October 12, 1989

Docket No. 50-368

Mr. T. Gene Campbell
Vice President, Nuclear
Arkansas Power and Light Company
P. O. Box 551
Little Rock, Arkansas 72203

Dear Mr. Campbell:

SUBJECT: ISSUANCE OF AMENDMENT NO.100 TO FACILITY OPERATING LICENSE NO. NPF-6 - ARKANSAS NUCLEAR ONE, UNIT NO. 2 (TAC NO. 73440)

The Commission has issued the enclosed Amendment No.100 to Facility Operating License No. NPF-6 for the Arkansas Nuclear One, Unit No. 2 (ANO-2). This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated June 15, 1989.

The amendment modifies the control element assembly (CEA) drop time requirements of Technical Specification 3.1.3.4. The change increases the maximum allowable individual full length CEA drop time from the previous 3.2 seconds to 3.5 seconds and specifies a maximum arithmetic average of all full length CEA drop times of 3.2 seconds.

A copy of our related Safety Evaluation is enclosed. Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,

/s/
Chester Poslusny, Jr., Project Manager
Project Directorate IV
Division of Reactor Projects - III,
IV, V and Special Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No.100 to NPF-6
2. Safety Evaluation

cc w/enclosures:
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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IV, V and Special Projects
Office of Nuclear Reactor Regulation

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1. Amendment No.100 to NPF-6
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cc w/enclosures:
See next page

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Honorable Joe W. Phillips
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Pope County Courthouse
Russellville, Arkansas 72801

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ARKANSAS POWER AND LIGHT COMPANY

DOCKET NO. 50-368

ARKANSAS NUCLEAR ONE, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 100
License No. NPF-6

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Arkansas Power and Light Company (the licensee) dated June 15, 1989, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Facility Operating License No. NPF-6 is hereby amended to read as follows:

   2. Technical Specifications

      The Technical Specifications contained in Appendix A, as revised through Amendment No. 100, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Frederick J. Hebdon, Director
Project Directorate IV
Division of Reactor Projects - III, IV, V and Special Projects
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical Specifications

Date of Issuance: October 12, 1989

ATTACHMENT TO LICENSE AMENDMENT NO. 100

FACILITY OPERATING LICENSE NO. NPF-6

DOCKET NO. 50-368

Revise the following pages of the Appendix "A" Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change.

REMOVE PAGES	INSERT PAGES
3/4 1-23	3/4 1-23
B 3/4 1-5	B 3/4 1-5

CEA DROP TIME

LIMITING CONDITION FOR OPERATION

3.1.3.4 The individual full length (shutdown and control) CEA drop time, from a fully withdrawn position, shall be ≤ 3.5 seconds and the arithmetic average of the CEA drop times of all full length CEAs, from a fully withdrawn position, shall be ≤ 3.2 seconds from when the electrical power is interrupted to the CEA drive mechanisms until the CEAs reach their 90 percent insertion positions with:

a. $T_{avg} \geq 525°F$, and

b. All reactor coolant pumps operating.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. With the CEA drop times determined to exceed either of the above limits, restore the CEA drop times to within the above limits prior to proceeding to MODE 1 or 2.

b. With the CEA drop times within limits but determined at less than full reactor coolant flow, operation may proceed provided THERMAL POWER is restricted to less than or equal to the maximum THERMAL POWER level allowable for the reactor coolant pump combination operating at the time of CEA drop time determination.

SURVEILLANCE REQUIREMENTS

4.1.3.4 The CEA drop time of full length CEAs shall be demonstrated through measurement prior to reactor criticality:

a. For all CEAs following each removal of the reactor vessel head,

b. For specifically affected individuals CEAs following any maintenance on or modification to the CEA drive system which could affect the drop time of those specific CEAs, and

c. At least once per 18 months.

BASES

CEA positions and OPERABILITY of the CEA position indicators are required to be verified on a nominal basis of once per 12 hours with more frequent verifications required if an automatic monitoring channel is inoperable. These verification frequencies are adequate for assuring that the applicable LCO's are satisfied.

