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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 23 TO FACILITY OPERATING LICENSE NO. NPF-41

AND AMENDMENT NO. 13 TO FACILITY OPERATING LICENSE NO. NPF-51

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

PALO VERDE NUCLEAR GENERATING STATION, UNIT NOS. 1, AND 2

DOCKET NOS. STN 50-528 AND STN 50-529

1.0 INTRODUCTION

By letter dated January 23, 1987, as supplemented by letters dated April 23, June 8, July 17 and October 1, 1987, the Arizona Public Service Company (APS) on behalf of itself, the Salt River Project Agricultural Improvement and Power District, Southern California Edison Company, El Paso Electric Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority (licensees), requested changes to the Technical Specifications for Palo Verde Nuclear Generating Station, Units 1, 2 and 3 (Appendices A to Facility Operating License Nos. NPF-41, NPF-51 and NPF-65, respectively). The application requested changes to: (1) revise Specifications 3.1.1.1 and 3.1.1.2, relating to Shutdown Margin requirements for the various modes of operation, and revised Tables 2.2-1 and 3.3-1 in support of these changes; (2) revise Specification 3.1.2.3, and the five Tables in Specification 3.1.2.7, relating to the number of charging pumps in operation while in Mode 5; (3) add a new Special Test Exception (Specification 3.10.9) to allow operability testing of the control element drive mechanism system during pre-startup testing without the need for alternating between Specifications 3.1.1.1 and 3.1.1.2, and (4) revise several other portions of the technical specifications representing related administrative changes, e.g., table of contents, bases sections, added definition of K_{N-1}, and renumbering of sections, resulting from the above changes. The October 1, 1987 letter further requested that these changes not be implemented in Palo Verde, Unit 3 until one week after initially reaching 100% power. Although the amendment for Palo Verde, Unit 3 has been deferred pursuant to the licensees' request, the following evaluation is applicable to all three Palo Verde units.

2.0 DISCUSSION

A discussion of the various proposed changes to the Technical Specifications is presented below:

a. Temperature Dependent Shutdown Margin

The current Limiting Conditions for Operation (LCOs) for Specifications 3.1.1.1 and 3.1.1.2 require that the Shutdown Margin be greater than or equal to 6% delta k/k for Modes 1-4 and greater than or equal

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to 4% delta k/k for Mode 5. The proposed changes would revise the Shutdown Margin requirements according to full-length control element assembly (CEA) position as follows.

The revised Specification 3.1.1.1 would be applicable when all full length CEAs are fully inserted and would require that the Shutdown Margin be greater than or equal to 1% delta k/k for Modes 3, 4 and 5. The licensees stated that verification that all CEAs are fully inserted will be done via the rod bottom contacts, or if these are unavailable, via the reed switch position transmitters.

The revised Specification 3.1.1.2 would be applicable when any full length CEA is withdrawn and would require that for Modes 1 through 5, the Shutdown Margin be greater than or equal to that given in a new Figure 3.1-1A. This figure specifies Shutdown Margin as a function of cold leg temperature, ranging from 6% delta k/k above 500°F and down to 3.5% delta k/k below 350°F.

In addition, a new parameter, K_{N-1}, is introduced and defined as the k_{eff} calculated by considering the actual CEA configuration and assuming that the CEA of highest worth is fully withdrawn. The proposed change would require K_{N-1} to be less than 0.99 for reactor coolant cold leg temperatures less than or equal to 500°F.

Shutdown Margin requirements vary throughout core life as a function of fuel depletion and reactor coolant system cold leg temperature. The most restrictive condition occurs at end of cycle, with the cold leg temperature at no-load operating temperature, and is associated with a postulated steam line break accident and the resulting reactivity transient due to the uncontrolled reactor coolant system cooldown in conjunction with a negative moderator temperature coefficient. Standard Review Plan (SRP) Section 15.1.5 requires that steam line break events be evaluated considering potential for fuel damage. If the minimum Departure from Nucleate Boiling Ratio (DNBR) during a steam line break event falls below specified limits (1.231), fuel damage must be assumed.

The licensees have presented the results of reanalyses of the limiting steam line break accidents. The results indicate that for a break occurring during Mode 3 operation for cold leg temperatures less than 500°F, with or without a loss of offsite power and in combination with a single failure, the proposed Shutdown Margin is sufficient to prevent a post trip return to power. For a large steam line break during Mode 4 operation, the proposed Shutdown Margin is also sufficient to prevent a return to core criticality. Since neither of these events result in a return to power operation, the minimum DNBR during these transients remains above 10 which is well above the specified safety limits.

At lower cold leg temperatures, the potential cooldown and the resulting reactivity transient become less severe and, therefore, the

required Shutdown Margin also decreases. Below about 210°F, an inadvertent boron dilution event becomes limiting with respect to Shutdown Margin requirements. The licensees have submitted the results of reanalyses which show that the proposed Shutdown Margin ensures that sufficient time exists for operator actions between the initial indication of a deboration event by an audible alarm and the total loss of Shutdown Margin. The inadvertent boron dilution event is discussed further with regard to the proposed changes in Section 2.c below.

