

## B.39-1

### B.39 LER No. 361/83-063

Event Description: Trip with Motor-Driven AFW Pump Inoperable

Date of Event: June 21, 1983

Plant: San Onofre 2

#### B.39.1 Summary

A few days after a trip on Unit 2, an endurance test was performed on one of the Unit 3 motor-driven auxiliary feedwater (AFW) pumps (3P-504). During the test, the outboard bearing on the motor failed, and the pump was declared inoperable. Upon examination, it was discovered that the oil grooves in the AFW pump bearings were inadequate. Presumably, the bearings were not being lubricated properly. Similar bearing defects were discovered in the other Unit 3 motor-driven AFW pump (3P-141), and one of the two motor-driven AFW pumps on Unit 2 (2P-504). A trip had occurred on Unit 2 a few days earlier, while the AFW pump was presumably inoperable. The conditional core damage probability estimated for the event at Unit 2 is  $1.1 \times 10^{-5}$ .

#### B.39.2 Event Description

While Unit 2 was shut down and Unit 3 was still precritical, a 48-hour endurance test was performed on the Unit 3 motor-driven AFW pump, 3P-504. During the run, the outboard bearing on the motor failed, rendering the pump inoperable. It was discovered later that the bearing oil grooves had been machined incorrectly and the bearing was apparently not being properly lubricated as a result. Similar problems were then identified with the other Unit 3 motor-driven AFW pump, 3P-141, and with the 2P-141 motor-driven AFW pump on Unit 2.

Low condenser vacuum caused a trip on Unit 2 on June 16, 1983.

#### B.39.3 Additional Event-Related Information

A supplemental report to the licensee event report for this event indicated that the bearing machining error would not by itself cause bearing failure. However the report did indicate that the machining error, in conjunction with other normally acceptable conditions, could cause bearing failure. The other conditions which might be required were not specified.

#### B.39.4 Modeling Assumptions

Since normally occurring conditions in conjunction with the bearing machining error could cause pump failure, it was assumed in this analysis that AFW pump 2P- 504 was inoperable in the long term. [The ASP models, like most PRA models, assume long-term (24 hours) operability for AFW success.] As the bearing condition apparently existed since the pump's manufacture, it was assumed that the AFW pump was inoperable at the

**LER No. 361/83-063**

## **B.39-2**

time of the Unit 2 trip which occurred 5 days earlier. This event was modeled as an inoperability of train 1 of AFW in conjunction with the unit trip.

The potential for common cause failure exists, even when a component is failed. Therefore, the conditional probability of a common cause failure was included in the analysis for those components that failed as part of the event.

The Unit 3 failures were not modeled, as Unit 3 was still in precritical status at the time.

### **B.39.5 Analysis Results**

The conditional core damage probability estimated for this event is  $1.1 \times 10^{-5}$ . The dominant core damage sequence, shown in Figure B.39.1, involves reactor trip, failure of main and auxiliary feedwater, and failure to supply makeup from the condensate system.

