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May 18, 1994

U.S. Nuclear Regulatory Commission
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Gentlemen: ULNRC-3022

DOCKET NUMBER 50-483
CALLAWAY PLANT
ECCS ACCUMULATOR ALLOWED OUTAGE TIME

Reference: 1. ULNRC-2960 dated February 17, 1994

The amendment application transmitted in Reference 1 above includes changes to Technical Specification 3/4.5.1, as well as Bases Section 3/4.5.1, to provide a 72 hour allowed outage time (AOT) for one accumulator inoperable due to its boron concentration not meeting the 2300-2500 ppm band and a 24 hour AOT if an accumulator is inoperable for any other reason. Recent questions from the NRC reviewer are addressed in the attached responses. These responses were made available to the reviewer on May 11 and May 16. Should you have any further questions, please contact us.

Very truly yours,

Al Passwater for
Donald F. Schnell

GGY/plr

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STATE OF MISSOURI)
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Alan C. Passwater, of lawful age, being first duly sworn upon oath says that he is Manager, Licensing and Fuels (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Alan C. Passwater
Alan C. Passwater
Manager, Licensing and Fuels
Nuclear

SUBSCRIBED and sworn to before me this 18th day of May, 1994.

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PRA ANALYSIS OF ACCUMULATOR AOT IN RESPONSE TO NRC QUESTIONS

As a result of their review of the PRA analysis supporting an increase in the accumulator Allowed Outage Time (AOT), the NRC has requested an analysis of the following events on the unavailability of the accumulators:

1. The impact of assuming that one accumulator is out of service for an entire year.

2. The impact of an event representing the improper alignment of the system.

3. The impact on a typical non-large LOCA sequence.

These three issues were analyzed by modifying the existing PRA analysis fault trees and requantifying them.

Impact of One Accumulator Out of Service for One Year

To model the impact of having one accumulator out of service for an entire year, the fault tree used in the PRA analysis was modified to include a house event that removed the events associated with accumulator A from the fault tree. This house event effectively reduced the top event for the fault tree to "Two of Three Accumulators Fail to Inject Into the Cold Legs."

Once the fault tree was developed it was quantified. As in the analysis performed in support of ULNRC-2960, the fault tree was quantified twice; once to model a large LOCA case, and once to model a non-LOCA case. These cases were identified as NRCRUN1 and NRCRUN2, respectively. In addition, to remove redundant cutsets a disallowed maintenance/cutsets fault tree was developed and quantified, and then the two fault trees' cutsets merged using the NUPRA cutsets merging feature.

NRCRUN1 resulted in an unavailability of 1.56E-04. This is a substantial increase over the unavailability of 7.74E-06 determined in the PRA analysis performed in support of ULNRC-2960. However, the impact on the CDF remains quite small as can be seen below:

CDF from NRCRUN1	= (1.56E-04)(5E-04) = 7.8E-08
Increase from Baseline	= 7.8E-08 - 3.0E-09 = 7.5E-08
% Increase in CDF	= (7.5E-08/5.846E-05)(100) = 0.128%

NRCRUN2 resulted in an unavailability of 6.029E-06. This compares to the unavailability of 6.0E-06 determined in the PRA analysis performed in support of UL' IRC-2960. As can be seen, the resulting increase is negligible.

Impact of Improper System Alignment

In determining which events constitute improper system alignment, a number of possible errors were examined. First, the possibility that the normally open accumulator discharge isolation MOVs (EPHV8808A, EPHV8808B, EPHV8808C, and EPHV8808D) could be mispositioned was examined. These valves are opened per procedure OTN-EP-00001 and then the power to the valves is isolated by opening and locking their supply breakers. In addition, the valves have alarms associated with them that actuate if the valves are not fully open as well as position indication on the main control board. Further, Technical Specifications 4.5.1.1.a.2) and 4.5.1.1.c require that these valves be verified open with their power isolated as part of the Surveillance Requirements for the accumulators. Lastly, the valves get an open signal upon an SIS. Therefore, because of these precautions and redundancies, a misalignment of the isolation valves was not felt to be a credible event.

The next error that was examined was an inadvertent venting of the accumulators. For the accumulators to be vented, a solenoid operated valve must be actuated from the main control board. There is no automatic actuation feature associated with these valves. In order to vent the accumulators, the operator must consciously operate these valves. Therefore, venting of multiple accumulators was not felt to be a credible error.

