July 6, 2000

Mr. Gregg R. Overbeck
Senior Vice President, Nuclear
Arizona Public Service Company
P. O. Box 52034
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 - ISSUANCE OF AMENDMENTS ON REACTOR PROTECTION SYSTEM INSTRUMENTATION (TAC NOS. MA5645, MA5646, AND MA5647)

Dear Mr. Overbeck:

The Commission has issued the enclosed Amendment No. 126 to Facility Operating License No. NPF-41, Amendment No. 126 to Facility Operating License No. NPF-51, and Amendment No. 126 to Facility Operating License No. NPF-74 for the Palo Verde Nuclear Generating Station, Units 1, 2, and 3, respectively. The amendments consist of changes to the Technical Specifications in response to your application dated May 26, 1999, as supplemented by letter dated March 31, 2000.

The amendments revise Technical Specification 3.3.1, “Reactor Protective System (RPS) Instrumentation - Operating,” to change the allowable values for two of the trip setpoints. The change was requested to reduce spurious reactor trip hazards associated with these setpoints while maintaining plant protection.

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

Sincerely,

/RA/

Mel B. Fields, Project Manager, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-528, STN 50-529,
and STN 50-530

Enclosures:
1. Amendment No. 126 to NPF-41
2. Amendment No. 126 to NPF-51
3. Amendment No. 126 to NPF-74
4. Safety Evaluation

cc w/encls: See next page

July 6, 2000

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cc:

Mr. Steve Olea
Arizona Corporation Commission
1200 W. Washington Street
Phoenix, AZ 85007

Douglas Kent Porter
Senior Counsel
Southern California Edison Company
Law Department, Generation Resources
P.O. Box 800
Rosemead, CA 91770

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P. O. Box 40
Buckeye, AZ 85326

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
Harris Tower & Pavillion
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Chairman
Maricopa County Board of Supervisors
301 W. Jefferson, 10th Floor
Phoenix, AZ 85003

Mr. Aubrey V. Godwin, Director
Arizona Radiation Regulatory Agency
4814 South 40 Street
Phoenix, AZ 85040

Ms. Angela K. Krainik, Director
Regulatory Affairs
Arizona Public Service Company
P.O. Box 52034
Phoenix, AZ 85072-2034

Mr. John C. Horne
Vice President, Power Generation
El Paso Electric Company
2702 N. Third Street, Suite 3040
Phoenix, AZ 85004

Mr. David Summers
Public Service Company of New Mexico
414 Silver SW, #1206
Albuquerque, NM 87102

Mr. Jarlath Curran
Southern California Edison Company
5000 Pacific Coast Hwy Bldg DIN
San Clemente, CA 92672

Mr. Robert Henry
Salt River Project
6504 East Thomas Road
Scottsdale, AZ 85251

Terry Bassham, Esq.
General Counsel
El Paso Electric Company
123 W. Mills
El Paso, TX 79901

Mr. John Schumann
Los Angeles Department of Water & Power
Southern California Public Power Authority
P.O. Box 51111, Room 1255-C
Los Angeles, CA 90051-0100

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-528

PALO VERDE NUCLEAR GENERATING STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 126
License No. NPF-41

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

   A. The application for amendment by the Arizona Public Service Company (APS or the licensee) on behalf of itself and the Salt River Project Agricultural Improvement and Power District, El Paso Electric Company, Southern California Edison Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority dated May 26, 1999, as supplemented March 31, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, 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 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-41 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 126, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this license. APS shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan, except where otherwise stated in specific license conditions.

3. This license amendment is effective as of the date of issuance, and the Technical Specifications shall be implemented within 60 days of the date of issuance. For surveillance requirements associated with the revised allowable values for functions 12 and 13 in Technical Specification Table 3.3.1-1, the first performance is due at the end of the first surveillance interval that began on the date the surveillance was last performed prior to the date of implementation of this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Stephen Dembek, Chief, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: July 6, 2000

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-529

PALO VERDE NUCLEAR GENERATING STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 126
License No. NPF-51

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

   A. The application for amendment by the Arizona Public Service Company (APS or the licensee) on behalf of itself and the Salt River Project Agricultural Improvement and Power District, El Paso Electric Company, Southern California Edison Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority dated May 26, 1999, as supplemented March 31, 2000, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, 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 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-51 is hereby amended to read as follows:

Date of Issuance: July 6, 2000 Attachment: Changes to the Technical 3.

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License No. NPF-74
Amendment No. 126

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3. Attachment: Changes to the Technical [illegible]

Date of Issuance: July 6, 200[illegible]

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

FACILITY OPERATING LICENSE NOS. NPF-41, NPF-51, AND NPF-74
ATTACHMENT TO LICENSE AMENDMENT NOS. 126, 126, AND 126

Replace the following revised page of Appendix A Technical Specifications with the attached marginal

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 126 TO FACILITY OPERATING LICENSE NO. NPF-41,

AMENDMENT NO. 126 TO FACILITY OPERATING LICENSE NO. NPF-51,

AND AMENDMENT NO. 126 TO FACILITY OPERATING LICENSE NO. NPF-74

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

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

1.0 INTRODUCTION

By application dated May 26, 1999, as supplemented by letter dated March 31, 2000, the Arizona Public Service Company (APS or the licensee) requested changes to the Technical Specifications (TSs) for the Palo Verde Nuclear Generating Station, Units 1, 2, and 3. APS submitted this request 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.

