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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 78 TO FACILITY OPERATING LICENSE NO. NPF-10

AND AMENDMENT NO. 66 TO FACILITY OPERATING LICENSE NO. NPF-15

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

THE CITY OF RIVERSIDE, CALIFORNIA

THE CITY OF ANAHEIM, CALIFORNIA

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

By letter dated July 31, 1989, Southern California Edison Company et al. (SCE or the licensee) submitted proposed changes to the Technical Specifications revising the control element assembly (CEA) drop-time limits for San Onofre Nuclear Generating Station, Unit Nos. 2 and 3 (SONGS 2/3). Specifically, the proposed amendment would expand Technical Specification 3/4.1.3.4 to include both an arithmetic average CEA drop time and a maximum individual CEA drop time. The maximum CEA drop time for any individual full-length CEA would be used to limit the CEA drop-time distribution from the arithmetic average.

These changes are necessary because the results of the SONGS-2 Cycle 4 startup testing showed that the maximum drop time for individual CEAs were longer than expected and were found to approach 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 each individual CEA gripper coil. The new test method, which is consistent with the actual CEA scram sequence, involved interrupting the power at the reactor trip breakers rather than the individual trip breakers. The additional delay time is associated with the difference between the electromagnetic decay time of multiple gripper coils and the decay time of an individual coil. The measurement of individual CEA drop times during a scram is made possible by the special computer software employed in plants with Core Protection Calculators (CPC), which initiates a CPC trip and simultaneously monitors the positions of all CEAs as a function of time.

A revised analysis of all events was made previously by the licensee to support a technical specification CEA drop-time 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 operating limit supervisory system (COLSS) and the core protection calculator (CPC) power uncertainty penalty factors were also increased in support of the revised analyses.

As a result of the Cycle 4 drop-time testing, the margin between the slowest CEA and technical specification CEA drop time was quite small. Since failure to pass the CEA drop-time test precludes entering the startup operational mode, SCE would like to increase this margin before the Cycle 5 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 SONGS 2/3 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.

On the basis of the SONGS 2/3 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, but have a spatial distribution about the average. 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 insertion.

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 SONGS 2/3. 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 Specifications. The revised Technical Specifications will actually have three average CEA drop-time criteria (3.0, 3.2, and 3.4 seconds) with corresponding maximum individual CEA drop-time criteria (3.2, 3.4, and 3.6 seconds). Different COLSS and CPC adjustment factors will be applied to accommodate each of these drop-time combinations as discussed below.

The licensee has reanalyzed the design-basis events that are potentially affected by the CEA drop-time change. The reanalyses indicate that an extra penalty has to be applied for several events to either the CPC margin-to-trip via the BERR1 addressable constant or to the COLSS margin via the EPOL2 or EPOL4 constants to offset the effect of an increased CEA drop time of greater than 3.2 seconds. Since the current safety analyses assume a CEA drop time of 3.2 seconds, no adjustments are needed for an average drop time of 3.2 seconds with a maximum individual CEA drop time of 3.4 seconds. In addition, a credit can be applied if the average CEA drop time is less than 3.0 seconds. Based on these reanalyses, the staff concurs that the effects of a longer CEA drop time can be accommodated by either the existing analyses or by appropriate COLSS and CPC penalties applied via addressable constants in accordance with Technical Specification 6.8.1. The proposed Technical Specification changes are therefore acceptable.

3.0 CONCLUSION

The staff has reviewed the proposed SONGS 2/3 Technical Specification changes. Instead of the present maximum CEA drop time of 3.2 seconds, the new specification would have three maximum drop times of 3.2, 3.4, and 3.6 seconds and corresponding average drop times of 3.0, 3.2, and 3.4 seconds. Based on the SONGS 2/3 CEA drop test data and the results of the CE calculations that were submitted to the staff, the time dependent reactivity insertion of a window shade scram at the average CEA drop time will provide essentially the same reactivity insertion as the more realistic distributed case about the same average. The staff finds the proposed changed to the Technical Specifications acceptable for SONGS 2/3 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, will 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, will require reverification of the average CEA drop-time concept.

Barring these types 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.

Per telephone conversation with the licensee on October 19, 1989, the licensee agreed that the associated Bases section should be modified to reflect the above conditions.

Therefore, based upon the above information, the staff finds the proposed modifications to the Technical Specifications, as detailed in a letter dated July 31, 1989, are acceptable.

4.0 CONTACT WITH STATE OFFICIAL

The NRC staff has advised the State Department of Health Services, State of California, of the proposed determination of no significant hazards consideration. No comments were received.

5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact have been prepared and published (54 FR 46661) in the Federal Register on November 6, 1989. Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of this amendment will not have a significant effect on the quality of the human environment.

6.0 CONCLUSION

We have 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, (2) such activities will be conducted in compliance with the Commission's regulations and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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Dated: November 9, 1989