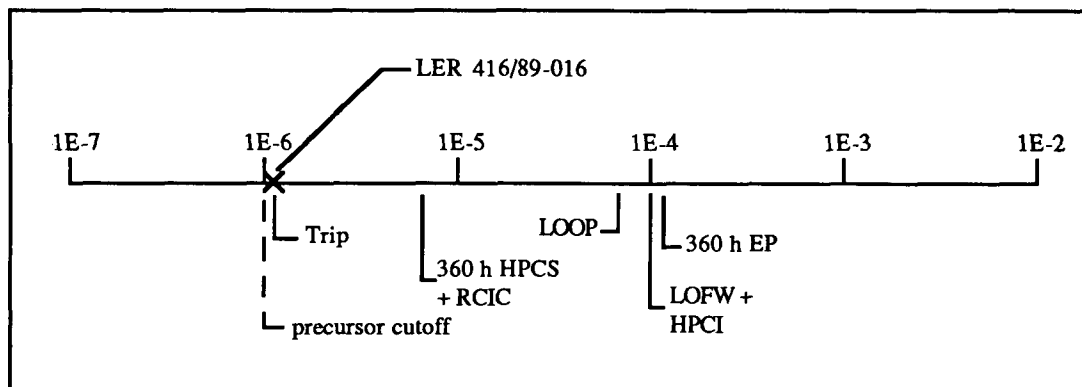


## ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No: 416/89-016  
 Event Description: Scram with RCIC unavailable  
 Date: December 6, 1989  
 Plant: Grand Gulf 1

### Summary

A lightning strike caused an electrical spike on the average power range monitors (APRMs), resulting in a high flux scram. The reactor core isolation cooling (RCIC) system received an initiation signal but could not initiate because the RCIC trip throttle valve was closed in preparation for surveillance testing. The conditional probability estimated for this event is  $1.2 \times 10^{-6}$ . The relative significance of this event compared with other postulated events at Grand Gulf is shown below.



### Event Description

During a severe electrical storm, lightning struck the plant site and caused electrical disturbances in plant instrumentation. A spurious high flux signal was detected by three of the eight APRM channels, and a high flux scram resulted.

Two high-pressure core spray (HPCS) low water level channels also tripped but did not seal in due to the short duration of the trip signal. RCIC received an auto-initiation signal but did not operate because the RCIC trip throttle valve was closed in preparation for an I & C surveillance.