The proposed changes would revise TS 3.3.1, “Reactor Protective System (RPS) Instrumentation - Operating,” to change the allowable values for two of the trip setpoints. The change was requested to reduce spurious reactor trip hazards associated with these setpoints while maintaining plant protection.

2.0 BACKGROUND

A reactor trip is initiated when the differential pressure across the primary side of either steam generator decreases below a variable setpoint. There is a separate trip for each steam generator. These reactor trips provide protection against a reactor coolant pump (RCP) sheared shaft event. The variable setpoint normally stays below the indicated differential pressure by a preset value called the Step function, unless limited by a preset maximum decreasing rate determined by the Ramp function, or by a preset minimum value called the Floor function. The Step function is the amount by which the trip setpoint remains below the input signal unless limited by the Ramp or Floor Functions. The Ramp function is the maximum permitted rate of decrease of the trip setpoint. The Floor function is the enforced minimum value of the trip setpoint. The trip setpoint ensures that the resultant power to flow ratio provides adequate core cooling to maintain departure from nucleate boiling ratio (DNBR) under the expected pressure condition for these events.

In 1986, two plant trips occurred at the Palo Verde site, due to spurious operation of the low reactor coolant flow variable trip, caused by random noise in the instrumentation. The source of noise was believed to be related to the large fluid system acoustic waves propagating throughout the reactor coolant system (RCS), and randomly initiated by the natural turbulence of flow. Subsequent TS amendments changed the variable trip setpoint (Step, Floor, and Ramp functions) so that process noise could be accommodated without tripping the units. However, since 1992, all three Palo Verde units have experienced multi-channel pre-trip alarms and/or single channel trips which are attributed to the differential pressure signal. Recent investigation shows that the differential pressure signal periodically rises approximately 3 psid in 6 to 8 seconds and then immediately drops by as much as 6 psid in about 2 seconds. During this sequence, the variable setpoint will increase and then hold at the increased setpoint when the process signal drops back down. This often results in the average value of the process signal falling close to the setpoint. Palo Verde data indicates that such pressure changes occur every 10 to 20 minutes. Depending on the magnitude of the pressure change, a pre-trip alarm or even a trip signal trip may occur. The frequency of these spurious trips appears to be increasing. This is attributed to the slowly increasing differential pressure across the steam generators over time, primarily due to steam generator tube plugging. As the differential pressure increases, the magnitude of the signal excursion due to the random noise component also increases. Therefore, as more steam generator tubes are plugged, the potential for a spurious trip increases. The licensee has concluded that a change to TS Allowable Values for the Ramp, Floor, and Step functions (i.e., lowering the effective setpoint) will directly increase the operating range and reduce the trip hazard associated with the random noise component.

By letter dated May 26, 1999, as supplemented by letter dated March 31, 2000, APS submitted a TS change request to revise Table 3.3.1-1 of TS 3.3.1. The allowable values in Table 3.3.1-1, Item 12, “Reactor Coolant Flow, Steam Generator #1-Low” and Item 13, “Reactor Coolant Flow, Steam Generator #2-Low,” would be changed from $\leq$0.118 psid/sec to $\leq$0.115 psid/sec for Ramp, from $\geq$11.7 psid to $\geq$12.49 psid for Floor, and from $\leq$10.2 psid to $\leq$17.2 psid for Step.

3.0 EVALUATION

The proposed TS changes provide a larger Step function between the indicated differential pressure and the variable trip setpoint, while making the Floor and Ramp functions more restrictive. The overall effect of the TS changes is to delay the reactor trip initiated by the low reactor coolant flow trip signal during design-bases transients. The staff evaluated the consequences of these proposed setpoint changes on both the normal operation of the units, and the ability of the RPS to perform its intended safety function.

3.1 Impact on Normal Plant Operation

The proposed changes to the TS Allowable Values for the Ramp, Floor, and Step functions will directly increase the operating range. The increase in operating range will reduce or eliminate unnecessary challenges to the RPS, and reduce the chance of unnecessary plant trips. Therefore, the staff concludes that the proposed changes to the low reactor coolant flow trip setpoints will have a favorable impact on normal operation of the units.

3.2 Impact on Design-Basis Accident Scenarios

Chapter 15 of the Updated Final Safety Analysis Report (UFSAR) identifies one event that relies on the low reactor coolant flow trip. This event involves a single RCP sheared shaft with a loss of offsite power (LOOP). The licensee reanalyzed the single RCP sheared shaft with a LOOP to determine the effect of the delayed reactor trip. The reanalysis of the sheared shaft event determined that the overall effect of the changes to the Allowable Values for the low reactor coolant flow trip function was to delay the RPS-initiated low reactor coolant flow reactor trip for this event from the current value of approximately 1.2 seconds after event initiation to approximately 2.5 seconds after event initiation.

