Form 1062.01A

NRC Form 366
(9-83)

U.S. Nuclear Regulatory Commission
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Arkansas Nuclear One, Unit Two | DOCKET NUMBER (2) 0|5|0|0|0| 3| 6| 8 | PAGE (3) 1|OF|0|5

TITLE (4) Control Element Assembly Drop Time Exceeded That Allowed By Technical Specifications And Assumed By Safety Analyses Due To Incorrect Testing Me[illegible]

EVENT DATE (5) Month	Day	Year	LER NUMBER (6) Year	Sequential Number	Revision Number	REPORT DATE (7) Month	Day	Year	OTHER FACILITIES INVOLVED (8) Facility Names	Docket Number(s)
0 5	0 3	8 8	8 8	0 0 9	0 0	0 6	0 6	8 8		0 5 0 0 0
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OPERATING MODE (9) 3 | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

POWER LEVEL (10) 0|0|0

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[X] Other (Specify in Abstract below and in Text, NRC Form 366A) Generic
[ ] 20.405(a)(1)(iii)	[X] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[X] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

Name: Patrick Rogers, Nuclear Safety and Licensing Specialist

Telephone Number: Area Code 5|0|1 9|6|4|-|3|1|0|0

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

Cause	System	Component	Manufacturer	Reportable to NPRDS	Cause	System	Component	Manufacturer	Reportable to NPRDS

SUPPLEMENT REPORT EXPECTED (14)

[ ] Yes (If yes, complete Expected Submission Date) [X] No

EXPECTED SUBMISSION DATE (15) Month | Day | Year

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On 5/1/88, while in Mode 3 operation following the sixth refueling outage, control element assembly (CEA) drop time testing was conducted which indicated that the allowable Technical Specifications (TS) time limit for CEA insertion was not met for certain CEAs. Since a new test method was being used for measuring drop times, evaluation of the test method and additional testing was performed. On 5/3/88, it was concluded that the drop times measured on 5/1/88 were valid. The cause was determined to be a deficiency in the method for performing CEA drop time testing used for previous cycles. Previous tests had not accurately reflected the actual CEA drop time associated with a reactor trip. An inherent time delay factor caused by the design of the electrical system for the CEA drive mechanisms was not recognized or accounted for during the development and implementation of the procedure specifying the test method to be used to measure CEA drop times. Arkansas Nuclear One, Unit 2 (ANO-2) Design Basis Accident Analyses were reviewed to determine the impact of the increased CEA drop time on Cycle 7 operation. These reviews concluded that the analyses were conservative with the exception of two events. The core protection calculators DNBR power uncertainty multiplier was conservatively increased. The TS were amended to increase the allowable CEA drop time from 3.0 seconds to 3.2 seconds. At 0406 hours on 5/18/88 the CEA drop time test was again successfully completed verifying that the CEA drop times were within the revised TS limit of 3.2 seconds. This occurrence is reportable per 10CFR50.73(a)(2)(i) and 10CFR50.73(a)(2)(ii).

I. Description of Event

A. Plant Status

On 5/1/88, ANO-2 was in Mode 3 operation with reactor coolant system (RCS) pressure at 2250 psia and RCS temperature at 545 degrees Fahrenheit. Completion of the sixth refueling outage (2R6) of the unit was in progress in preparation for startup and operation of Cycle 7.

B. Component Identification

The components identified by this event were certain control element assemblies (CEAs) which exceeded the drop time specified in TS.

The CEAs were supplied by Combustion Engineering. EIIS identifier is AA-ROD and the manufacturer code in C490.

C. Sequence of Events

On 5/1/88 at 1707 hours, in preparation for CEA drop time testing following refueling of the reactor, all CEAs had been fully withdrawn from the core. At 1825 hours, testing was initiated by opening the reactor trip breakers (RTBs). Analysis of the test data indicated that the allowable TS limit for CEA insertion time (a maximum of 3.0 seconds from the time that power is interrupted from the control element drive mechanisms (CEDMs) to the time that the CEAs are inserted to the 90% position) was not met for certain CEAs. Since a new test method was being used to perform the test, the computer software used to calculate the drop times was examined. No errors were apparent, therefore to verify the measured drop time values, the test was repeated on 5/2/88 at 1856 hours. This second test yielded results that were consistent with those of the first test. At 2140 hours on 5/2/88, six of the CEAs which did not meet the TS allowable drop time were tested individually by opening their individual power supply breakers and obtaining the drop times for each CEA. These results were consistent with test results obtained from previous cycles when testing had been performed in this manner and indicated the drop times were within the TS limit. All of the obtained data were analyzed, and on 5/3/88 it was concluded that the drop times measured on 5/1/88 were valid and certain CEAs had actually exceeded the TS allowable value. Following evaluation of the effects of an increased CEA drop time on the results of the safety analyses, an emergency TS amendment request was submitted. On 5/16/88 a TS amendment was approved which increased the allowable CEA drop time from 3.0 seconds to 3.2 seconds. At 0406 hours on 5/18/88 the CEA drop time test was again successfully completed verifying that the CEA drop times were within the revised TS limit of 3.2 seconds.