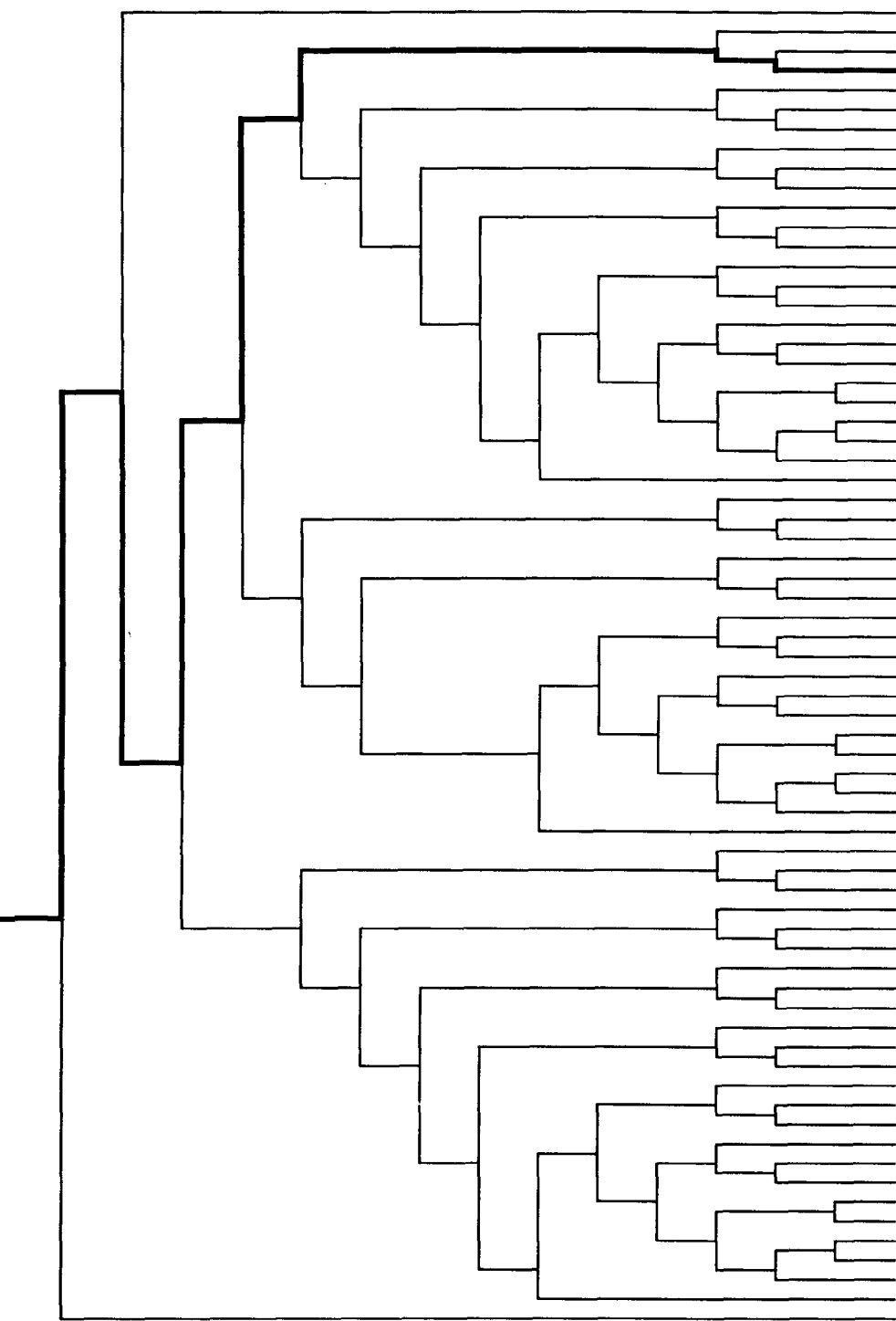
## **ASP Modeling Assumptions and Approach**

The event has been modeled as a scram with RCIC initially unavailable but locally recoverable.

## **Analysis Results**

The conditional probability of severe core damage estimated for this event is  $1.2 \times 10^{-6}$ . The dominant sequence for this event involves failure of the power conversion system, successful short-term core cooling, and failure to remove heat from the suppression pool in the long term. The dominant sequence for this event is highlighted on the following event tree.

TRANS- IENT	Rx SHUT DOWN	PCS	SRV CHAL	SRV-C	FW	HPCI OR HPCS	RCIC	CRD	SRVs/ ADS	LPCS	LPCI (RHR)	RHR (SDC MODE)	RHR (SP COOLING MODE)	RHRSW or OTHER
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SEQ NO	END STATE
11	OK OK OK CORE DAMAGE
12	OK OK CORE DAMAGE
13	OK OK CORE DAMAGE
14	OK OK CORE DAMAGE
15	OK OK CORE DAMAGE
16	OK OK CORE DAMAGE
17	OK OK CORE DAMAGE
18	OK CORE DAMAGE
19	CORE DAMAGE
20	CORE DAMAGE
21	OK OK CORE DAMAGE
22	OK OK CORE DAMAGE
23	OK OK CORE DAMAGE
24	OK OK CORE DAMAGE
25	OK CORE DAMAGE
26	OK CORE DAMAGE
27	CORE DAMAGE
28	CORE DAMAGE
29	OK OK CORE DAMAGE
30	OK OK CORE DAMAGE
31	OK OK CORE DAMAGE
32	OK OK CORE DAMAGE
33	OK OK CORE DAMAGE
34	OK OK CORE DAMAGE
35	OK CORE DAMAGE
36	OK CORE DAMAGE
37	CORE DAMAGE
38	CORE DAMAGE
99	ATWS

