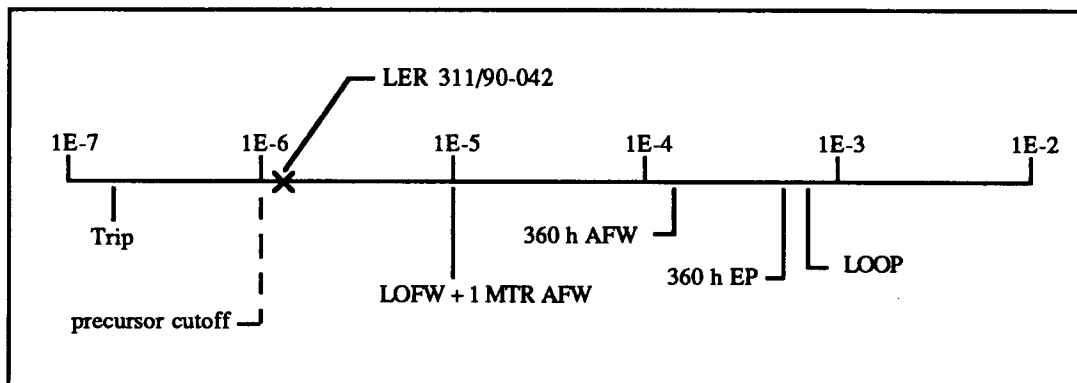


## ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No: 311/90-042  
 Event Description: Safety injection and one train of emergency power unavailable  
 Date of Event: December 20, 1990  
 Plant: Salem 2

### Summary

One train of the safety injection (SI) system and one emergency diesel generator (EDG) were unavailable for approximately 6 h. The EDG was in the process of being repaired when a leak in the service water (SW) system caused the one train of SI to be unavailable. In the event of a loss of offsite power (LOOP), the second train of SI would be unavailable because it is powered by the EDG that is also out of service. The conditional core damage probability estimated for this event is  $1.3 \times 10^{-6}$ . The relative significance of this event compared to other postulated events at Salem 2 is shown below.



### Event Description

The 2B EDG was inoperable because of maintenance activities. In the event of a LOOP, this rendered the No. 22 SI pump unavailable. At 1442 on December 20, 1990, a SW through-wall leak on the inlet pipe to the No. 21 component cooling water (CCW) pump room cooler occurred. The No. 21 SW header was isolated to stop the leak. This resulted in unavailability of charging pump 22 (due to the SW line isolation) and, in the event of a LOOP, charging pump 21 (due to unavailability of EDG 2B). This also caused the Nos. 21 and 22 containment fan cooling units (CFCU) and the No. 21 containment spray (CS) pump room cooler to be inoperable. The leak caused spray to hit

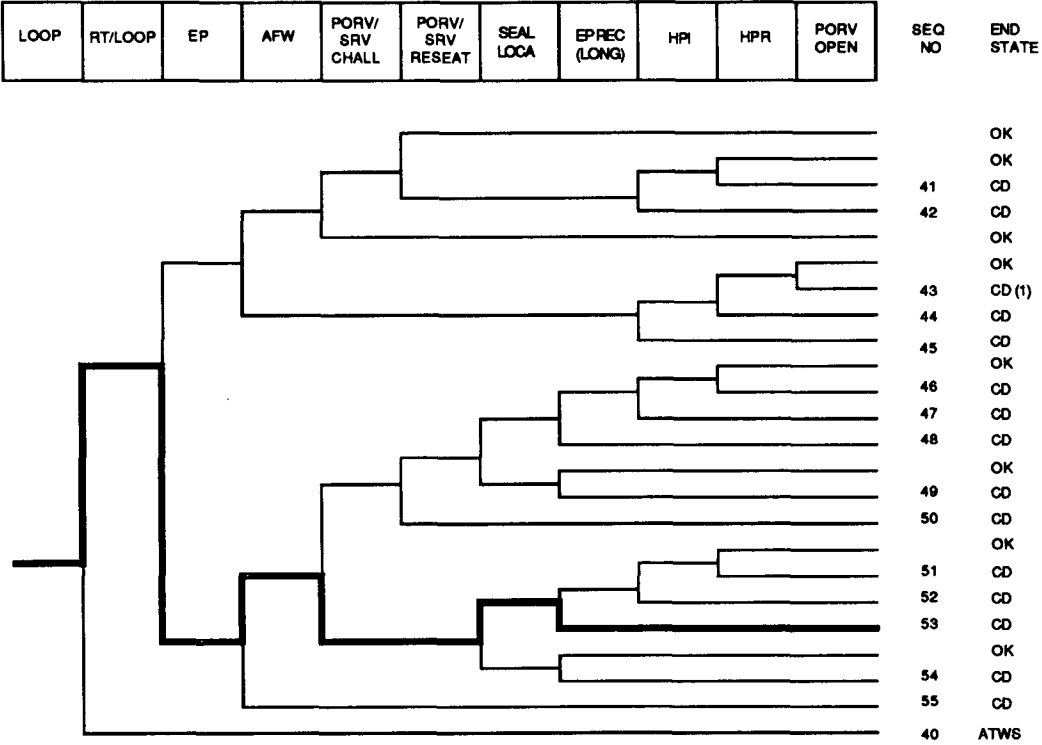
both motor-driven auxiliary feedwater (AFW) pumps. These pumps were declared inoperable, but subsequent inspection and testing indicated that the pumps would have worked. The combined EDG and SW header unavailability lasted approximately 6 h.