The staff reviewed the licensee's analytical methods and transient analyses for acceptability, confirmed that the analytical results met required acceptance criteria, and ensured that the proposed TS changes appropriately reflected the results of the acceptable safety analyses.

The analytical methods used by the licensee included the following computer codes to perform the transient reanalyses:

. HERMITE: This is a few-group, space- and time-dependent neutron diffusion code, which includes feedback effects of fuel temperature, coolant temperature, coolant density and control rod motion.

. TORC and CETOP: TORC is a three-dimensional, open-lattice core thermal hydraulic code used to determine the local coolant conditions and to calculate the minimum DNBRs for the core. CETOP is a fast-running variant of the TORC code used in the thermal margin analyses.

The licensee stated that the same analytical methods used in the NRC-approved reload analysis methodology (NRC letter to APS dated June 14, 1993) were used to perform the transient analyses. The staff concludes that the use of these previously approved analytical methods are appropriate for use in reanalysis of the RCP sheared shaft event.

Using these computer codes, the licensee evaluated the effects of changing the setpoints on the UFSAR design-basis event that depends on the low reactor coolant flow trip for event mitigation, the single RCP sheared shaft event coincident with a LOOP. The effect of the TS changes (a larger Step function) would delay the reactor trip initiated by the low reactor coolant flow trip signal.

The RCP sheared shaft event may be initiated by an instantaneous failure of an RCP shaft and is classified as a limiting-fault event. During the transient, flow through the affected reactor loop drops rapidly, leading to a reactor trip on a reactor coolant low flow trip signal. After the reactor trip, energy stored in the fuel rods continues to be transferred to the coolant, causing the coolant temperature to increase. The combination of decreased RCS flow and increased RCS temperature may result in low DNBRs and thus, fuel failure.

In order to calculate the maximum amount of failed fuel rods, the licensee made the following assumptions:

- The highest licensed core power was used to maximize the RCS temperature increase at the low RCS flow conditions. A combination of a higher RCS temperature increase and a low RCS flow condition results in lower DNBRs. Therefore, this assumption is conservative and acceptable.

- A minimum control element assembly worth was used. This assumption delays the core power decrease after reactor trip and results in a later DNBR turnaround and a lower flow at the time of minimum DNBR. Therefore, this assumption is conservative and acceptable.

- The moderator temperature coefficient (MTC) was assumed to be the most positive value allowed by the core operating limits report. The most positive MTC increased the positive reactivity insertion due to moderator temperature feedback during the RCS flow coastdown. This assumption resulted in a higher power level and lower DNBRs. Therefore, this assumption is conservative and acceptable.

- The low reactor coolant flow trip was credited at 2.5 seconds after the event initiation. This time to trip was calculated using the proposed low reactor flow trip setpoint, and is acceptable.

The licensee assessed various combinations of plant parameters within a power operating limit in establishing the initial plant conditions that would maximize the amount of failed fuel rods. The conservative initial conditions used in the analyses were maximum core average heat flux, maximum core mass flux, minimum reactor vessel inlet temperature, maximum RCS pressure, maximum radial peaking factor, and maximum bottom-peaked axial power shape.

The licensee also included the following assumptions in the analyses: (1) the RCP coastdown curve was based on 90 percent pump inertia, resulting in a faster RCS flow coastdown and lower calculated DNBRs, (2) the core average heat flux decrease during the transient was not credited for determining the time of minimum DNBR conditions, and (3) the effect of the pressure increase (resulting in higher values of calculated minimum DNBRs) during the transient was not credited.

The results of the analyses showed that the calculated DNBRs during the transient remained relatively unchanged when compared with the results of the existing calculations. Also, the results of the analyses showed that the calculated maximum fuel failure was within the limit used to calculate the radiological release consequences for the sheared shaft seizure event.

Since the percentage of the failed fuel rods in the core calculated by the licensee, using acceptable methods and input assumptions, was bounded by the limit used to calculate the radiological consequences, the staff concludes that the proposed changes in the low reactor coolant flow trip setpoints are acceptable. Therefore, the staff finds acceptable the licensee's proposal to change, as indicated, the proposed low reactor coolant flow trip setpoints in Table 3.3.1-1 of TS 3.3.1, "Reactor Protective System (RPS) Instrumentation - Operating."

Since the licensee's proposal will modify TS surveillance requirements, the licensee requested that the following condition be added to the amendment issuance letter:

> For surveillance requirements associated with the revised allowable values for functions 12 and 13 in Technical Specification Table 3.3.1-1, the first performance is due at the end of the first surveillance interval that began on the date the surveillance was last performed prior to the date of implementation of this amendment.

This condition allows the licensee to implement this TS amendment without having to conduct surveillances of the instrumentation before their next scheduled tests, and is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arizona State official was notified of the proposed issuance of the amendments. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and change surveillance requirements. The NRC 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 a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (65 FR 31355). 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 be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission 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 the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: N. Trehan
S. Sun

Date: July 6, 2000