The licensees also proposed administrative changes to the following specifications since they specifically include the current Shutdown Margin requirements of Specification 3.1.1.1. The action statements for LCOs 3.1.2.2, 3.1.2.4, and 3.1.2.6 require in part that when the requirements of the LCOs are not met, boration to a Shutdown Margin equivalent to at least 6% delta k/k at 210°F be carried out. The proposed changes would delete any reference to the Shutdown Margin requirements. The licensees indicated that since these action statements require the reactor to be in hot standby, this automatically requires boration to a Shutdown Margin consistent with Specification 3.1.1.1 or 3.1.1.2 and any reference to Shutdown Margin requirements would be redundant.

b. Tables 2.2-1 and 3.3-1

Item B.2 of Table 2.2-1 specifies a trip setpoint for the logarithmic power level high trip of less than or equal to 0.798% of rated thermal power and an allowable value of less than or equal to 0.815% of rated thermal power. The logarithmic power level trip provides protection in the event of an inadvertent CEA bank withdrawal from Modes 2 and 3 with four reactor coolant pumps operating, to assure that the minimum DNBR remains above the plant safety limit of 1.231. The proposed change would revise the trip setpoint and allowable value to 0.010% and 0.011% of rated thermal power, respectively, in support of the proposed revisions to the Shutdown Margin requirements. The results of an evaluation of an inadvertent CEA bank withdrawal with the proposed changes have shown that the core does not exceed its safety limits in terms of DNBR and local power density.

Table notation (c) for Table 3.3-1 and Table notation (5) for Table 2.2-1 state that core protection calculator (CPC) trips may be manually bypassed below 1% of rated thermal power and the bypass shall automatically be removed when thermal power is greater than or equal to 1% of rated thermal power. The proposed changes would revise the value at which the CPC trip may be manually bypassed, and at which the manual bypass is automatically removed, from 1% of rated thermal power to 10^{-4}% of rated thermal power. This proposed change also provides added protection for an inadvertent CEA bank withdrawal from Modes 3, 4, or 5 with less than four reactor coolant pumps operating.

c. Number of Charging Pumps in Operation in Mode 5

The LCO for Specification 3.1.2.3 currently requires that only one charging pump shall be operating whenever the reactor coolant level is below the bottom of the pressurizer in Mode 5. The proposed change to Specification 3.1.2.3 would remove this restriction.

Tables 3.1-1 through 3.1-5 in Specification 3.1.2.7 specify the monitoring frequencies for backup boron dilution detection whenever the boron dilution alarm is inoperable. The proposed changes to these Tables would include the following:

(1) redefine the operational mode conditions for Modes 4 and 5 according to whether or not the Shutdown Cooling System is being used,

(2) permit operation of more than one charging pump in Mode 5 whenever k_{eff} is below 0.98, and

(3) remove the requirements for Mode 6 whenever k_{eff} is above 0.95, since the definition of Mode 6 is a k_{eff} of less than 0.95.

In support of the above proposed changes, the licensees have reevaluated the inadvertent boron dilution event, with and without the boron dilution alarm available. Standard Review Plan (SRP) Section 15.4.6 states that for such an event, a minimum of 15 minutes must be available between the time when an alarm announces an unplanned dilution and the time of loss of Shutdown Margin. The results of the licensees' reanalysis indicate that for an unplanned boron dilution from the most limiting conditions, i.e., operating three charging pumps while in Mode 5 with the reactor coolant system drained down, the time to a complete loss of shutdown margin would be 52 minutes. Therefore, there is more than the required 15 minutes available for an alarm to alert the operator before a complete loss of Shutdown Margin would occur.

In the event that the boration dilution alarm is inoperable, the results of the reanalysis have also shown that by monitoring the reactor coolant system boron concentration at the frequencies shown in revised Tables 3.1-1 through 3.1-5, the operators would have more than the required 15 minutes to take the necessary actions to mitigate the event. In the case of the most limiting event discussed above, the proposed monitoring frequency of 0.5 hours shown in Table 3.1-5 for three charging pumps operating would allow at least 22 minutes for the operators to take appropriate action.

d. Special Test Exceptions 3.10.9 and 3.10.1

The licensees have proposed a new special test exception (Specification 3.10.9) to allow the suspension of the proposed Shutdown Margin requirements of Specifications 3.1.1.1 and 3.1.1.2 during the pre-startup tests to demonstrate the operability of the control

element drive mechanism system (CEDMS). Since testing is performed by withdrawing a single CEA, the proposed Shutdown Margin requirements of Specification 3.1.1.1 would not be applicable since they would apply only when all CEAs are fully inserted. Also, the proposed requirements of Specification 3.1.1.2 are too restrictive for this case since they would require sufficient boration to account for a fully withdrawn maximum worth CEA.