The average CEA drop time restriction is consistent with the assumed CEA drop time used in the accident analysis. The maximum CEA drop time restriction is used to limit the CEA drop time distribution about the average to that used in the accident analysis. Measurement with $T_{avg} \geq 525°F$ and with all reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a reactor trip at operating conditions.

The establishment of LSSS and LCOs require that the expected long and short term behavior of the radial peaking factors be determined. The long term behavior relates to the variation of the steady state radial peaking factors with core burnup and is affected by the amount of CEA insertion assumed, the portion of a burnup cycle over which such insertion is assumed and the expected power level variation throughout the cycle. The short term behavior relates to transient perturbations to the steady-state radial peaks due to radial xenon redistribution. The magnitudes of such perturbations depend upon the expected use of the CEAs during anticipated power reductions and load maneuvering. Analyses are performed based on the expected mode of operation of the NSSS (base load, load following, etc.) and from these analyses CEA insertions are determined and a consistent set of radial peaking factors are defined. The Long Term Steady State and Short Term Insertion Limits are determined based upon the assumed mode of operation used in the analyses and provide a means of preserving the assumptions on CEA insertions used. The limits specified serve to limit the behavior of the radial peaking factors within the bounds determined from analysis. The actions specified serve to limit the extent of radial xenon redistribution effects to those accommodated in the analyses. The Long and Short Term Insertion Limits of Specifications 3.1.3.6 and 3.1.3.7 are specified for the plant which has been designed for primarily base loaded operation but which has the ability to accommodate a limited amount of load maneuvering.

The Transient Insertion Limits of Specification 3.1.3.6 and the Shutdown CEA Insertion Limits of Specification 3.1.3.5 ensure that 1) the minimum SHUTDOWN MARGIN is maintained, and 2) the potential effects of a CEA ejection accident are limited to acceptable levels. Long term operation at the Transient Insertion Limits is not permitted since such operation could have effects on the core power distribution which could invalidate assumptions used to determine the behavior of the radial peaking factors.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 100 TO

FACILITY OPERATING LICENSE NO. NPF-6

ARKANSAS POWER AND LIGHT COMPANY

ARKANSAS NUCLEAR ONE, UNIT NO. 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated June 15, 1989, Arkansas Power and Light Company (AP&L), the licensee, submitted proposed Technical Specification changes revising the control element assembly (CEA) drop time limits for Arkansas Nuclear One, Unit 2 (ANO-2). Specifically, the proposed amendment would expand Technical Specification 3.1.3.4 to include the average drop time of all full length CEAs, which must be no greater than the 3.2 second limit currently applied to individual CEAs. The maximum CEA drop time for any individual full length CEA would be changed from 3.2 seconds to 3.5 seconds.

The reason for these changes is due to the results of the ANO-2 Cycle 7 startup testing where the maximum drop time for individual CEAs exceeded the Technical Specification maximum value. This adverse change in the measured CEA drop times was revealed by a new measurement methodology. The testing method used previously for measuring CEA drop times involved interrupting the power to the control element drive mechanism (CEDM) from each individual CEDM breaker. The new test method, which is consistent with the actual CEA scram sequence, involved interrupting the power to all the CEDMs simultaneously via the main trip breakers. The additional delay time is associated with the difference between the electromagnetic decay time of multiple CEDM coils and the decay time of an individual coil.

A revised analysis of all events was made previously by the licensee to support a CEA drop time Technical Specification increase from 3.0 seconds to 3.2 seconds. The revised analyses credited space-time kinetics in conjunction with the new CEA drop time curve to calculate the time dependent scram reactivity insertion. The core protection calculator (CPC) power uncertainty penalty was also increased in support of the revised analyses.

