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

# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# RELATED TO AMENDMENT NO. 19 TO FACILITY OPERATING LICENSE NO. NPF-41,

# AMENDMENT NO. 10 TO FACILITY OPERATING LICENSE NO. NPF-51

# AND AMENDMENT NO. 1 TO FACILITY OPERATING LICENSE NO. NPF-65

# ARIZONA PUBLIC SERVICE COMPANY, ET AL.

# PALO VERDE NUCLEAR GENERATING STATION, UNIT NOS. 1, 2 AND 3

# DOCKET NOS. STN 50-528, STN 50-529 AND STN 50-530

## 1.0 INTRODUCTION

By letters dated January 23, April 6, May 4 and May 6, 1987, as supplemented by letter dated May 15, 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 four applications requested changes to (1) the surveillance requirements in Specification 4.6.4.2 for the hydrogen recombiner system, (2) the pressurizer heater capacity in Specification 3/4.4.3, (3) the definition in Table 2.2-1 of the Rate and Band terms which provide input to the Variable Overpower Trip function, and (4) the number of steps in Specification 3.0.3 for achieving Cold Shutdown.

## 2.0 DISCUSSION

A discussion of each of the four applications is presented below:

### (a) Hydrogen Recombiner

By letters dated January 23 and May 15, 1987, APS requested approval of a proposed change to Technical Specification (TS) 4.6.4.2, which specifies the surveillance requirements for the electric hydrogen recombiners. In March 1986, new power control cabinets for the hydrogen recombiners were installed at the Palo Verde plant. This modification necessitated certain changes in the testing procedure for recombiners to conform to the requirements specified by the vendor. As a result, the licensees have proposed modified surveillance requirements for TS 4.6.4.2, based on the vendor's operational manual.

In order to demonstrate operability of the recombiners, the surveillance requirements currently in TS 4.6.4.2 specify a series of different tests which have to be performed at least once per 6 months, annually or at 5-year intervals. In the current TS, the 6-month tests do not require the recombiner heater to be powered; only the air blast heat exchanger fan motor and the enclosed blower motor had to operate continuously for 30 minutes. The proposed modified TS requires the recombiner to operate at a reactor chamber temperature of approximately 800°F. This additional requirement is in agreement with the vendor's specification for low level power testing. Performing this test once every 6 months meets the vendor's recommendations, is more conservative than the current TS, and is consistent with Standard Review Plan (SRP) Section 6.2.5.

The proposed surveillance requirements for the annual tests would be a considerable change to the current TS. Channel calibration of the recombiner instrumentation remains unchanged, but the tests at low level with heater power off and heater power on would be replaced by a functional test of the recombiner at 1200°F ± 50°F maintained for at least 4 hours. This surveillance requirement is in agreement with the vendor's specification for high level hot testing. Performing this test annually provides a degree of conservatism by exceeding the vendor's recommendations which require this test every 18 months. This modification is more conservative than the current TS and is consistent with SRP Section 6.2.5.

The specification for performing high level hot tests once every 5 years would be deleted because this requirement becomes redundant when superseded by the previously specified annual high level hot surveillance testing.

(b) Pressurizer Heater

TS 3/4.4.3 for the pressurizer currently requires at least two groups of pressurizer heaters, capable of being powered from Class 1E buses, each having a nominal capacity of at least 150 kw. The purpose of having two groups of heaters is to enhance the capability to control Reactor Coolant System (RCS) pressure and to establish and maintain natural circulation, when required.

By a letter dated April 6, 1987, APS proposed a change to this TS for Palo Verde Units 1, 2 and 3. The request is to change the capacity for the pressurizer heaters from a nominal value of 150 kw to a minimum value of 125 kw.

