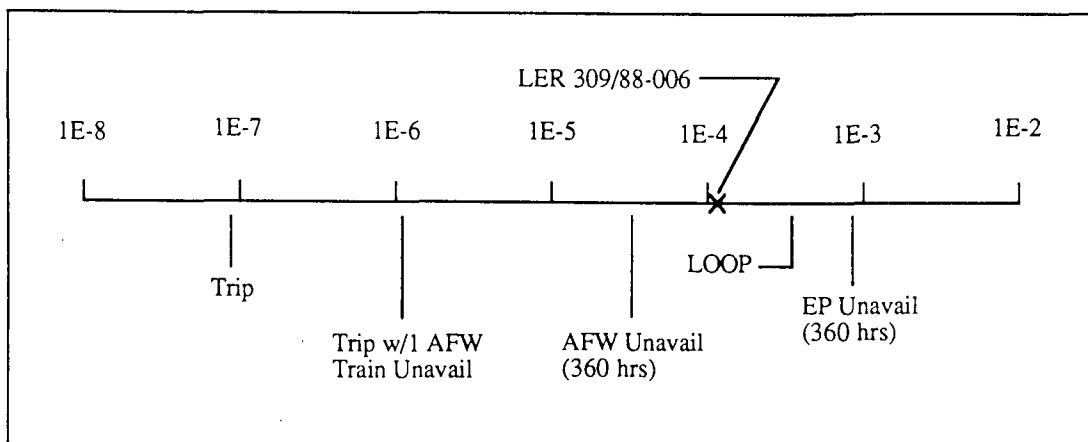


Accident Sequence Precursor Program Event Analysis

LER No: 309/88-006
 Event Description: Loss of offsite power
 Date of Event: August 13, 1988
 Plant: Maine Yankee

Summary

A fault on an output transformer caused a momentary low-voltage condition. This condition resulted in turbine and reactor trips and failure of automatic transfer of electrical power from the station service transformer to the reserve transformer. The emergency diesel generators started and loaded. One service water pump tripped when the DGs repowered the safety buses. A standby service water pump autostarted and supplied required loads. The core damage probability estimate for this event is 1.2×10^{-4} . This event is considered significant from an ASP standpoint. The relative significance of this event compared with other potential events at Maine Yankee is shown below.



Event Description

While at 98% power, an internal phase to ground fault on the high side of the X-1A main output transformer propagated a voltage transient from the main generator output transformer, to the station service transformer, and through the 345-kV grid back to the 115-kV reserve station transformer. This caused a simultaneous low-voltage condition on the station service and reserve station transformers. The coincident low-voltage condition prevented autotransfer of the source power to the reserve station transformer from the station service transformer. This caused a loss of offsite power to the unit. Both emergency diesel

generators started and loaded as designed. With no power to the reactor coolant pumps, the core was cooled by natural circulation. An intermittent failure of an overcurrent device in a circuit breaker caused a service water pump to trip after the generators repowered the vital buses. A standby service water pump autostarted on the trip of the primary pump and maintained service water flow. After the plant was stabilized, the reserve circuit breakers were manually closed, all buses were repowered from offsite sources, and a reactor coolant pump was started to reinstate forced circulation.

Event-Related Plant Design Information

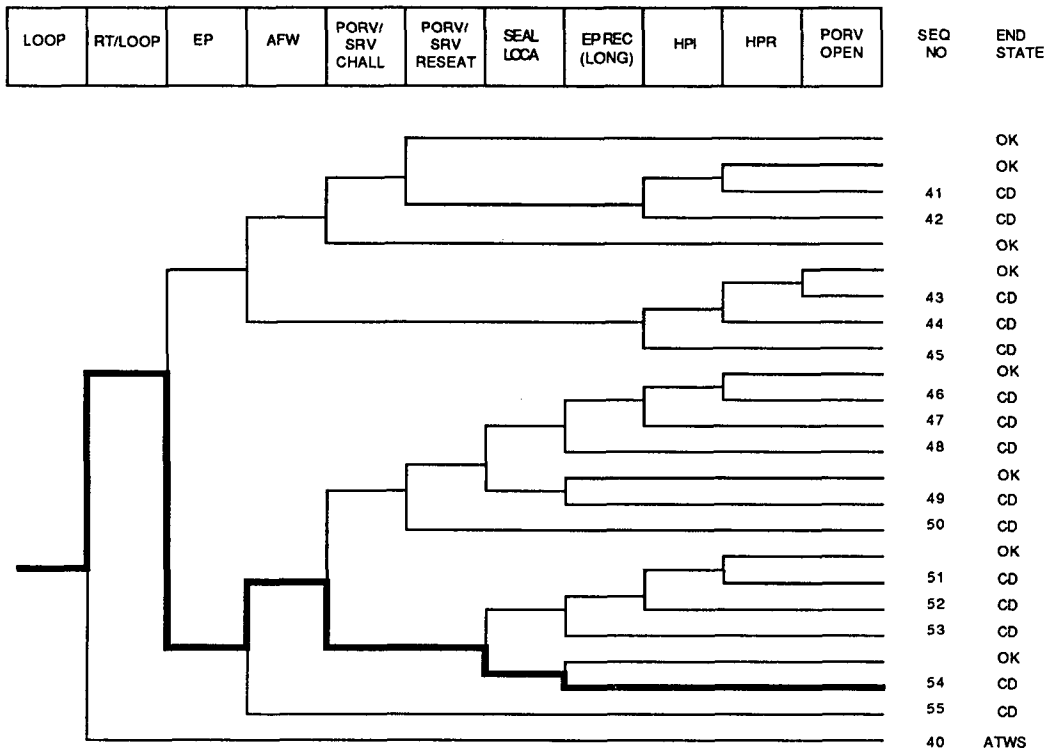
Main generator output is provided to the Maine Yankee 345-kV distribution switchyard via paralleled main transformers X-1A and X-1B. The switchyard initially supplies three other transmission systems, one of which is the Mason transmission line. The Mason line operates at 115-kV and provides two alternate transmission routes for Maine Yankee Reserve Station power. With the unavailability of both main and reserve power, emergency power was provided by two emergency diesel generators, DG-1A and DG-1B. Each of these generators provides power to their respective 4160-V emergency buses.