As a result of the Cycle 7 drop time testing, the margin between the slowest CEA and Technical Specification CEA drop time was 20 milliseconds (3.20 - 3.18 seconds) which is comparable to expected cycle-to-cycle variations. Since failure to pass the CEA drop time test precludes entering the startup operational mode, AP&L would like to increase this margin before the Cycle 8 startup without any further penalties. The proposed method for increasing the time between the measured CEA drop time and the Technical Specification drop time of 3.2 seconds is to credit the measured spatial distribution of CEAs about an

average position as opposed to the present safety analysis assumption that all CEAs drop at the same speed and therefore are at the same axial height as the slowest CEA. This proposed analysis method is evaluated below.

2.0 EVALUATION

The current ANO-2 safety analyses assume that all CEAs drop into the core at the same time and at the same rate following a reactor trip. Therefore, every CEA is at the same axial height at any time during a trip. The drop time is assumed to be governed by the slowest CEA, which is limited to no longer than 3.2 seconds. Therefore, current Technical Specifications require that all CEAs fall within the 3.2 second drop time.

The reactivity worth of a CEA is a function of the power or neutron flux environment surrounding the CEA. During a reactor trip, the faster CEAs will be in higher flux regions sooner and will therefore make a greater relative contribution to the net negative reactivity insertion than the slower CEAs. Therefore, the licensee contends that the negative reactivity insertion for any reasonable distribution of CEAs is more directly correlated to, and can be represented by, the average CEA insertion rather than by the slowest.

Based on ANO-2 measured CEA drop patterns presented by the licensee, the CEAs do not fall at the same time and at the same rate during a reactor trip. The scatter in the drop time about the average increases with CEA insertion and varies with individual CEA. This is primarily due to the distribution of CEA extension shaft weights in ANO-2. The longer heavier extension shafts located at the core interior cause faster CEA drop times which become progressively slower towards the core periphery where the CEA extension shafts are shorter and less heavy. The staff concurs that the ANO-2 measured CEA drop time test data shows the CEAs have a predictable spatial distribution about the average during a reactor trip.

Combustion Engineering (CE) has performed a set of three-dimensional space-time calculations using the NRC-approved HERMITE computer program. The staff has reviewed the initial conditions assumed in the HERMITE calculations and finds that they adequately cover the range of operating conditions and the limits of the as-measured CEA distributions. These calculations show that essentially the same reactivity will be inserted by CEAs falling in a reasonable distribution about an average CEA position as the reactivity inserted by all CEAs falling at the same average position, the so-called "window shade" case. This is true for any reasonable family of CEA distributions similar to those measured at ANO-2. However, if the distance between the fastest and slowest CEAs becomes too large or the distribution of CEAs deviates significantly from that modeled by CE in this study, then the average CEA position (window shade) may not be representative of the time dependent reactivity insertion. Therefore, a limit will be placed on the CEA drop time distribution. This will be expressed as a maximum drop time limit on the slowest CEA in the revised Technical Specification. The staff concurs that this will ensure that the safety analyses remain valid for the average CEA drop time Technical Specification and finds the proposed Technical Specification changes acceptable.

The staff has reviewed the proposed ANO-2 Technical Specification changes which would include an average drop time of all CEAs of no greater than 3.2 seconds and a maximum drop time for any individual CEA of 3.5 seconds. Based on the ANO-2 CEA drop test data and the results of the CE calculations which were submitted to the staff, the time dependent reactivity insertion of a window shade scram at the average CEA drop time will provide the same reactivity insertion as the more realistic distributed case about the same average. The staff therefore finds the proposed Technical Specification changes acceptable for ANO-2 with the following conditions:

(1) Any fuel management change that significantly affects the core wide axial or radial power profiles, such as axial blankets or ultra-low leakage fuel management, may necessitate reverification of the average CEA drop time analysis.

(2) Changes that would significantly affect the CEA drop time distribution, such as changes to the CEDM circuits, large increases in the core flow pressure drop, changes in the total drop weight of the CEAs or changes in the location of the CEAs, may also require reverification of the average CEA drop time concept.

Barring these type of changes or failure to meet the new Technical Specification limits, reverification of the average drop time analysis will not be required on a cycle-by-cycle basis.

3.0 ENVIRONMENTAL CONSIDERATION

The amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposures. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: October 12, 1989

Principal Contributor: L. Kopp