II. Event Analysis

A. Event Cause

A change in the measurement methodology for CEA drop time testing revealed that the actual drop time for certain CEAs exceeded the maximum limit of 3.0 seconds specified by TS 3.1.3.4. The "traditional" method used for measuring CEA drop time during previous tests involved interrupting electrical power to Control Element Drive Mechanism (CEDM) from each individual CEDM breaker. The "new" test method implemented during the sixth refueling outage (2R6) involved interrupting the power to all the CEDMs simultaneously via the Reactor Trip Breakers (RTBs) and is representative of the actual conditions which would occur upon receipt of a manual or automatic reactor trip signal from the reactor protection system. The following is a summary of the two methods.

The "traditional" method used since the initial startup and through the fifth refueling outage tested each CEA individually. A chart recorder (visicorder) was connected to the subject CEA reed switch position transmitter (RSPT) to provide the position and to the upper gripper coil to show when current was interrupted to the CEA gripper. The CEA was then withdrawn from the core to its full out position; the visicorder was switched on to high speed; the CEA was dropped by opening its individual circuit breaker. Position of the CEA as a function of time was recorded on the visicorder chart in the form of the changing RSPT signal. From this chart the time from interruption of power to 90% CEA insertion was determined.

The "new" method was used for the first time at ANO-2 during the pre-critical testing prior to Cycle 7 reactor startup. This method uses special software loaded into one of the Control Element Assembly Calculators (CEACs) which utilizes the selected CEAC as a specialized high speed data acquisition system capable of initiating a reactor trip and monitoring all 81 CEA positions every 50 milliseconds through their individual RSPTs. The data may then be transferred for permanent storage or analysis. The special software (CEA Drop Time Test, or CDTT software) initiates the test by transmitting a large penalty factor to each of the Core Protection Calculator (CPC) channels, producing a reactor trip. It should be noted that the point at which power is interrupted to the CEA drive mechanism is the reactor trip breakers, not the individual CEA breakers as in the traditional method.

Because the CDTT software begins sampling data as soon as it issues the penalty factor, the recorded drop times must be corrected for the delay time which is associated with the CPC processing time and actuation of the trip logic and trip breakers. This delay is part of the CPC instrumentation response time and is therefore already accounted for in other testing. This delay time is determined by monitoring a target CEA during its drop using a visicorder which is connected to the CEA in the same way as done for the traditional method. The visicorder trace drop time and the CDTT computed drop time are then compared to determine the delay time in the CDTT output to be subtracted from each CEA drop time.

Testing utilizing the new test method revealed an additional time delay factor due to circuit time constants associated with the electromagnetic decay of multiple CEDM coils tied together versus the decay time of an individual coil isolated from the other CEDM coils. The traditional method of response time testing provided coil discharge time of less than 0.3 seconds. The energy stored in the holding coil was dissipated through a resistor. The time for the energy to dissipate through the resistor established the response time. The new method of response time testing (power removal by opening trip circuit breakers) provides discharge times of approximately 0.25 seconds longer than the traditional method.

It is important to note that the actual physical drop time of the CEAs does not appear to have increased, as shown by the test performed during 2R6 and the historical drop time data from previous cycle testing.

B. Safety Significance

The safety significance of the discovery that the actual drop time for certain CEAs exceeded the value for this parameter used as an assumption in the Safety Analyses relates to the effect of this discrepancy on the applicable accident analyses results for the past operating cycles. The actual effects, if any, on the analyses results for these cycles is dependent upon the magnitude of the difference in the drop times. During the past operating cycles, none of the accidents analyzed in the Safety Analyses which might have been significantly affected by the difference in CEA drop time actually occurred. The previous operating cycles analyses were not re-analyzed utilizing the increased CEA drop time value in order to determine the calculated effect for each event that is postulated to occur. Therefore, the effect of the discrepancy for all potential conditions was not quantified and is not known. However, as part of the effort to resolve the problem and justify acceptable operation during Cycle 7, the ANO-2 SAR design basis accident analyses were reviewed and re-evaluated to determine the impact of an increased drop time on the thirty-five (35) Chapter 15 events considered in the SAR. In addition, two potentially affected analyses from Chapter 6 of the SAR, and one of the analyses from the ANO-2 Reload Analysis were reviewed. As a result of these evaluations, it was determined that the majority of the analyses were not affected by the difference in CEA drop times. Also, it was noted that a significant amount of conservatisms are available which were not used to support the conclusions of the analyses. For example, the analyses model reactivity insertion assuming all rods are inserted at the TS limit, or slowest acceptable times. In other words, credit is not taken as part of the analysis for those CEAs which insert or drop faster than the 3.0 seconds required by TS. Significant additional reactivity is, in fact, inserted by virtue of the majority of CEAs which insert more rapidly than the TS limit. Also, many of the existing analyses utilize overly conservative inputs. For example, Beginning of Cycle full power events assume a positive moderator temperature coefficient (MTC) which is prohibited by the current TS. A revised analysis crediting the proper MTC value would provide significantly more favorable results. Also most analyses assume a higher initial thermal power (2900 MW thermal) than allowed. Nonetheless, the analyses credit none of these conditions, demonstrating the significant conservatisms in the analyses.