In its submittal dated April 6, 1987, APS indicated that TS Section 4.4.3.1.2 states that the capacity of the required groups of pressurizer heaters shall be verified to be at least 150 kw at least once per 92 days. The required pressurizer heaters are powered from Class 1E buses and have a nominal rating of 150 kw. During surveillance testing, the pressurizer heaters may fail the surveillance criteria because of normal variations of the bus voltage. The proposed TS change would reduce the required measured capacity of the pressurizer heaters to 125 kw to allow for variation in the bus voltage. APS asserts that the measured value of the pressurizer heat loss is 118 kw, so that the proposed pressurizer heater capacity requirement of 125 kw is sufficient to offset pressurizer heat loss. Also, the pressurizer heaters are not classified as safety related at Palo Verde Units 1, 2 and 3 and no credit is taken for their capacity in any of the accidents previously evaluated.

(c) Variable Overpower Trip

By letter dated May 4, 1987, the licensees requested an amendment to change TS Table 2.2-1 to limit the Rate at which the Variable Overpower Trip (VOPT) setpoint decreases as reactor power is decreased; there are presently no limitations in the TS on the Rate at which the VOPT setpoint can decrease. Also, the definition of Band for the VOPT would be changed for clarity. The proposed changes to Table 2.2-1 involving the VOPT setpoint would help prevent unnecessary reactor trips during reactor power cutback events at Palo Verde.

The VOPT is provided for the Palo Verde reactors to protect the reactors during rapid positive reactivity excursion events. The events that take credit for the VOPT as the primary trip in safety analyses are the Control Element Assembly (CEA) ejection accident, and the CEA withdrawal from subcritical and low power events. The VOPT is also a backup trip for the feedwater line break event. These events are initiated from steady-state reactor conditions and involve an increase in reactor power from this steady-state condition.

There are three factors which affect the VOPT. These are (1) the Ceiling, (2) the Rate, and (3) the Band. The Ceiling refers to the maximum value of the VOPT setpoint, which is currently set at less than or equal to 110% of rated thermal power. The Rate is the maximum rate of increase of the VOPT setpoint when power is increasing, which is currently set at less than or equal to 10.6% of rated thermal power per minute. Although there is no current TS limitation on a decreasing Rate, the slowest Rate at which the VOPT setpoint can decrease when power is decreasing is currently set at 195% of rated thermal power per second. The Band is the amount by which the VOPT setpoint exceeds steady-state power (currently set

at 9.8% of rated thermal power) unless limited by either the Rate or the Ceiling. The proposed changes to the VOPT setpoint would add a limit to the Rate at which the setpoint can decrease when power is decreasing to 5% of rated thermal power per second, and add a clarification to the notation in TS Table 2.2-1 of the definition of Bank to state it is based on steady-state power.

The licensees have provided an analysis of the effect of the proposed change to the slowest Rate at which the VOPT setpoint can decrease with decreasing power. For those events for which the VOPT provides the primary or backup trip function (CEA ejection accident, CEA withdrawal when subcritical or at low power transient, and feedwater line break events), the change to the Rate at which the VOPT setpoint can decrease has no effect since these events are events which increase the reactor power, as long as the initial conditions for these events are not affected by the decreasing rate setting. In order to assure that the initial conditions for an increasing power event are not affected by the proposed decreasing rate setting, the licensee provided the following evaluation. The licensees established that the maximum rate of normal power reduction was 0.22% of rated thermal power per second at end-of-life core conditions. This power reduction rate is based on an assumed 120 gpm of charging flow at a boron concentration of 4000 ppm and a high rate CEA insertion. Since the maximum rate of normal power reduction (0.22% of rated thermal power per second) is less than the proposed allowable VOPT setpoint reduction rate of 5% of rated thermal power per second, the Band of 9.8% of rated thermal power will be maintained between the VOPT and reactor power during normal power decreases. Therefore, the initial conditions for the power increasing events previously discussed will be maintained prior to an event occurring.