Dominant core damage sequence for LER 416/89-016

# B-396

## CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 416/89-016  
 Event Description: Reactor scram with RCIC unavailable  
 Event Date: 12/06/89  
 Plant: Grand Gulf 1

### INITIATING EVENT

#### NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

#### SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	1.2E-06
Total	1.2E-06

#### ATWS

TRANS	3.0E-05
Total	3.0E-05

#### SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
11	trans -rx.shutdown pcs/trans srv.chall/trans.-scram -srv.close -fw/pcs.trans rhr(sdc) rhr(spcool)/rhr(sdc)	CD	8.0E-07	1.0E-01
28	trans -rx.shutdown pcs/trans srv.chall/trans.-scram srv.close fw/pcs.trans hpci srv.ads	CD	1.5E-07	8.2E-02
12	trans -rx.shutdown pcs/trans srv.chall/trans.-scram -srv.close fw/pcs.trans -hpci rhr(sdc) rhr(spcool)/rhr(sdc)	CD	1.5E-07	3.9E-02
21	trans -rx.shutdown pcs/trans srv.chall/trans.-scram srv.close -fw/pcs.trans rhr(sdc) rhr(spcool)/rhr(sdc)	CD	5.7E-08	1.0E-01
99	trans rx.shutdown	ATWS	3.0E-05	1.0E+00

\*\* non-recovery credit for edited case

#### SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
11	trans -rx.shutdown pcs/trans srv.chall/trans.-scram -srv.close -fw/pcs.trans rhr(sdc) rhr(spcool)/rhr(sdc)	CD	8.0E-07	1.0E-01
12	trans -rx.shutdown pcs/trans srv.chall/trans.-scram -srv.close fw/pcs.trans -hpci rhr(sdc) rhr(spcool)/rhr(sdc)	CD	1.5E-07	3.9E-02
21	trans -rx.shutdown pcs/trans srv.chall/trans.-scram srv.close -fw/pcs.trans rhr(sdc) rhr(spcool)/rhr(sdc)	CD	5.7E-08	1.0E-01
28	trans -rx.shutdown pcs/trans srv.chall/trans.-scram srv.close fw/pcs.trans hpci srv.ads	CD	1.5E-07	8.2E-02
99	trans rx.shutdown	ATWS	3.0E-05	1.0E+00

\*\* non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1989\bwrseal.cmp  
 BRANCH MODEL: c:\asp\1989\gulf.sll  
 PROBABILITY FILE: c:\asp\1989\bwr\_csll.pro

No Recovery Limit

#### BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
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Event Identifier: 416/89-016

# B-397

trans	5.1E-04	1.0E+00	
loop	1.6E-05	5.3E-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	
srv.chall/trans.-scram	1.0E+00	1.0E+00	
srv.chall/loop.-scram	1.0E+00	1.0E+00	
srv.close	6.6E-02	1.0E+00	
emerg.power	2.9E-03	8.0E-01	
ep.rec	4.9E-02	1.0E+00	
fw/pcs.trans	4.6E-01	3.4E-01	
fw/pcs.loca	1.0E+00	3.4E-01	
hpci	2.0E-02	3.4E-01	
RCIC	6.0E-02 > 1.0E+00	7.0E-01 > 3.4E-01	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	6.0E-02 > Unavailable		
crd	1.0E-02	1.0E+00	1.0E-02
srv.ads	3.7E-03	7.1E-01	1.0E-02
lpcs	2.0E-02	3.4E-01	
lpci(rhr)/lpcs	6.0E-04	7.1E-01	
rhr(sdc)	2.3E-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  
06-13-1990  
09:36:58