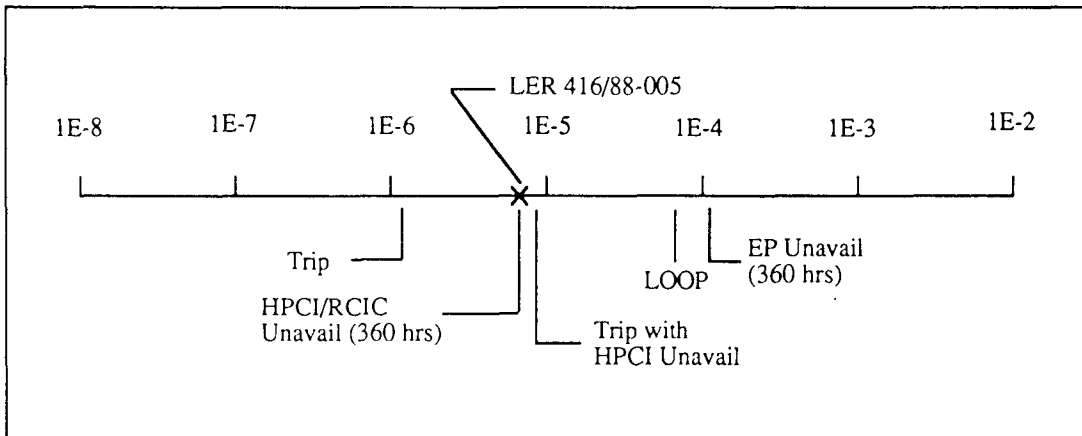


Accident Sequence Precursor Program Event Analysis

LER No: 416/88-005
 Event Description: Effective SLB due to failed open TBS valves
 Date of Event: January 11, 1988
 Plant: Grand Gulf Unit 1

Summary

While at 0% power, an incorrect setpoint on the turbine bypass valves caused the valves to fail open, which induced a void formation during reactor depressurization. This event has been modeled as an effective main steam line break with the potential for recovery from the control room. The conditional probability of core damage is estimated at 6.9×10^{-6} . The relative significance of this event compared with other potential events at Grand Gulf 1 is shown below.



Event Description

After an automatic reactor scram on Jan. 10, 1988, RCS pressure was being reduced as the core decay heat declined. The operators were also lowering the reactor pressure controller setpoint for the turbine bypass control valves to prevent their inadvertent opening. During shift turn-over on January 11, operators observed that RCS level was increasing rapidly. After verifying that an ECCS injection had not occurred, the operators discovered that the three turbine bypass valves had spuriously opened to 80%, causing a void formation in the reactor vessel and a water level increase. Since the valves are approximately 0.25 ft^2 each, this total flow area amounted to 0.6 ft^2 . RCS pressure dropped to 260 psig before the operators discovered the valves were open and closed

them to terminate the loss of inventory. RCS water level fell to 9 in. above instrument zero, which was 2 in. below the low level scram setpoint and 175 in. above the top of the active fuel. Though no specific equipment failures were identified, the motor-driven potentiometer and the pressure setpoint RAISE and LOWER push buttons were the suspected cause and were replaced.

ASP Modeling Assumptions and Approach

This event has been modeled as an effective main steam line break, which could have occurred at higher RPV pressures shortly after shutdown. The probability of not recovering in the control room was assumed to be 0.04.

Analysis Results

The conditional probability associated with this event is estimated to be 6.9×10^{-6} . The dominant sequence involves failure of long-term core cooling following successful initial mitigation.

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 416/88-005
 Event Description: Effective SLB due to failed open TBS valves
 Event Date: 01/11/88
 Plant: BWR C Main Steam Line Break

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

SLB 4.0E-02

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
SLB	6.9E-06
Total	6.9E-06
CV	
SLB	0.0E+00
Total	0.0E+00
ATWS	
SLB	1.4E-06
Total	1.4E-06

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
1 SLB -SCRAM -rv.isol -hpci rhr(sdc) rhr(spcool) /-lpci.rhr(sdc) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	6.3E-06	1.4E-02
8 SLB -SCRAM -rv.isol hpci rcic srv.ads	CD	4.3E-07	1.4E-02
29 SLB SCRAM SLC.OR.RODS -rv.isol	ATWS	1.4E-06	4.0E-02

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
1 SLB -SCRAM -rv.isol -hpci rhr(sdc) rhr(spcool) /-lpci.rhr(sdc) C.I.AND.V/RHR(SDC).RHR(SPCOOL)	CD	6.3E-06	1.4E-02
8 SLB -SCRAM -rv.isol hpci rcic srv.ads	CD	4.3E-07	1.4E-02
29 SLB SCRAM SLC.OR.RODS -rv.isol	ATWS	1.4E-06	4.0E-02

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\newmodel\bwrmslb.cmp
 BRANCH MODEL: c:\asp\newmodel\sibbwrc.txt
 PROBABILITY FILE: c:\asp\newmodel\bwr_cnew.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
SLB	1.1E-07 > 1.1E-07	1.0E+00 > 4.0E-02	
Branch Model: INITOR			

Event Identifier: 416/88-005

Initiator Freq:	1.1E-07			
SCRAM	3.5E-04 > 3.5E-05 **	1.0E+00		
Branch Model: 1.OF.1				
Train 1 Cond Prob:	3.5E-04			
SLC.OR.RODS	1.0E-02 > 1.0E+00 **	1.0E+00		1.0E-02
Branch Model: 1.OF.1+opr				
Train 1 Cond Prob:	1.0E-02			
rv.isol	4.0E-03	1.0E+00		
hpci	2.9E-02	7.0E-01		
rcic	6.0E-02	7.0E-01		
srv.ads	3.7E-03	7.1E-01		1.0E-02
COND	1.0E+00 > 1.0E+00	3.4E-01 > 1.0E+00		1.0E-03
Branch Model: 1.OF.1+opr				
Train 1 Cond Prob:	1.0E+00			
lpcs	3.0E-03	3.4E-01		
lpci(rhr)/lpcs	1.0E-03	7.1E-01		
rhrsw/lpcs.lpci	2.0E-02	3.4E-01		2.0E-03
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		
rhr(spcool)/-lpci.rhr(sdc)	2.0E-02	1.0E+00		
rhr(spcool)/lpci.rhr(sdc)	5.2E-01	1.0E+00		
C.I.AND.V/RHR(SDC).RHR(SPCOOL)	1.0E-03 > 1.0E+00 **	1.0E+00		1.0E-02
Branch Model: 1.OF.1+opr				
Train 1 Cond Prob:	1.0E-03			

* branch model file
 ** forced

Minarick
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