The licensees also evaluated the effect of the proposed decreasing Rate setting on a Reactor Power Cutback System (RPCS) actuation. The RPCS functions to reduce the power mismatch caused by a large loss of load, or by the loss of one of the two main feedwater pumps, without causing a reactor trip. The RPCS accomplishes this function by dropping preselected CEA groups into the reactor. However, with the current VOPT Rate decrease setting of 195% of rated thermal power per second on power decreases, a reactor trip may occur at end-of-cycle (EOC) at Palo Verde because of the moderator temperature coefficient (MTC). Near EOC, after CEA groups are dropped on RPCS actuation and power decreases initially, the MTC then causes the reactor power to increase. This power increase may be sufficient to trip the reactor and thereby defeat the purpose of the RPCS by causing an unnecessary reactor trip. These unnecessary reactor trips also provide unnecessary challenges to various reactor protection and safety systems. The purpose of the proposed Rate decrease setting limitation of 5% of rated thermal power power per second is to eliminate these unnecessary reactor trips.

A limiting power mismatch event was also analyzed for which CEA groups 4 and 5 help make this event limiting. This abnormal RPCS event does require a reactor trip. The results of the analysis indicate that a VOPT, with a Rate decrease of 5% per second on power decreases, occurs at about 13.8 seconds with the reactor power at about 92.6% of rated thermal power. In the analysis, the trip was delayed to 14.8 seconds and reactor power reached 93.8% of rated thermal power. The analysis indicates that the minimum DNBR reached is 1.34 and the maximum linear heat generation rate (LHGR) reached is 15.6 kW/ft. Both the minimum DNBR and maximum LHGR values for the limiting RPCS actuation event are within the Specified Acceptable Fuel Design Limits (SAFDLs) for DNBR and LHGR for Palo Verde. For those RPCS actuations for which the turbine runback occurs, the reactor power increase following the power drop caused by the drop of preselected CEA groups would be less and, thus, less limiting under similar conditions.

(d) Specification 3.0.3

By letter dated May 6, 1987, the licensees requested a change to Technical Specification Section 3.0.3. The proposed change would modify the existing Action Statement by deleting the requirement to be in Hot Shutdown within 6 hours after attaining Hot Standby. The modification does not change the total time allowed (30 hours) to be in a Cold Shutdown from a Hot Standby condition.

The request was predicated on an April 29, 1986 incident at Palo Verde, Unit 2. The unit was at a Hot Standby condition with normal operating temperature and pressure when it entered TS 3.0.3. Because of the plant design, it took approximately 11-1/2 hours to reach Hot Shutdown in a safe and orderly manner. The staff's position on shutdown time allowances when a Limiting Condition for Operation (LCO) is not met is as follows:

> A stated allowable out-of-service time (frequently 72 hours or 7 days) should be applicable regardless of the operational mode in which the inoperability is discovered. However, the times provided for achieving a reduction in operational modes (e.g., generally 6 hours from Mode 1 or 2 to Mode 3, and 6 hours from Mode 3 to Mode 4) should not be applicable if the inoperability is discovered in a lower operation mode.

Since Palo Verde, Unit 2 was in the Hot Standby condition during the April 29, 1986 incident, it had seven hours to reach Hot Shutdown in accordance with TS 3.0.3 (the one hour action time plus the six hours from Hot Standby to Hot Shutdown). Thus, the licensees exceeded the requirements of TS 3.0.3 by 4-1/2 hours.

As a result of this incident, the licensees reevaluated the plant design and shutdown procedures. Based on the cooldown time calculations and a time analysis of shutdown procedures submitted with the May 6, 1987 letter, the licensees concluded that the time needed to go from Hot Standby to Hot Shutdown would be at least nine hours. Therefore, the licensees have proposed a change to TS 3.0.3 to be consistent with the Palo Verde plant design.

## 3.0 EVALUATION

The staff's evaluation of the proposed changes is presented below:

(a) Hydrogen Recombiner

The staff has evaluated the proposed changes to the surveillance testing requirements in TS 4.6.4.2 for the hydrogen recombiner and has determined the following:

(1) The changes in the testing program are consistent with the vendor's recommendations.