ASP Modeling Assumptions and Approach

This event has been modeled as a grid-related loss of offsite power. Since information regarding service water impacts was not readily available in the FSAR and the standby service water pump started as designed, the potential impacts of a service water train unavailability have not been modeled.

Analysis Results

The conditional core damage probability for this event is 1.2×10^{-4} . The dominant sequence is a station blackout sequence involving failure to recover offsite power in the short term ($p = 0.48$), failure of emergency power ($p = 2.3 \times 10^{-3}$), subsequent RCP seal failure ($p = 0.036$), and failure to recover electric power prior to core uncover ($p = 0.44$). This sequence is highlighted on the following event tree.



Dominant Core Damage Sequence for LER 309/88-006

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 309/88-006
 Event Description: Momentary loss of offsite power
 Event Date: 08/13/88
 Plant: Maine Yankee

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

LOOP 4.8E-01

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
LOOP	1.2E-04
Total	1.2E-04

ATWS

LOOP	0.0E+00
Total	0.0E+00

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
54 LOOP -rt/loop emerg.power -afw/emerg.power -porv.or.srv.chall - SEAL.LOCA EP.REC	CD	8.0E-05	3.8E-01
55 LOOP -rt/loop emerg.power afw/emerg.power	CD	1.9E-05	1.3E-01
53 LOOP -rt/loop emerg.power -afw/emerg.power -porv.or.srv.chall SEAL.LOCA EP.REC(SL)	CD	1.6E-05	3.8E-01
49 LOOP -rt/loop emerg.power -afw/emerg.power porv.or.srv.chall - porv.or.srv.reseat/emerg.power -SEAL.LOCA EP.REC	CD	3.3E-06	3.8E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
49 LOOP -rt/loop emerg.power -afw/emerg.power porv.or.srv.chall - porv.or.srv.reseat/emerg.power -SEAL.LOCA EP.REC	CD	3.3E-06	3.8E-01
53 LOOP -rt/loop emerg.power -afw/emerg.power -porv.or.srv.chall SEAL.LOCA EP.REC(SL)	CD	1.6E-05	3.8E-01
54 LOOP -rt/loop emerg.power -afw/emerg.power -porv.or.srv.chall - SEAL.LOCA EP.REC	CD	8.0E-05	3.8E-01
55 LOOP -rt/loop emerg.power afw/emerg.power	CD	1.9E-05	1.3E-01

** non-recovery credit for edited case

SEQUENCE MODEL: a:\sealmod\pwrseal.cmp
 BRANCH MODEL: a:\sealmod\mainyank.sll
 PROBABILITY FILE: a:\sealmod\pwr_bsll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	3.2E-04	1.0E+00	
LOOP	2.0E-05 > 2.0E-05	5.8E-01 > 4.8E-01	
Branch Model: INITOR			

Event Identifier: 309/88-006

Initiator Freq:	2.0E-05		
loca	2.4E-06	4.3E-01	
rt	2.8E-04	1.2E-01	
rt/loop	0.0E+00	1.0E+00	
emerg.power	2.9E-03	8.0E-01	
afw	3.8E-04	2.6E-01	
afw/emerg.power	5.0E-02	3.4E-01	
mfw	1.9E-01	3.4E-01	
porv.or.srv.chall	4.0E-02	1.0E+00	
porv.or.srv.reseat	2.0E-02	1.1E-02	
porv.or.srv.reseat/emerg.power	2.0E-02	1.0E+00	
SEAL,LOCA	5.5E-02 > 3.6E-02	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	5.5E-02 > 3.6E-02		
EP.REC(SL)	6.5E-01 > 4.4E-01	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	6.5E-01 > 4.4E-01		
EP.REC	2.3E-01 > 8.0E-02	1.0E+00	
Branch Model: 1.OF.1			
Train 1 Cond Prob:	2.3E-01 > 8.0E-02		
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	
porv.open	0.0E+00	1.0E+00	0.0E+00
* branch model file			
** forced			

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