

B.22-1

B.22 LER No. 316/82-113

Event Description: Long-Term Unavailability of SI Train B

Date of Event: December 29, 1982

Plant: Cook 2

B.22.1 Summary

An emergency core cooling system (ECCS) flow balance test determined that safety injection (SI) train B could not meet test flow requirements. Subsequent investigation determined that the B train check valve was obstructed by a second check valve disk, which was lodged in the outlet of the valve. This condition was believed to have existed for a prolonged period. The increase in core damage probability (CDP), or importance, over the duration of the event is 1.4×10^{-6} . The base-case CDP over the duration of the event is 9.0×10^{-5} , resulting in an estimated conditional core damage probability (CCDP) of 9.1×10^{-5} .

B.22.2 Event Description

An ECCS flow balance test of the safety injection system determined that SI train B could not provide the flow rate required of it. A radiographic exam was performed and on December 29, 1982, it was recognized that a second valve disk was stuck in SI train B check valve SI-152S. The check valve was repaired on December 30, and the system subsequently passed a flow balance test.

It was not known precisely when the check valve failed; however it was reported that check valve SI-152S was found to be "leaking excessively" in May 1981. In October, 1981, the valve was opened, the disk was found to be missing and it was replaced. No ECCS flow balance test was performed at that time.

It is possible that the check valve was failed before or at the time of the May testing. Reconstructed test data from 1979 indicated that SI train B flow may have been around 243 gpm at that time, with a minimum of 300 gpm required for the train to be considered operable. Certainly the valve was failed between October 1981, and discovery of the extra disk on December 29, 1982.

B.22.3 Additional Event-Related Information

None.

B.22.4 Modeling Assumptions

This event was modeled as an unavailability of one train of high-pressure injection (HPI) for one operating year (one year is the maximum unavailability period normally considered in ASP analyses).

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Cook reported in the licensee event report for this event that flow from the degraded HPI pump in conjunction with the flow from a charging pump would provide most of the flow required from a single HPI pump. As the charging pumps are included in the ASP model as a distinct backup source of high-pressure injection (successful operation of both charging pumps is assumed to provide adequate high-pressure injection), this potential augmentation of a degraded HPI pump by a charging pump was not credited in the ASP analysis. Other events were reported during the year, which were affected by the SI train B unavailability. These analyses are reported separately.

B.22.5 Analysis Results

The increase in core damage probability (CDP), or importance, over the duration of the event is 1.4×10^{-6} . The dominant sequence, highlighted on the event tree in Figure B.22.1, involves a steam generator tube rupture, reactor trip and auxiliary feedwater (AFW) success, and failure of HPI. The base-case CDP over the duration of the event is 9.0×10^{-5} (not shown on calculation sheet), resulting in an estimated CCDP of 9.1×10^{-5} .

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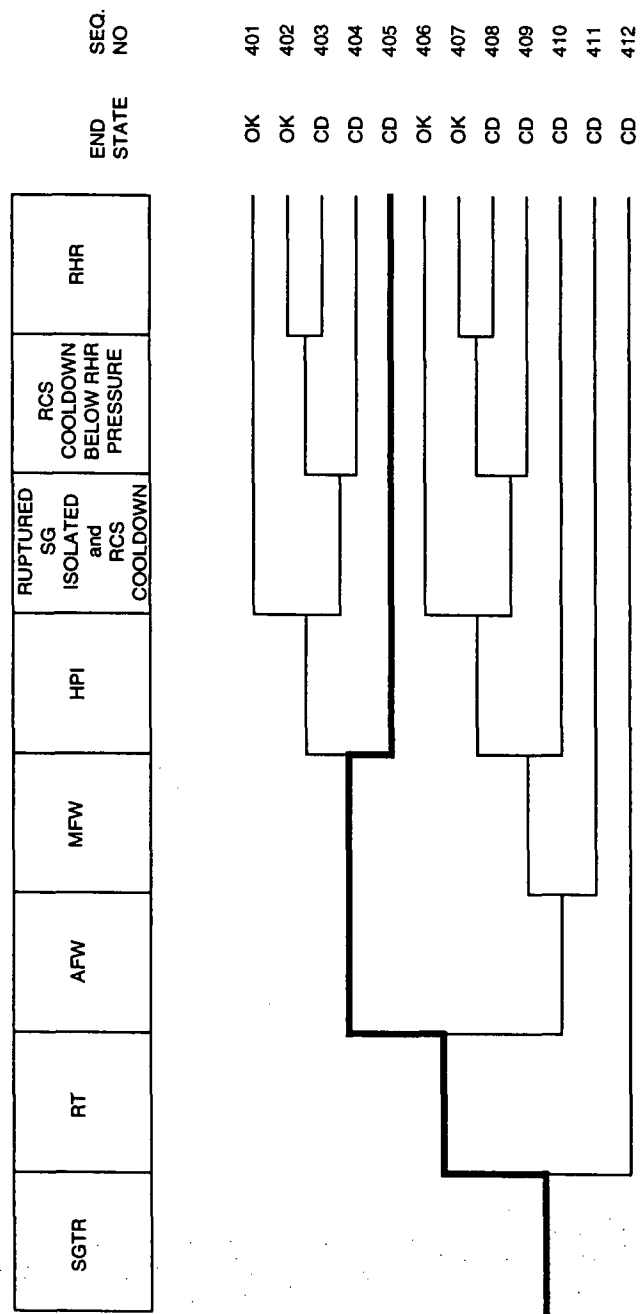