The various drain and fill lines off the accumulators were next examined. These are all small diameter lines that either have check valves in them to prevent backflow or contain valves with no automatic features associated with them that must be consciously actuated by the operators. Thus, errors associated with filling and draining multiple accumulators were not felt to be credible.

The last area of potential error examined was the accumulator instrument loops. Each accumulator has two level and two pressure transmitters associated with it. These transmitters provide indication and alarm to the operators on the pressure and level in the accumulators. Miscalibration of these transmitters could result in the accumulators having improper amounts of borated water at the wrong pressure for proper injection into the RCS. However, a closer examination of the level transmitters shows that their level taps are relatively close together. In fact, the span on the transmitter is only 16 inches. The accumulator volume at the lower tap (equivalent to 0% level) is 5934 gal., which is 127 gal. below the Technical Specification minimum. Although physically impossible, if we assume that the operator grossly miscalibrates the level transmitter such that it reads 100%

when the accumulator water level just reaches the lower level tap, the tank volume will be off by a maximum of 850 gal. However, the operators maintain the level in the accumulators between the high (69% level) and low (31% level) level alarms. This alarm band is between 6520 and 6196 gal. If we assume the level miscalibration described above, this will result in the accumulator volume being 715 gal, or 11.8%, below the Technical Specification minimum. When this volume was compared against the MAAP calculations done to support the Callaway IPE, it was determined that this reduced volume is still sufficient to prevent core damage. Therefore, miscalibration of the level transmitters was neglected. A miscalibration of the pressure transmitters was, however, still considered to be a credible error. As a result, a new basic event was added to the basic fault tree to model this error and assigned a failure probability of 3.0E-04 based on values found in the Surry PRA (NSAC-152, Volume 3).

Once the fault tree was developed it was quantified. To model the impact of these errors on the analysis, the accumulator A test and maintenance (TM) unavailability was set to the value of 1.14E-02 used in the PRA analysis performed in support of ULNRC-2960. Once again a large LOCA case and a non-large LOCA case were quantified to see the impact of the new error. The large LOCA case was identified as NRCRUN3 and the non-large LOCA case as NRCRUN4. The results of these cases are discussed below.

NRCRUN3 resulted in an accumulator unavailability of 3.077E-04. When compared to NRCRUN1 we can see that the miscalibration error results in a factor of 2 increase in accumulator unavailability.

NRCRUN4 resulted in an accumulator unavailability of 3.060E-04. When compared to NRCRUN2 we can see that this results in an almost two order of magnitude increase in accumulator unavailability.

These cases show that a miscalibration error of the accumulator pressure transmitters may have a much larger impact on the unavailability of the accumulators than does an increase in the allowed outage time of the accumulators.