### **ASP Modeling Assumptions and Approach**

The event has been modeled as a postulated LOOP with one EDG and the high pressure injection system unavailable. Because of the EDG unavailability, one motor-driven AFW pump was also assumed to be unavailable.

### **Analysis Results**

The conditional probability of severe core damage estimated for this event is  $1.3 \times 10^{-6}$ . The dominant core damage sequence, highlighted on the following event tree, involves a postulated LOOP, failure of emergency power, a subsequent seal loss-of-coolant accident (LOCA), and failure to recover emergency power prior to core uncover.



(1) OK for Class D

Dominant core damage sequence for LER 311/90-042

# B-245

## CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 311/90-042  
 Event Description: Safety injection and one train of emergency power unavail  
 Event Date: 12/20/90  
 Plant: Salem 2

UNAVAILABILITY, DURATION= 6

### NON-RECOVERABLE INITIATING EVENT PROBABILITIES

LOOP 5.2E-05

### SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
---------------------	-------------

CD

LOOP	1.3E-06
------	---------

Total	1.3E-06
-------	---------

ATWS

LOOP	0.0E+00
------	---------

Total	0.0E+00
-------	---------

### SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
53	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall seal.loca ep.rec(s1)	CD	5.4E-07	4.2E-01
52	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall seal.loca -ep.rec(s1) HPI	CD	4.4E-07	4.2E-01

\*\* non-recovery credit for edited case

### SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
52	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall seal.loca -ep.rec(s1) HPI	CD	4.4E-07	4.2E-01
53	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall seal.loca ep.rec(s1)	CD	5.4E-07	4.2E-01

\*\* non-recovery credit for edited case

Note: For unavailabilities, conditional probability values are differential values which reflect the added risk due to failures associated with an event. Parenthetical values indicate a reduction in risk compared to a similar period without the existing failures.

SEQUENCE MODEL: c:\asp\1989\pwrseal.cmp  
 BRANCH MODEL: c:\asp\1989\salem2.s11  
 PROBABILITY FILE: c:\asp\1989\pwr\_bs11.pro

No Recovery Limit

Event Identifier: 311/90-042

## BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	9.0E-04	1.0E+00	
loop	1.6E-05	5.3E-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	7.5E-03 > 9.7E-02	8.0E-01	
Branch Model: 2.OF.3			
Train 1 Cond Prob:	5.0E-02		
Train 2 Cond Prob:	5.7E-02		
Train 3 Cond Prob:	1.9E-01 > Unavailable		
AFW	3.8E-04 > 1.3E-03	2.6E-01	
Branch Model: 1.OF.3+ser			
Train 1 Cond Prob:	2.0E-02		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
Train 3 Cond Prob:	5.0E-02		
Serial Component Prob:	2.8E-04		
afw/emerg.power	5.0E-02	3.4E-01	
mfw	1.0E+00	7.0E-02	
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	2.7E-01	1.0E+00	
ep.rec(sl)	5.7E-01	1.0E+00	
ep.rec	7.0E-02	1.0E+00	
HPI	1.0E-03 > 1.0E+00	8.4E-01 > 1.0E+00	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	1.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
HPI(F/B)	1.0E-03 > 1.0E+00	8.4E-01 > 1.0E+00	1.0E-02
Branch Model: 1.OF.2+opr			
Train 1 Cond Prob:	1.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
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			

Minarick  
08-06-1991  
17:33:27