

May 31, 1996

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U. S. Nuclear Regulatory Commission
Document Control Desk
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Washington, DC 20555

Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Review of Preliminary Accident Sequence Precursor Analysis

Gentlemen:

Enclosed is a copy of ANO's review of your Preliminary Accident Sequence Precursor Analysis of Licensee Event Report 50-313/95-005-00 as requested in your letter dated April 23, 1996.

We have several minor comments with respect to the narrative portion of the analysis:

- The event description incorrectly states that PSV-2684 "remained open longer than operators expected." The root cause section of the LER states that subsequent review verified that the valve responded normally on blowdown and reseal.
- The event description states that control of the atmospheric dump valve was lost. Adding the word "remote" to the description clarifies that local control was still available. The same clarification may be added in the Additional Event-Related Information section.
- The Modeling Assumptions section states that the EFW control valves were not declared unavailable until about one hour after the trip, leaving the impression that they were unavailable previous to that time. A clarification that the valves actually became unavailable at that time would seem appropriate.

Upon evaluating the event description, and reviewing the Event Tree and resulting cutsets, it was identified that credit was not given for use of ANO-1's Auxiliary (Startup) Feedwater Pump (P-75). The Auxiliary Feedwater pump is an electric motor-driven centrifugal pump that is normally used during startup and shutdown conditions when there is insufficient steam available to run the main feed pumps. This pump is credited in the ANO-1 PSA as a recovery.

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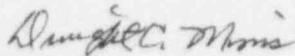
The Auxiliary Feedwater Pump has also been recognized by the NRC (Resolution of Generic Issue 124-Auxiliary Feedwater System Reliability, August 24, 1988) to provide sufficient reliability to meet the unavailability criterion of SRP Section 10.4.9 for the more frequently occurring transients, such as loss of Main Feedwater.

The auxiliary feedwater pump can be credited in all transient sequences except for Loss of Offsite Power and Loss of Power Conversion System. The probability of failure for this recovery includes a mechanical failure probability as well as an operator failure. ANO-1's success criteria regarding the transient sequences involving loss of all feedwater defines an available time of 36 minutes for Loss of Power Conversion System sequences with reactor coolant pumps still running. Attachment 1 of the enclosure shows the inputs and results of the analysis which calculates the failure probability for this recovery.

The enclosure documenting ANO's analysis concludes that by crediting the auxiliary feedwater pump and by utilizing ANO specific probabilities and beta factors from NUREG/CR-4780, (NRC and EPRI, Procedures for Treating Common Cause Failures in Safety and Reliability Studies), the calculated core damage probability can be reduced to 9.11E-07.

Documentation which justifies crediting the auxiliary feedwater pump is also included with this submittal. If you have any questions or need additional information, please contact Mr. Richard Scheide at 501-858-4618.

Very truly yours,



Dwight C. Mims
Director, Nuclear Safety

DCM/rhs

Enclosure

cc: Mr. Leonard J. Callan
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

Mr. George Kalman
NRR Project Manager Region IV/ANO-1 & 2
U. S. Nuclear Regulatory Commission
NRR Mail Stop 13-H-3
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

I. Purpose

The purpose of this analysis is to modify the Conditional Core Damage Probability (CCDP), submitted as an Accident Precursor Analysis, to more accurately reflect the risk at ANO-1.

II. References

1. "NRC and EPRI, *Procedures for Treating Common Cause Failures in Safety and Reliability Studies*", NUREG/CR-4780, Vols. 1 and 2, January 1988
2. Calc. 89-E-0167-18, *Quantification Manual for Probabilistic Risk Assessment*, Rev. 2, 12/7/95
3. Calc. #89-E-0047-20, *ANO-1 Initiating Events and Accident Sequence Analysis Work Package*, Rev. 1, 10/9/95
4. Calc. #89-E-0047-22, *ANO-1 Human Reliability Analysis Work Package*, Rev. 1, 10/20/95
5. 1CNA088808, NRC Letter - *Resolution of Generic Issue 124 - Auxiliary Feedwater System Reliability*, August 24, 1988

III. Analysis

1. TRANS Sequence 20:

The probability of failure for the Aux. Feed pump as a recovery can be applied to all cutsets in this sequence. Thus the new CCDP for this sequence becomes $1.97\text{E-}07$ (See Attachment 2).

2. TRANS Sequence 21-8:

The cutset for this sequence includes a failure of the EFW system. Therefore, the Aux. Feedwater recovery can be applied. Applying this recovery yields a new CCDP of $8.48\text{E-}08$ (See Attachment 2).

