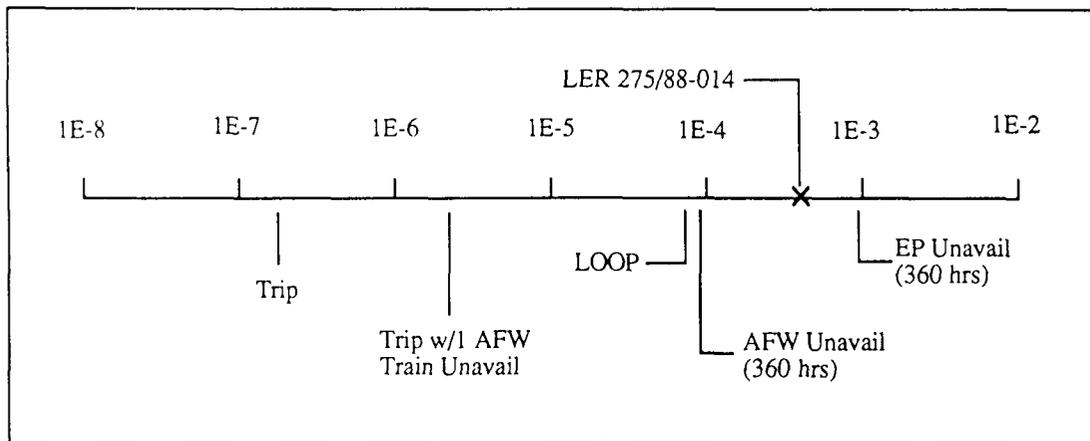


### Accident Sequence Precursor Program Event Analysis

LER No.: 275/88-014  
 Event Description: Degraded diesel generators due to clogged filters  
 Date of Event: May 5, 1988  
 Plant: Diablo Canyon Unit 1

#### Summary

During the performance of a diesel generator surveillance test, the generator load decreased below specified acceptance criteria. This was caused by a fungus, which clogged the primary fuel oil filter. The fungus existed in the day tanks and main fuel storage tanks in units 1 and 2. For this analysis, the fungus is assumed to render the diesel generators unavailable if required to mitigate a loss of offsite power. Such a situation would result in a station blackout. The conditional core damage probability estimated for the event is  $4.1 \times 10^{-4}$ . The relative significance of this event compared to other postulated events at Diablo Canyon is shown below.



#### Event Description

During the performance of the 1-1 diesel generator surveillance test, the generator load decreased below specified acceptance criteria. The cause of the load decrease was due to high differential pressure across the primary fuel oil filter, which was clogged by fungus. Ten minutes into the test, operations switched to the standby primary fuel oil filter, which caused the load to return to the required value. Investigation revealed that the primary fuel oil filter had been clogged by fungus and fungus spores from the generator day tank. This fungus was

found in the day tanks and main fuel storage tanks for both units. To prevent recurrence, the day tanks were drained, inspected, and cleaned; and the main fuel storage tanks were suctioned out and biocided. Also, a biocide program and an inspection program were to be developed to prevent and monitor fungus growth in the diesel fuel storage tanks.

### Event-Related Design Information

There are five diesel generators serving Diablo Canyon Units 1 and 2. Two generators are dedicated to each unit, and one generator may swing between units. Each diesel is equipped with a 550-gal fuel oil day tank that provides about 2.5 h of operation at full load. Additionally, two 40 000-gal storage tanks provide a 7-day supply of fuel, which feeds the day tanks. There is a primary and secondary fuel filter between the day tank and the diesel, with redundant filters that permit either filter to be isolated and changed during diesel operation. Diesel 1-1, which was discovered to be impacted during testing, is dedicated to Unit 1 and provides power to vital 4160-V bus H serving the following equipment:

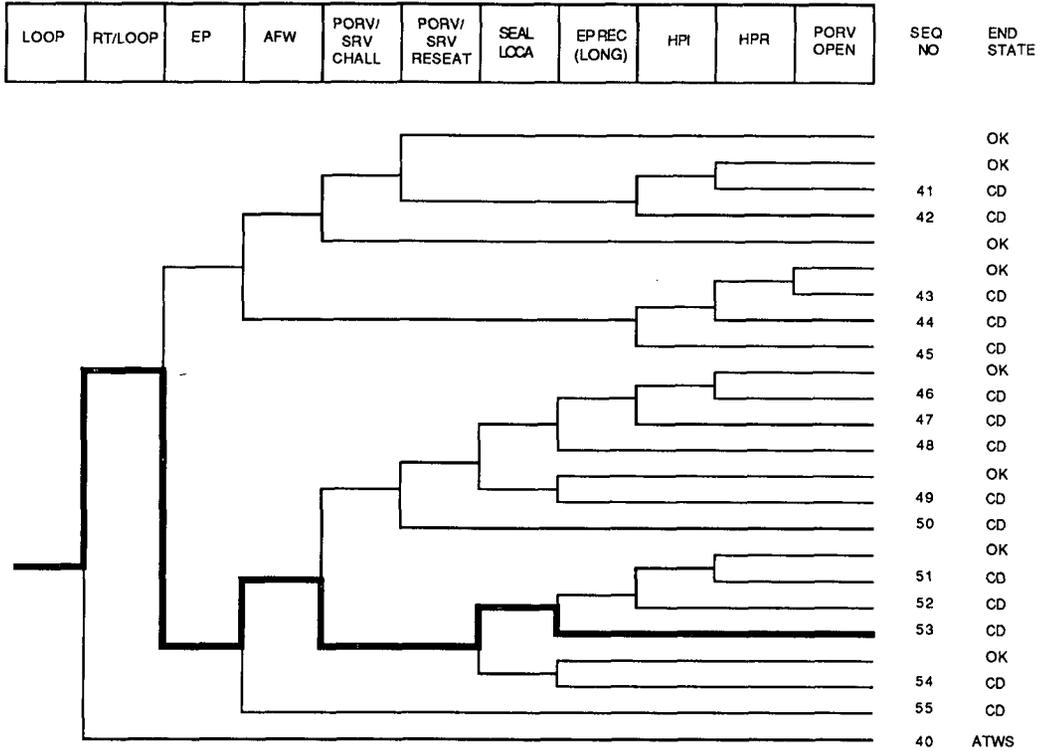
Redundant Equipment on bus H available	Equipment available
1. Auxiliary feedwater pump No. 12	1 of 2
2. Containment spray pump No. 12	1 of 2
3. Residual heat removal pump No. 12	1 of 2
4. Component cooling water pump No. 13	2 of 3
5. Safety injection pump No. 12	1 of 2
6. 480-V vital busses	

### ASP Modeling Assumptions and Approach

The event has been modeled as a potential loss of offsite power with unavailability of all emergency diesel generators. Because the fungus was both in the day tanks and in the main fuel storage tanks, all the diesels have an equal opportunity of failing before operators could detect, evaluate, and then respond to the trouble during an actual loss of offsite power. The failure period of the diesels has been assumed to be 360 h (one-half of a 1-month test interval). Because local recovery of the diesels is possible, a nonrecovery likelihood of 0.34 was assigned.

## Analysis Results

Given that the diesel generators were potentially unavailable for half a month, the probability for core damage resulting from diesel unavailability without a specific initiating event is  $4.1 \times 10^{-4}$ . This event is considered a significant event from an ASP standpoint. The dominant core damage sequence (highlighted on the following event tree) is associated with station blackout: a postulated LOOP in the vulnerability period ( $p = 4.1 \times 10^{-3}$ ), failure to recover emergency power ( $p = 0.34$ ), a subsequent seal LOCA ( $p = 0.32$ ), and failure to recover AC power prior to core uncover ( $p = 0.65$ ). If the diesels cannot be recovered, then the probability of core damage frequency is increased by a factor of 3 to  $1.2 \times 10^{-3}$ .



Dominant Core Damage Sequence for LER 275/88-014

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 275/88-014  
 Event Description: Degraded diesel generators due to clogged filters  
 Event Date: 05/05/88  
 Plant: Diablo Canyon 1

UNAVAILABILITY, DURATION= 360

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

LOOP 4.1E-03

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
LOOP	4.1E-04
Total	4.1E-04

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	2.7E-04	1.9E-01
54	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall - seal.loca ep.rec	CD	9.8E-05	1.9E-01
55	loop -rt/loop EMERG.POWER afw/emerg.power	CD	2.4E-05	6.7E-02
48	loop -rt/loop EMERG.POWER -afw/emerg.power porv.or.srv.chall - porv.or.srv.reseat/emerg.power seal.loca ep.rec(s1)	CD	1.1E-05	1.9E-01

\*\* non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

	Sequence	End State	Prob	N Rec**
48	loop -rt/loop EMERG.POWER -afw/emerg.power porv.or.srv.chall - porv.or.srv.reseat/emerg.power seal.loca ep.rec(s1)	CD	1.1E-05	1.9E-01
53	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall seal.loca ep.rec(s1)	CD	2.7E-04	1.9E-01
54	loop -rt/loop EMERG.POWER -afw/emerg.power -porv.or.srv.chall - seal.loca ep.rec	CD	9.8E-05	1.9E-01
55	loop -rt/loop EMERG.POWER afw/emerg.power	CD	2.4E-05	6.7E-02

\*\* 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\sealmod\pwrseal.cmp  
 BRANCH MODEL: c:\asp\sealmod\diablol.sll  
 PROBABILITY FILE: c:\asp\sealmod\pwr\_bsll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
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Event Identifier: 275/88-014

trans	5.6E-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 > 1.0E+00	8.0E-01 > 3.4E-01	
Branch Model: 1.OF.3			
Train 1 Cond Prob:	5.0E-02 > Failed		
Train 2 Cond Prob:	5.7E-02 > Failed		
Train 3 Cond Prob:	1.9E-01 > Failed		
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-03
porv.open	1.0E-02	1.0E+00	4.0E-04

\* branch model file  
\*\* forced

Minarick  
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