The proposed Specification 3.10.9 would allow only one CEA to be withdrawn at any time (LCO 3.10.9.a), and by no more than seven inches (LCO 3.10.9.b). Since all CEAs during the CEDMS testing are essentially fully inserted except the one being tested (which is withdrawn no more than seven inches), K_{N-1} would be equivalent to the Shutdown Margin in terms of minimum acceptable boron concentration. Therefore, proposed LCO 3.10.9.c, which would require that the K_{N-1} proposed criterion of Specification 3.1.1.2 be met prior to the start of CEDMS testing, would ensure that sufficient subcriticality is maintained to preclude inadvertent criticality in the event of a CEA ejection accident. In addition, the reduction of the logarithmic power high level trip setpoint discussed in Section 2(b) above would ensure that the consequences of an uncontrolled CEA withdrawal are bounded by the reference cycle analysis. Furthermore, LCO 3.10.9.d would require suspension of all other operations involving positive reactivity changes.

Specification 3.10.1, which involves a special test exception for measuring CEA worth and Shutdown Margin, currently requires that a reactivity equivalent to at least the highest estimated CEA worth be available for trip insertion when the Shutdown Margin requirement of Technical Specification 3.1.1.1 is suspended for measurement of CEA worth and Shutdown Margin during physics tests. Boration is required when this requirement is not met. To account for the proposed Shutdown Margin requirements of Specification 3.1.1.2, the proposed change to Specification 3.10.1 states that the Shutdown Margin and K_{N-1} requirements of Specification 3.1.1.2 may also be suspended, provided that reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from operable CEAs or the reactor is subcritical by at least the reactivity equivalent of the highest worth CEA.

e. <u>Administrative Changes</u>

In support of the above proposed changes to the Technical Specifications, the following additional administrative changes have also been proposed.

(1) revisions to the bases sections to be consistent with the proposed changes,

(2) renumbering of the Specification for the Special Test Exception for Natural Circulation Testing from 3.10.9 to 3.10.10 (Unit 1 only), and

(3) revisions to the Table of Contents to be consistent with the proposed changes.

3.0 EVALUATION

The staff has evaluated the licensees' proposed changes to the Technical Specifications. As a result of that evaluation, the staff has made the following determinations.

a. The results of the licensees' reanalysis of the limiting steam line break accidents with the proposed changes to Specifications 3.1.1.1 and 3.1.1.2, demonstrate that the DNBR remains well above the plant safety limit of 1.231.

b. The results of licensees' reanalysis of an inadvertent CEA bank withdrawal with the proposed changes to Specifications 3.1.1.1 and 3.1.1.2, and Tables 2.2-1 and 3.3-1, demonstrate that the core does not exceed its safety limits in terms of DNBR and local power density.

c. The results of the licensees' reanalysis of the limiting inadvertent boron dilution event with the proposed changes to Specifications 3.1.1.1 and 3.1.2.3, and Tables 3.1-1 through 3.1-5, demonstrate that there would be more than the required 15 minutes available to alert the operator before a complete loss of Shutdown Margin would occur.

   With regard to the proposed change in Specification 3.1.2.3, the staff has also reviewed the overpressure protection for the reactor coolant pressure boundary during low temperature operation of the plant (i.e. during startup and shutdown) which is provided by the shutdown cooling system relief valves. These were sized based on an inadvertent safety injection actuation signal (SIAS) with full pressurizer heaters operating from a water-solid condition. The SIAS assumed simultaneous operation of the two high pressure safety injection pumps and three charging pumps with letdown isolated. Therefore, the allowance of more than one operable charging pump is also consistent with the assumptions used in the postulated mass addition event which was analyzed to support the low temperature overpressure protection (LTOP) system.

d. The LCOs for the proposed new special test exception (Specification 3.10.9), to permit pre-startup testing of the CEDMS to demonstrate operability, would ensure that sufficient subcriticality is maintained to preclude inadvertent criticality in the event of a CEA injection accident.

e. The remaining proposed changes are all administrative in nature and are being made in support of the other proposed changes (e.g., changes in the bases sections) or as a result of those changes (e.g., changes in the Table of Contents).

Based on the above evaluation, the staff concludes that the proposed changes to the Technical Specifications are acceptable.

4.0 CONTACT WITH STATE OFFICIAL

The Arizona Radiation Regulatory Agency has been advised of the proposed determination of no significant hazards consideration with regard to these changes. No comments were received.

5.0 ENVIRONMENTAL CONSIDERATIONS

These amendments involve changes in the installation or use of facility components located within the restricted area as defined in 10 CFR 20. The staff has determined that the amendments involve 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 exposure. The Commission has previously issued proposed findings that the amendments involve no significant hazards consideration, and there has been no public comment on such findings. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need to be prepared in connection with the issuance of these amendments.

6.0 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public. We, therefore, conclude that the proposed changes are acceptable.

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Dated: October 9, 1987