

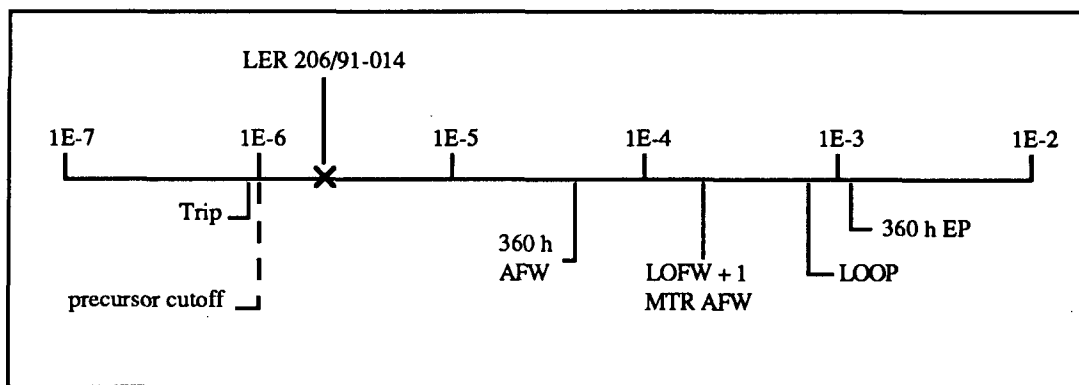
ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No: 206/91-014
 Event Description: Inoperable volume control tank level transmitters
 Date of Event: August 7, 1991
 Plant: San Onofre 1

Summary

The automatic actuation for re-alignment of the charging pumps from the volume control tank (VCT) to the refueling water storage tank (RWST) on low VCT level was disabled. In the event of a small-break loss-of-coolant accident (LOCA), and if manual realignment failed, the charging pumps would become gas bound due to hydrogen from the VCT. This condition existed for ~17 h.

The conditional probability of core damage associated with this event is 2.1×10^{-6} . The relative significance of the event compared to other postulated events at San Onofre 1 is shown below:



Event Description

VCT level transmitter LT-1100 was exhibiting erratic indication as compared to the opposite train level transmitter (LT-2550). To avoid inadvertent actuation during corrective maintenance on LT-1100, the automatic actuation functions of both transmitters were bypassed. Both transmitters were bypassed for a period of ~17 h.

Additional Event-Related Information

Level transmitters (LT-1100 and LT-2550) function to realign the charging pumps from

the VCT to the RWST when the VCT level becomes low and to provide a protective trip to the charging pumps to avoid the introduction of VCT hydrogen gas to the pump suction. On a low-low VCT level, each level transmitter (LT-1110 for train A and LT-2550 for train B) initiates opening of its respective RWST isolation valve; when these valves complete opening, limit switches initiate closure of the associated VCT isolation valves.

On low-low-low VCT level these transmitters also trip the charging pumps. Two trains of automatic charging pump protection are provided on low VCT level to preclude the VCT hydrogen cover gas from gas binding and potentially damaging the charging pump.

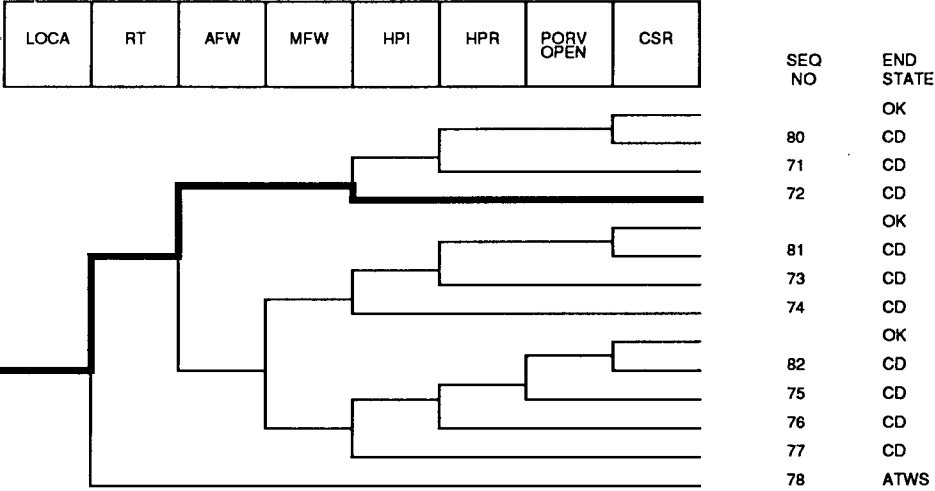
The valves controlled by LT-1100 and LT-2550 were still capable of being repositioned by their safety injection (SI) contacts. However, for certain small LOCAs, the VCT would have drained and the charging pumps would have been damaged before the reactor coolant system depressurized to the SI setpoint.

ASP Modeling Assumptions and Approach

The level transmitters were assumed to be unavailable for 17 h. For the purposes of this analysis, all potential small-break LOCAs were assumed to be small enough to drain the VCT before reaching the SI setpoint. Because the operators were aware that VCT level transmitters were unavailable, a non-recovery probability of 0.12 for high-pressure injection (HPI) was assumed. Feed and bleed was assumed not to be impacted by the unavailability of the level transmitters, since SI is manually actuated when initiating feed and bleed.

Analysis Results

The conditional probability of subsequent core damage estimated for this event is 2.1×10^{-6} . The dominant core damage sequence, highlighted on the following event tree, involves a postulated LOCA with successful reactor trip and auxiliary feedwater initiation with a failure of HPI.



Dominant core damage sequence for LER 206/91-014

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 206/91-014
 Event Description: Inoperable Volume Control Tank level transmitters
 Event Date: 08/07/1991
 Plant: San Onofre 1

UNAVAILABILITY, DURATION= 17

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

TRANS	2.0E-03
LOOP	1.9E-04
LOCA	1.8E-05

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
TRANS	2.1E-09
LOOP	5.9E-09
LOCA	2.1E-06
Total	2.1E-06
ATWS	
TRANS	0.0E+00
LOOP	0.0E+00
LOCA	0.0E+00
Total	0.0E+00

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
72 loca -rt -afw HPI	CD	2.1E-06	5.2E-02

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
72 loca -rt -afw HPI	CD	2.1E-06	5.2E-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\1989\pwrbscal.cmp
 BRANCH MODEL: c:\asp\1989\sanonol.sll
 PROBABILITY FILE: c:\asp\1989\pwr_bsll.pro

No Recovery Limit

Event Identifier: 206/91-014

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
trans	1.2E-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	2.9E-03	8.0E-01	1.0E-03
afw	2.3E-03	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	3.2E-01	1.0E+00	
ep.rec(sl)	7.6E-01	1.0E+00	
ep.rec	1.6E-01	1.0E+00	
HPI	1.0E-03 > 1.0E+00 **	8.4E-01 > 1.2E-01	
Branch Model: 1.OF.2			
Train 1 Cond Prob:	1.0E-02 > Unavailable		
Train 2 Cond Prob:	1.0E-01 > Unavailable		
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			

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