Another factor which should be considered is the probability of occurrence of the analyzed events for which the increased CEA drop time may have altered the analysis conclusions for past operating cycles. Although it is necessary to provide analyses and demonstrate acceptable results for these types of events, the probability of occurrence of these events is remote.

C. Root Cause

The root cause was determined to be a deficiency in the method for performing CEA drop time testing used for previous cycles. This method did not accurately measure the actual CEA drop time associated with a reactor trip by not accounting for the additional time delay factor due to circuit time constants associated with the electromagnetic decay of multiple CEDM coils versus the decay time for an individual coil. The presence of this factor was not recognized or accounted for during the development and implementation of the procedure specifying the test method to be used to measure CEA drop times and verify compliance with TS allowable values.

D. Basis for Reportability

At approximately 1900 hours on 5/3/88 following preliminary evaluations of CEA drop time data collected on 5/1/88 and 5/2/88, the discovery of the condition was reported under the provisions of 10CFR50.72(b)(1)(ii).

Although exact CEA drop times during previous cycles cannot be precisely determined, data indicates that the TS limit was likely exceeded. Therefore, based on evaluations of the occurrence, it was conlcuded that plant operation with a conditon prohibited by TS existed since initial startup of the unit after construction and discovery of this condition is reportable per 10CFR50.73(a)(2)(i)(B) and 10CFR50.73(A)(2)(ii).

III. Corrective Actions

A. Immediate

The CEA drop time test results were validated which verifed that certain CEAs actually exceeded the TS requirements. Examination of the saftey analyses then commenced to support startup and operation of Cycle 7.

B. Subsequent

ANO-2 SAR Design Basis Accident Analyses were reviewed to determine the impact of an increased CEA drop time on the thirty-five (35) Chapter 15 events considered in the SAR. In addition, two potentially affected analyses from Chapter 6 of the SAR, and one of the analyses from the ANO-2 Reload Analysis were reviewed. The accidents were re-evaluated considering the currently approved analyses of record as defined by the Safety Analysis Report and cycle specific reload reports.

These reviews concluded that the analyses were conservative with the exception of the event regarding uncontrolled CEA withdrawal from 100% power and the event regarding excess heat removal due to secondary system malfunction. In order to compensate for these slight non-conservatisms, the CPC DNBR power uncertainty multiplier (BERR1), a CPC addressable constant, was conservatively increased by a factor of 1.005 in accordance with TS 6.8.1.g. This effectively reduces the operating margin to the trip setpoint and will ensure that a CPC DNBR trip will occur at least 0.3 seconds earlier than the trip time presented in the reload analyses in order to offset the effect of the increased holding coil decay time so that the results of the analyzed events remain unchanged.

An emergency TS amendment request was submitted on 5/9/88 to increase the allowable CEA drop time from 3.0 seconds to 3.2 seconds. On 5/16/88 the TS amendment was approved which increased the allowable CEA drop time to 3.2 seconds. At 0406 hours on 5/18/88 the CEA drop time test was successfully completed verifying that the CEA drop times were within the TS limit of 3.2 seconds.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		Year	Sequential Number	Revision Number	
Arkansas Nuclear One, Unit Two	0|5|0|0|0| 3| 6| 8	8| 8	0| 0| 9	0| 0	0|5 OF 0|5

TEXT (If more space is required, use additional NRC Form 366A's) (17)

The test method used to measure drop times for Arkansas Nuclear One, Unit One (ANO-1) as well as the test results from previous testing were reviewed to determine if a similar discrepancy existed for ANO-1. These reviews concluded that the test method was appropriate and the test results were satisfactory for previous control rod drop times.

C. Future

No future actions are planned.

IV. Additional Information

Additional details related to this event are contained in the following correspondence addressed to U. S. Nuclear Regulatory Commission Document Control Desk to the attention of Mr. Jose Calvo.

1. AP&L letter 2CANØ588Ø1, dated May 5, 1988, "Request for Temporary Waiver of Compliance Technical Specification 3/4.1.3.4 - CEA Drop Time."

2. AP&L letter 2CANØ588Ø2, dated May 9, 1988, "Request for Emergency License Amendment Technical Specification 3.1.3.4 - CEA Drop Time."

ARKANSAS POWER & LIGHT COMPANY

June 6, 1988

2CANØ688Ø8

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

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Licensee Event Report 50-368/88-009-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i) and 10CFR50.73(a)(2)(ii), attached is the subject report concerning the drop time for certain control element assemblies exceeding that allowed by technical specification and assumed by the safety analyses due to incorrect testing method.

Very truly yours,

J. M. Levine
Executive Director,
Nuclear Operations

JML:PCR:sms

attachment

cc w/att: Regional Administrator
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