3. TRANS Sequence 08:

The common cause failure probability assumed for the HPI-CKV-00-MST is conservatively high based upon the ANO-1 Common Cause failure probability for these valves. The ANO-1 Common Cause probability for these valves is $7.38\text{E-}04$ based upon a beta factor of .08 obtained from Ref. 1 and a probability of failure for the MOV of $9.23\text{E-}03$.

For HPI-MOV-CF-SUCT, the CCF probability is also higher than is representative for ANO-1. The HPI suction valves are stop check valves. Using Reference 1, the beta factor for check valves is .06. Using ANO-1's failure to open probability for these valves of

4.93E-04, yields a common cause failure probability of 2.96E-05 when the beta factor is applied.

When these ANO specific values are applied to the cutsets in Table 5 for the TRANS Sequences 08, the CCDP becomes 3.19E-07 (See Attachment 2).

IV. Conclusion

Crediting the Aux. Feedwater in the analysis reduces the CCDP calculated in the original report. In addition, by utilizing ANO specific probabilities and beta factors from Ref. 1, the CCDP is reduced even further.

The new CCDP= 9.11E-07. This value is below the criteria for an Accident Sequence Precursor.

HUMAN FAILURE RECORD SHEET
In-Control Room Model

1. EVENT AFWFEEDREC

2. EVENT IDENTIFICATION

2.1 Descriptor Operator fails to start and align AFW pump P75
after loss of EFW (may require MFW iso., RBF)
2.2 Comment EOP 1202.06, non T2,T3 and condensate avail.

3. EVENT CATEGORIZATION

3.1 Event type post-initiator recovery
3.2 Location of action(s) in control room
3.3 Failure mode mistake

4. METHOD USED SAIC TRC system

5. INPUT PARAMETERS

5.1 Type of behavior		response
5.2 Presence of burden		no
5.3 SLI (0.0 to 1.0)	nominal is 0.5	default
5.4 Median time (min), m1	default is 4.0	default
5.5 Model error factor, f1	generic is 3.2	default
5.6 Model uncert. error factor, fU	generic is 1.68	default
5.7 Available time (min), t		36

6. CALCULATED PARAMETERS

6.1 Behavior factor	1.0
6.2 SLI factor	1.0
6.3 Burden factor	1.0
6.4 Adjusted median response time, m = m1 item 6.1 item 6.2	4.0
6.5 Adjusted model error factor, fR = f1 x item 6.3	3.2

7. EVENT OCCURENCE PROBABILISTIC ESTIMATES

7.1 Mean (explicitly includes associated equipment failures)	1.6E-02
7.2 95th percentile	1.5E-02
7.3 5th percentile	2.3E-04
7.4 Error Factor	15.00

8. ASSOCIATED EQUIPMENT RELIABILITY TREATMENT

8.1 Human reliability event mean failure probability	2.8E-03
8.2 Associated equipment reliability limited (1=yes,0=no)	1
8.3 Associated equipment failure probability (see E51)	1.32E-02
8.4 Combined human and equipment failure probability	1.60E-02

Attachment 2

TRANS SEQ 20	PREVIOUS CCDP	AFW REC		NEW CCDP
	5.60E-06	1.60E-02		8.96E-08
	3.50E-06	1.60E-02		5.60E-08
	1.40E-06	1.60E-02		2.24E-08
	8.80E-07	1.60E-02		1.408E-08
	5.50E-07	1.60E-02		8.8E-09
	2.20E-07	1.60E-02		3.52E-09
	1.70E-07	1.60E-02		2.72E-09
SUBTOTAL	1.23E-05			1.97E-07
TRANS SEQ 21-8	PREVIOUS CCDP	AFW REC		NEW CCDP
SUBTOTAL	5.30E-06	1.60E-02		8.48E-08
TRANS SEQ 08	PREVIOUS CCDP	PREVIOUS CCF PROB. FOR HPI-CKV-00-MST & HPI-MOV-CF-SUCT	ANO-1 CCF PROB. FOR HPI-CKV-00-MST & HPI-MOV-CF-SUCT	Column B divided by Column C multiplied by Column D = NEW CCDP
	8.30E-07	3.00E-03	7.38E-04	2.04E-07
	3.00E-07	3.00E-03	7.38E-04	7.38E-08
	7.30E-08	2.60E-04	2.96E-05	8.31E-09
	3.00E-08			3.00E-08
	2.60E-08	2.60E-04	2.96E-05	2.96E-09
SUBTOTAL	1.26E-06			3.19E-07
TRANS SEQ 20-9	PREVIOUS CCDP			NEW CCDP
SUBTOTAL	3.10E-07			3.10E-07
	PREVIOUS CCDP			NEW CCDP
TOTAL	1.92E-05			9.11E-07