(2) The revision to the surveillance requirements are more conservative than the current TS requirements.

(3) The revised testing program is consistent with Standard Review Plan (SRP) Section 6.2.5.

Based on the above, the staff concludes that the proposed changes to the surveillance requirements for TS 4.6.4.2 on hydrogen recombiners are acceptable.

(b) Pressurizer Heaters

The staff has evaluated the proposed changes to TS 3/4.4.3 and has determined the following:

(1) The pressurizer heaters at Palo Verde Units 1, 2 and 3 are not designed to safety grade standards and no credit is taken for their function in any of the transient and accident analyses for the units.

(2) No credit is given to the function of pressurizer heaters in the natural circulation and boron mixing test at the Palo Verde units for demonstrating compliance with Branch Technical Position RSB 5-1.

(3) The proposed heater capacity of 125kw is sufficient to offset pressurizer heat loss and thus is capable of controlling RCS pressure.

Based on the above, the staff concludes that the proposed changes to the pressurizer heater capacity in TS Section 3/4.4.3 are acceptable.

(c) Variable Overpower Trip

The staff has evaluated the proposed changes to the Variable Overpower Trip setpoint in Table 2.2-1 and has determined the following:

(1) The staff concurs with the licensees' assessment that the proposed addition of a Rate limitation of 5% of rated thermal power by which the VOPT setpoint can decrease with decreasing power has no effect on the previously analyzed accidents involving an increase in reactor power.

(2) The results of the analyses of an abnormal RPCS actuation event provides an acceptable justification for setting the Rate of decrease of the VOPT setpoint to 5% of rated thermal power for power decreases since the setting generates a reactor trip in sufficient time before specified fuel limits are exceeded.

(3) The proposed Rate of decrease of the VOPT setpoint for power decreases will eliminate unnecessary trips during a normal RPCS actuation event.

(4) The change which adds the words steady-state to the notation on the Band in Table 2.2-1 provides clarification on when the concept of a Band is applicable in transient power conditions and does not change the intended meaning of Band.

Based on the above, the staff concludes that the proposed changes to the VOPT input definitions in Table 2.2-1 do not adversely affect the function of the VOPT and would help prevent unnecessary reactor trips during reactor power cut backs. We, therefore, find that the proposed changes are acceptable.

(d) Specification 3.0.3

The staff has evaluated the proposed change to Specification 3.0.3 and has determined the following:

(1) The time allowances specified in Standard TS 3.0.3 were developed from a qualitative risk assessment of continued plant operation outside the design envelope (e.g. redundant trains of an Emergency Core Cooling (ECC) system inoperable) and from discussions with each of the NSSS vendors, several licensees, and resident inspectors on the length of time required to offload the generator and provide a safe and orderly shutdown of the reactor. The approach allows sufficient time for an orderly safe shutdown for the majority of the NSSS designs.

(2) For some NSSS designs, the time limits may be inadequate to shutdown the plant in a safe and orderly manner. The staff concurs with the licensees' analysis which shows that under certain circumstances with the Palo Verde plant design, the time needed to provide a safe and orderly shutdown of the reactor from Hot Standby to Hot Shutdown will exceed 6 hours.

(3) The requested change permits the Palo Verde design to achieve a safe and orderly cooldown and shutdown of the reactor without changing the total time allowed for achieving Cold Shutdown from a Hot Standby condition. Since the plant would be cooling down through the Hot Shutdown Mode in the process of reaching Cold Shutdown, achieving the intermediate step of Hot Shutdown within 6 hours is not essential to plant safety. In addition, the proposed change is patterned after similar LCOs/Action Statements included in the Palo Verde Technical Specifications (i.e., Hot Standby within 6 hours and Cold Shutdown within the following 30 hours).

Based on the above, the staff concludes that the proposed change to Specification 3.0.3 is 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

This amendment involves 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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