B.39-3

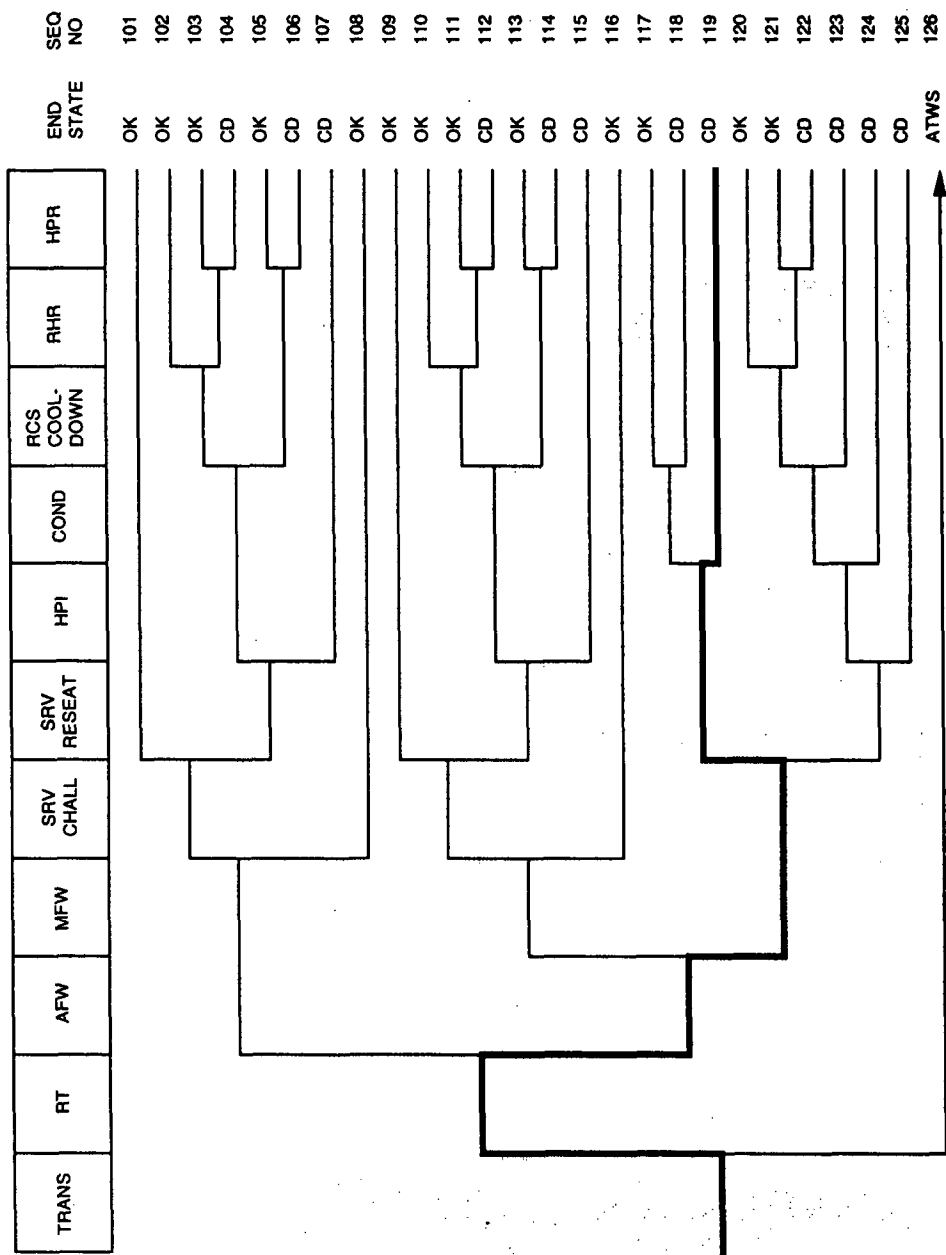


Figure B.39.1 Dominant core damage sequence for LER 361/83-063

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 361/83-063  
 Event Description: Trip with AFW pump inoperable  
 Event Date: June 21, 1983  
 Plant: San Onofre 2

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	1.1E-05
Total	1.1E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
119 trans -rt AFW mfw -srv.reseat cond	CD	5.5E-06	1.5E-01
508 trans rt -prim.press.limited AFW/ATWS	CD	4.2E-06	1.0E-01
118 trans -rt AFW mfw -srv.reseat -cond rcs.cooldown	CD	3.1E-07	1.5E-01
509 trans rt prim.press.limited	CD	2.5E-07	1.0E-01
507 trans rt -prim.press.limited -AFW/ATWS emrg.boration	CD	2.4E-07	1.0E-01
107 trans -rt -AFW srv.chall srv.reseat hpi	CD	2.1E-07	8.9E-01

\*\* non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
107 trans -rt -AFW srv.chall srv.reseat hpi	CD	2.1E-07	8.9E-01
118 trans -rt AFW mfw -srv.reseat -cond rcs.cooldown	CD	3.1E-07	1.5E-01
119 trans -rt AFW mfw -srv.reseat cond	CD	5.5E-06	1.5E-01
507 trans rt -prim.press.limited -AFW/ATWS emrg.boration	CD	2.4E-07	1.0E-01
508 trans rt -prim.press.limited AFW/ATWS	CD	4.2E-06	1.0E-01
509 trans rt prim.press.limited	CD	2.5E-07	1.0E-01

\*\* non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\1982-83\pwrh8283.cmp  
 BRANCH MODEL: c:\asp\1982-83\sanono2.82  
 PROBABILITY FILE: c:\asp\1982-83\pwr8283.pro

No Recovery Limit

**B.39-5**

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.7E-03	1.0E+00	
loop	2.0E-05	5.8E-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 > 5.3E-03	4.5E-01	
Branch Model: 1.0F.3+ser			
Train 1 Cond Prob:	2.0E-02 > Failed		
Train 2 Cond Prob:	1.0E-01		
Train 3 Cond Prob:	5.0E-02		
Serial Component Prob:	2.8E-04		
AFW/ATWS	4.3E-03 > 1.5E-01	1.0E+00	
Branch Model: 1.0F.1			
Train 1 Cond Prob:	4.3E-03 > 1.5E-01		
afw/ep	5.0E-02	3.4E-01	
mfw	2.0E-01	3.4E-01	
cond	2.5E-02	1.0E+00	1.0E-02
srv.chall	4.0E-02	1.0E+00	
srv.chall/afw	1.0E+00	1.0E+00	
srv.chall/loop	1.0E-01	1.0E+00	
srv.chall/sbo	1.0E+00	1.0E+00	
srv.reseat	2.0E-02	1.0E+00	
srv.reseat(atws)	1.0E-01	1.0E+00	
hpi	3.0E-04	8.9E-01	
rhr	7.1E-03	5.7E-02	1.0E-03
hpr	2.0E-03	1.0E+00	
ep	2.9E-03	8.9E-01	
seal.loca	5.5E-02	1.0E+00	
offsite.pwr.rec/seal.loca	7.6E-01	1.0E+00	
offsite.pwr.rec/-seal.loca	3.4E-01	1.0E+00	
sg.iso.and.rcs.cooldown	1.0E-02	1.0E-01	
rsc.cooldown	1.0E-03	1.0E+00	1.0E-03
rsc.cool.below.rhr	3.0E-03	1.0E+00	3.0E-03
prim.press.limited	8.8E-03	1.0E+00	
emrg.boration	0.0E+00	1.0E+00	1.0E-02

\* branch model file

\*\* forced