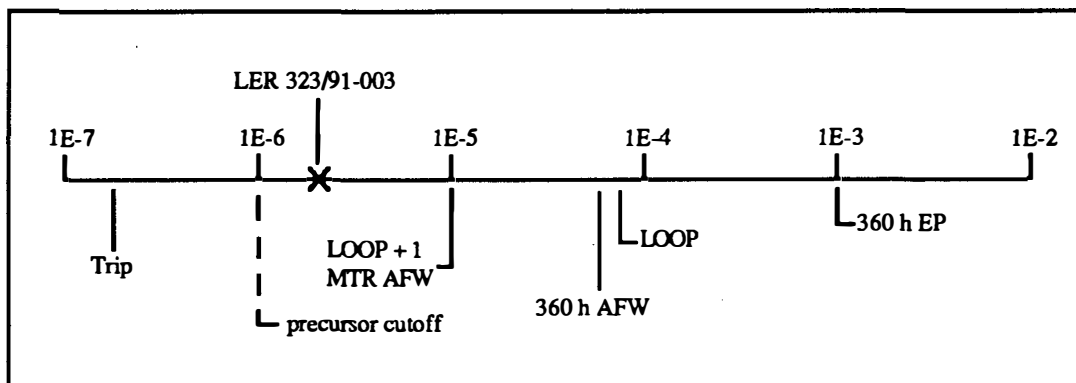


## ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No.: 323/91-003  
 Event Description: Containment sump isolation valves and containment spray pumps deenergized during hot shutdown  
 Date of Event: September 1, 1991  
 Plant: Diablo Canyon 2

### Summary

Both Diablo Canyon 2 residual heat removal (RHR) containment sump isolation valves were depowered for 6 h in mode 4 by locally opening the valve breakers. In this mode, power should have been interrupted by opening series contactors in the control room, which would have allowed rapid restoration of power to the valves if their operation was required following a loss-of-coolant accident (LOCA). The conditional core damage probability estimated for the event is  $2.1 \times 10^{-6}$ . The relative significance of this event compared to other postulated events at Diablo Canyon 2 is shown below.



### Event Description

While Diablo Canyon 2 was in hot shutdown, a walkdown of the control room boards revealed that power had been removed from both RHR containment recirculation sump suction valves, 8982A and B. The cause of power loss was that the 480-V breakers serving the RHR valves had been opened locally in preparation for entering cold shutdown. A procedure had been revised in 1988 in violation of Technical Specification (Tech Spec) requirements, to require local opening of the breakers associated with the valves. The Tech Specs require control room operation of the valves while the plant is in hot shutdown — the procedure should have specified use of the contactor located in the control room for removing power from the valves. The valve breakers were open for

approximately 6 h.

The walkdown also revealed that, due to personnel error, the control power to both containment spray (CS) pumps had been deenergized. The CS pumps were deenergized for approximately 1.5 h before power restoration.

#### **Additional Event-Related Information**

The RHR system consists of two trains. During high-pressure recirculation (HPR), each RHR pump takes suction from the containment sump via separate containment isolation valves. After the sump water is cooled by the RHR heat exchangers, it is supplied to the suctions of the safety injection (SI) and charging pumps. RHR pump 1 provides flow to SI pump 1 and both charging pumps; RHR pump 2 provides flow to SI pump 2.

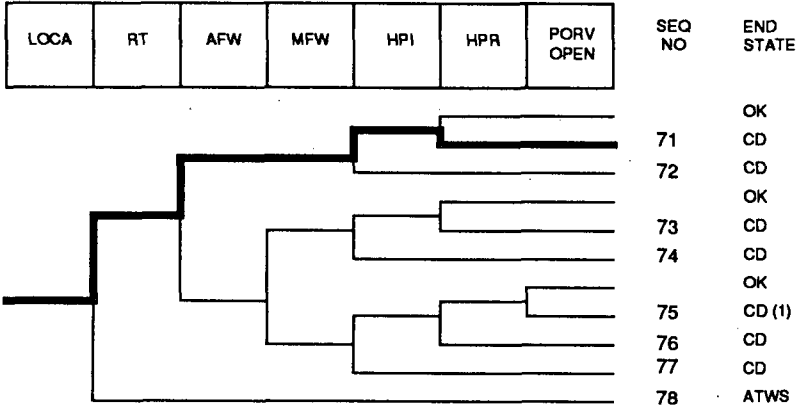
The CS system is also a two-train system that initially provides water from the reactor water storage tank (RWST) to two spray ring headers for containment pressure suppression following a LOCA. After the RWST is empty, CS flow is provided from the RHR system.

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

The event has been modeled as a 6-h unavailability of HPR. Local recovery of HPR at the recirculation valve breakers was assumed to be possible (the utility estimated this would take ~15 min). Since the Accident Sequence Precursor (ASP) models only address core damage, the unavailability of the CS pumps was not considered.

#### **Analysis Results**

The core damage probability estimated for the event is  $2.1 \times 10^{-6}$ . The dominant core damage sequence, highlighted on the following event tree, involves a postulated small-break LOCA with successful high-pressure injection and failure of HPR. This estimate is believed to be conservative, since the actual event occurred in mode 4 and the ASP model success criteria and timing assume operation at power.



(1) OK for Class D

Dominant core damage sequence for LER 323/91-003

# B-291

## CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 323/91-003  
 Event Description: Containment sump isolation valves deenergized  
 Event Date: 09/01/91  
 Plant: Diablo Canyon 2

UNAVAILABILITY, DURATION= 6

### NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	1.5E-03
LOOP	6.8E-05
LOCA	6.2E-06

### SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	1.0E-08
LOOP	3.6E-09
LOCA	2.1E-06
Total	2.1E-06
ATWS	
TRANS	0.0E+00
LOOP	0.0E+00
LOCA	0.0E+00
Total	0.0E+00

### SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
71 loca -rt -afw -hpi HPR/-HPI	CD	2.1E-06	1.5E-01

\*\* non-recovery credit for edited case

### SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
71 loca -rt -afw -hpi HPR/-HPI	CD	2.1E-06	1.5E-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\diablo2.sl1  
 PROBABILITY FILE: c:\asp\1989\pwr\_bs11.pro

No Recovery Limit

Event Identifier: 323/91-003

## BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	2.5E-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	5.4E-04	8.0E-01	
afw	3.8E-04	2.6E-01	
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	3.0E-02	1.1E-02	
porv.or.srv.reseat/emerg.power	3.0E-02	1.0E+00	
seal.loca	3.2E-01	1.0E+00	
ep.rec(sl)	6.5E-01	1.0E+00	
ep.rec	1.1E-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+00 > 3.4E-01	1.0E-03
Branch Model: 1.OF.2+opr			
Train 1 Cond Prob:	1.0E-02 > Unavailable		
Train 2 Cond Prob:	1.5E-02 > Unavailable		
porv.open	1.0E-02	1.0E+00	4.0E-04
* branch model file			
** forced			

Minarick  
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