Figure B.22.1 Dominant core damage sequence for LER 316/82-113

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 316/82-113
 Event Description: Long-term unavailability of SI train B
 Event Date: December 29, 1982
 Plant: Cook 2

UNAVAILABILITY, DURATION= 6132

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	4.0E+00
LOOP	2.3E-02
LOCA	7.9E-03
SGTR	1.0E-02

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	6.9E-10
LOOP	3.7E-10
LOCA	6.3E-07
SGTR	8.0E-07
Total	1.4E-06

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

	Sequence	End State	Prob	N Rec**
405	sgtr -rt -afw HPI	CD	8.0E-07	8.9E-01
306	loca -rt -afw HPI	CD	6.3E-07	4.8E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
306	loca -rt -afw HPI	CD	6.3E-07	4.8E-01
405	sgtr -rt -afw HPI	CD	8.0E-07	8.9E-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: d:\asp\models\pwr8283.cmp
 BRANCH MODEL: d:\asp\models\cook2.82
 PROBABILITY FILE: d:\asp\models\pwr8283.pro

No Recovery Limit

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BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
Event Identifier: 316/82-113			
trans	6.5E-04	1.0E+00	
loop	1.6E-05	2.4E-01	
loca	2.4E-06	5.4E-01	
sgtr	1.6E-06	1.0E+00	
rt	2.8E-04	1.0E-01	
rt(loop)	0.0E+00	1.0E+00	
afw	3.8E-04	4.5E-01	
afw/atws	4.3E-03	1.0E+00	
afw/ep	5.0E-02	3.4E-01	
mfw	2.0E-01	3.4E-01	1.0E-03
porv.chall	4.0E-02	1.0E+00	
porv.chall/afw	1.0E+00	1.0E+00	
porv.chall/loop	1.0E-01	1.0E+00	
porv.chall/sbo	1.0E+00	1.0E+00	
porv.reseat	2.0E-02	1.1E-02	
porv.reseat/ep	2.0E-02	1.0E+00	
srv.reseat(atws)	1.0E-01	1.0E+00	
HPI	1.0E-05 > 1.0E-04	8.9E-01	
Branch Model: 1.0F.3			
Train 1 Cond Prob:	1.0E-02		
Train 2 Cond Prob:	1.0E-01 > 1.0E+00		
Train 3 Cond Prob:	1.0E-02		
feed.bleed	2.0E-02	1.0E+00	1.0E-02
emrg.boration	0.0E+00	1.0E+00	1.0E-02
recov.sec.cool	2.0E-01	1.0E+00	
recov.sec.cool/offsite.pwr	3.4E-01	1.0E+00	
rsc.cooldown	3.0E-03	1.0E+00	1.0E-03
rhr	2.2E-02	5.7E-02	1.0E-03
rhr.and.hpr	1.0E-03	1.0E+00	1.0E-03
hpr	4.0E-03	1.0E+00	1.0E-03
ep	2.9E-03	8.9E-01	
seal.loca	2.5E-01	1.0E+00	
offsite.pwr.rec/-ep.and.-afw	2.7E-01	1.0E+00	
offsite.pwr.rec/-ep.and.afw	1.6E-01	1.0E+00	
offsite.pwr.rec/seal.loca	6.9E-01	1.0E+00	
offsite.pwr.rec/-seal.loca	5.2E-02	1.0E+00	
sg.iso.and.rsc.cooldown	1.0E-02	1.0E-01	
rsc.cool.below.rhr	3.0E-03	1.0E+00	3.0E-03
prim.press.limited	8.8E-03	1.0E+00	
* branch model file			
** forced			