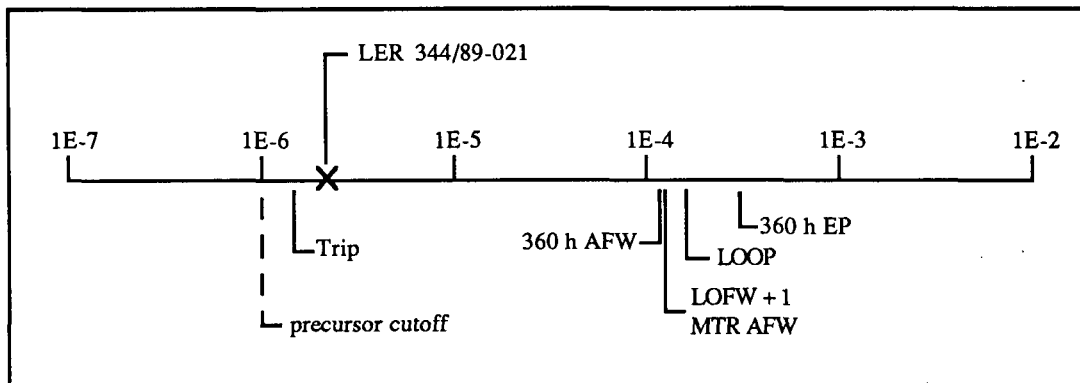


ACCIDENT SEQUENCE PRECURSOR PROGRAM EVENT ANALYSIS

LER No: 344/89-021
 Event Description: HHSI inoperable due to unavailability of VCT isolation during testing
 Date of Event: October 30, 1989
 Plant: Trojan

Summary

The potential existed for the high head safety injection (HHSI) system to be inoperable during performance of portions of a surveillance test. This test involves bypassing the charging pumps' suction isolation valves from the volume control tank. If a safety injection were required during this time, hydrogen cover gas from the volume control tanks could become entrained in both charging pumps. This would render safety injection inoperable. The conditional probability of core damage associated with this event is estimated to be 2.1×10^{-6} . The relative significance of this event compared with other potential events at Trojan is shown below.



Event Description

During review of procedures an operator trainee discovered that performance of portions of periodic operating test (POT) 2-3, "Safety Injection System Emergency Core Cooling System (ECCS) Valve In Service Test," could render both trains of centrifugal charging pumps (CCPs) inoperable if a safety injection signal (SIS) occurred while the POT was in progress. POT 2-3 requires that the volume control tank (VCT) isolation valves be bypassed during portions of the test. If an SIS occurred while in this bypassed state, the pressure from the VCT hydrogen cover gas, depending on safety injection flow and VCT

level and pressure, could cause the VCT to preferentially provide the CCP suction, with subsequent entrainment of the VCT cover gas in both CCPs.

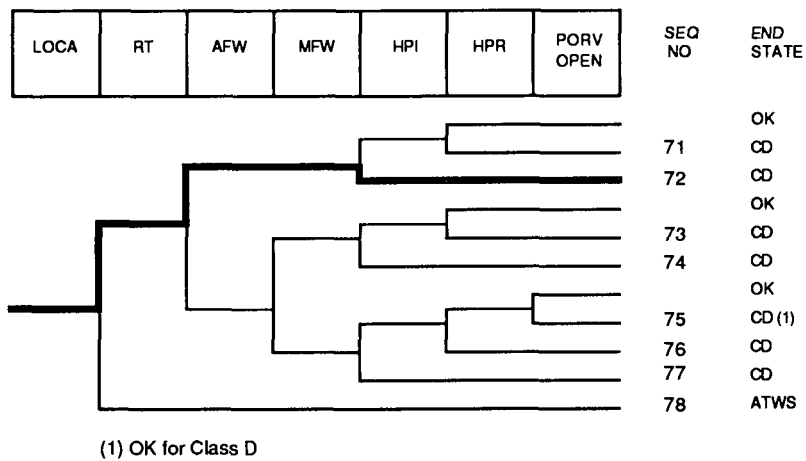
ASP Modeling Assumptions and Approach

This event was modeled as a potential loss of safety injection for 2 h/year.

Analysis Results

The conditional probability of subsequent severe core damage estimated for this event is 2.1×10^{-6} . Such an event is of low significance from an ASP standpoint.

The dominant sequence leading to core damage for this event involves a postulated loss of coolant accident and failure of high-pressure injection. The conditional probability of severe core damage for the dominant sequence is 1.7×10^{-6} . This sequence is highlighted on the following event tree.



Dominant core damage sequence for LER 344/89-021

B-263

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 344/89-021
 Event Description: HHSI inoperable due to unavailability of VCT isolation
 Event Date: 10/30/89
 Plant: Trojan

UNAVAILABILITY, DURATION= 2

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

| | |
|-------|---------|
| TRANS | 1.1E-03 |
| LOOP | 1.2E-05 |
| LOCA | 2.1E-06 |

SEQUENCE CONDITIONAL PROBABILITY SUMS

| End State/Initiator | Probability |
|---------------------|-------------|
| CD | |
| TRANS | 7.6E-08 |
| LOOP | 1.2E-08 |
| 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 | 4.3E-01 |
| 17 trans -rt afw mfw HPI(F/B) | CD | 6.7E-08 | 2.4E-02 |

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

| Sequence | End State | Prob | N Rec** |
|-------------------------------|-----------|---------|---------|
| 17 trans -rt afw mfw HPI(F/B) | CD | 6.7E-08 | 2.4E-02 |
| 72 loca -rt -afw HPI | CD | 2.1E-06 | 4.3E-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: c:\asp\1989\pwrbscal.cmp
 BRANCH MODEL: c:\asp\1989\trojan.sll
 PROBABILITY FILE: c:\asp\1989\pwr_bsll.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

| Branch | System | Non-Recov | Opr Fail |
|--------|---------|-----------|----------|
| trans | 5.6E-04 | 1.0E+00 | |
| loop | 1.6E-05 | 3.6E-01 | |
| loca | 2.4E-06 | 4.3E-01 | |

Event Identifier: 344/89-021

| | | | |
|--------------------------------|----------------------|-------------------|---------|
| rt | 2.8E-04 | 1.2E-01 | |
| rt/loop | 0.0E+00 | 1.0E+00 | |
| emerg.power | 2.9E-03 | 8.0E-01 | |
| afw | 2.5E-03 | 3.4E-01 | |
| afw/emerg.power | 2.5E-03 | 3.4E-01 | |
| mfw | 1.0E+00 | 7.0E-02 | |
| 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 | 2.3E-01 | 1.0E+00 | |
| ep.rec(sl) | 5.9E-01 | 1.0E+00 | |
| ep.rec | 6.1E-02 | 1.0E+00 | |
| HPI | 1.0E-03 > 1.0E+00 ** | 8.4E-01 > 1.0E+00 | |
| Branch Model: 1.OF.2 | | | |
| Train 1 Cond Prob: | 1.0E-02 > Failed | | |
| Train 2 Cond Prob: | 1.0E-01 > Failed | | |
| HPI(F/B) | 1.0E-03 > 1.0E+00 | 8.4E-01 > 1.0E+00 | 1.0E-02 |
| Branch Model: 1.OF.2+opr | | | |
| Train 1 Cond Prob: | 1.0E-02 > Failed | | |
| Train 2 Cond Prob: | 1.0E-01 > Failed | | |
| 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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