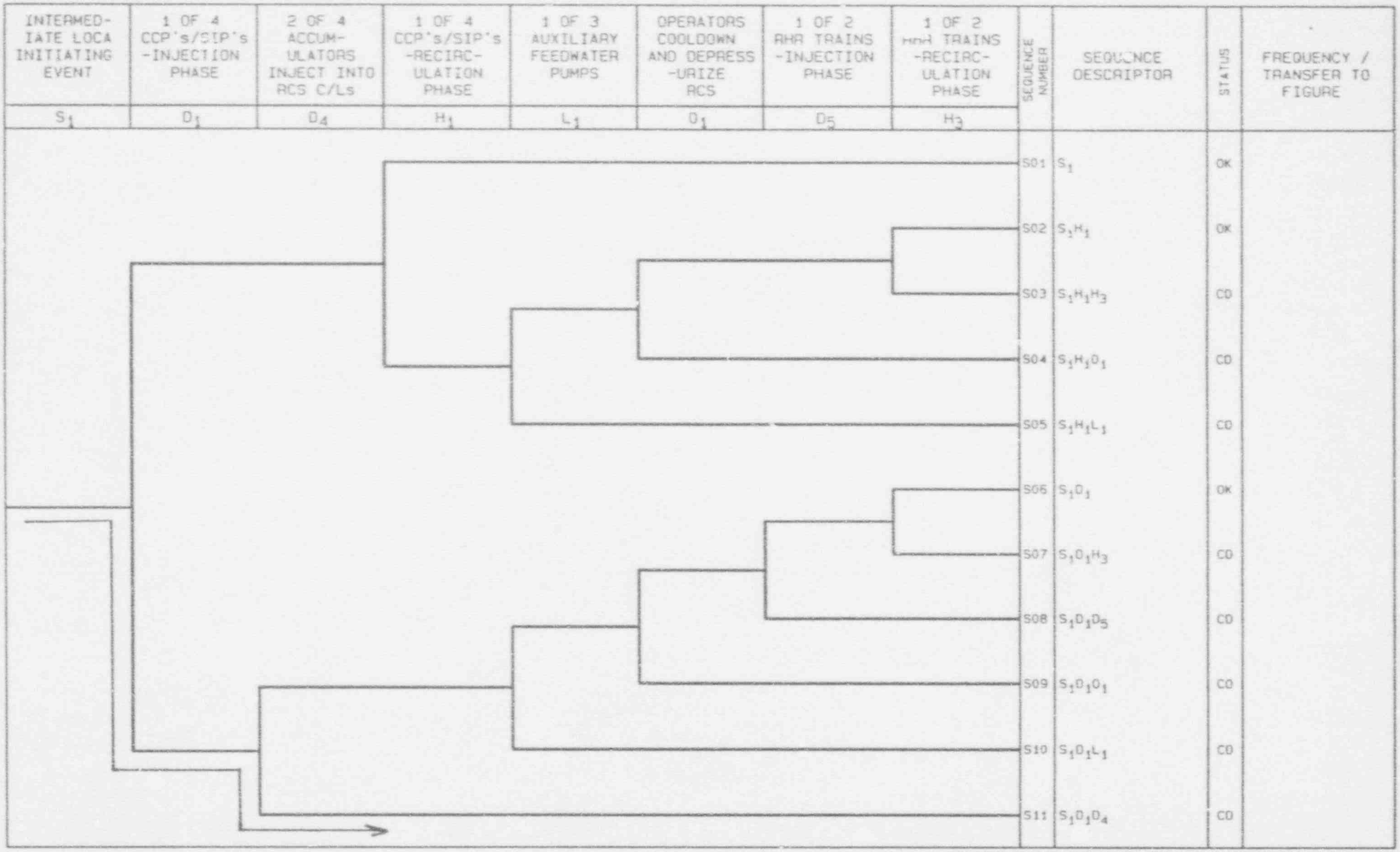
<u>Impact on a Typical Non-Large LOCA Sequence</u>

To address NRC questions regarding the impact of the requested 24 hour accumulator AOT on non-large LOCA accident sequences, an intermediate LOCA sequence was requantified to assure that the 24 hour AOT had an insignificant impact on non-large LOCA sequence frequencies.

The sequence requantified is identified on the attached event tree. The sequence (S(1)S11) involves an intermediate LOCA initiating event, followed by failure of all four high head ECCS pumps and failure of two accumulators to inject.

In order to determine the impact of increasing the accumulator AOT on the core damage frequency (CDF) due to this sequence, two sets of runs were made. The first set used an accumulator model that contained the accumulator pressure transmitter miscalibration error as discussed above. The second set of runs used an accumulator model without the miscalibration error. Descriptions of the individual runs made and tneir results are provided in the attached table.

As can be seen in the table, there is no discernible increase in the accumulator injection unavailability or accident sequence frequency in the first set of cases for an increased accumulator AOT. In the second set of cases, there is no discernible increase in the accumulator injection unavailability or the sequence frequency with accumulator A in test/maintenance for 100 hours per year. There is a discernible increase in accumulator injection unavailability and sequence frequency for the case where accumulator A is in test/maintenance all year. However, this is a gross overestimate of the 24 hour AOT requested in ULNRC-2960. Even with this overestimate, the increase in sequence S(1)S11 frequency is in the E-14 range which is clearly insignificant.The impact on this sequence is representative of the effect on all other non-large LOCA sequences.



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INTERMEDIATE LOCA

EVENT TREE

RESULTS OF NON-LARGE LOCA ACCUMULATOR TEST AND MAINTENANCE (TM) SENSITIVITY RUNS

CASE	CASE DESCRIPTION	ACCUMULATOR INJECTION UNAVAILABILITY	SEQUENCE S(1) S11 CDF(yr^{-1})
a.	Base case with accumulator pressure miscalibration (MC) error. No accumulator TM.	3.06E-4	1.095E-10
b.	Also includes MC error. Accumulator A in TM all year.	3.06E-4	1.095E-10
c.	Also includes MC error. Accumulator A in TM 100 hrs. per year.	3.06E-4	1.095E-10
a.[1]	Base case. No accumulator TM. No MC error.	6.00E-6	2.147E-12
b.[1]	Accumulator A in TM all year. No MC error.	6.03E-6	2.158E-12
c.[1]	Accumulator A in TM 100 hours per year. No MC error.	6.00E-6	2.147E-12