October 27, 1994

Mr. William L. Stewart
Executive Vice President, Nuclear
Arizona Public Service Company
Post Office Box 53999
Phoenix, Arizona 85072-3999

SUBJECT: ISSUANCE OF AMENDMENTS FOR THE PALO VERDE NUCLEAR GENERATING STATION UNIT NO. 1 (TAC NO. M87322), UNIT NO. 2 (TAC NO. M87323), AND UNIT NO. 3 (TAC NO. M87324)

Dear Mr. Stewart:

The Commission has issued the enclosed Amendment No. 84 to Facility Operating License No. NPF-41, Amendment No. 72 to Facility Operating License No. NPF-51, and Amendment No. 56 to Facility Operating License No. NPF-74 for the Palo Verde Nuclear Generating Station, Unit Nos. 1, 2, and 3, respectively. The amendments consist of changes to the licenses in response to your application dated August 23, 1993, as supplemented by letter of July 21, 1994.

These amendments remove the Units 1 and 3 license condition regarding an augmented reactor coolant pump vibration monitoring program and rescind the Confirmatory Order modifying the Unit 2 license regarding the same issue. The staff has determined that the alternative monitoring and inspection activities are acceptable.

A copy of the related Safety Evaluation is also enclosed. A notice of issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,
ORIGINAL SIGNED BY:
Brian E. Holian, Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

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

Enclosures: 1. Amendment No. 84 to NPF-41
2. Amendment No. 72 to NPF-51
3. Amendment No. 54/56 to NPF-74
4. Safety Evaluation

cc w/enclosures:
See next page

DISTRIBUTION

Docket File	NRC & Local PDRs
KPerkins, WCFO	DFoster-Curseen
DHagan, T4A43	GHill (6), T5C3
OPA, O2G5	OC/LFDCB, T9E10
JRoe	PDIV-2/RF
TQuay	OGC, O15B18
CGrimes, O11E22	ACRS (10), TWFN
Region IV	BHolian
LTran	FGrubelich

DOCUMENT NAME: PV87322.AMD * See previous concurrence

OFC	PDIV-2/LA	PDIV-2/PM	PDIV-2/PM	OGC
NAME	DFoster-Curseen	LTran BEH for	BHolian:pk	EHoller*
DATE	10/27/94	10/27/94	10/27/94	10/11/94

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NRC FILE CENTER COPY

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DFU 1

October 27, 1994

Mr. William L. Stewart
Executive Vice President, Nuclear
Arizona Public Service Company
Post Office Box 53999
Phoenix, Arizona 85072-3999

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ORIGINAL SIGNED BY:
Brian E. Holian, Project Manager
Project Directorate IV-2
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Docket Nos. STN 50-528, STN 50-529
and STN 50-530

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OFFICIAL RECORD COPY

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 27, 1994

Mr. William L. Stewart
Executive Vice President, Nuclear
Arizona Public Service Company
Post Office Box 53999
Phoenix, Arizona 85072-3999

SUBJECT: ISSUANCE OF AMENDMENTS FOR THE PALO VERDE NUCLEAR GENERATING STATION UNIT NO. 1 (TAC NO. M87322), UNIT NO. 2 (TAC NO. M87323), AND UNIT NO. 3 (TAC NO. M87324)

Dear Mr. Stewart:

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These amendments remove the Units 1 and 3 license condition regarding an augmented reactor coolant pump vibration monitoring program and rescind the Confirmatory Order modifying the Unit 2 license regarding the same issue. The staff has determined that the alternative monitoring and inspection activities are acceptable.

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Sincerely,

B. E. Holian

Brian E. Holian, Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

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

Enclosures:
1. Amendment No. 84 to NPF-41
2. Amendment No. 72 to NPF-51
3. Amendment No. 56 to NPF-74
4. Safety Evaluation

cc w/enclosures:
See next page

cc:
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Chairman, Maricopa County Board
of Supervisors
111 South Third Avenue
Phoenix, Arizona 85003

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-528

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 84
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 August 23, 1993, as supplemented by letter of July 21, 1994, 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;

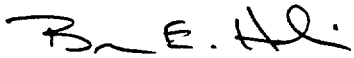
   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   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, by Amendment No. 84 , the license is amended by removing License Condition 2.C(13).

3. This license amendment is effective as of the date of issuance and must be fully implemented no later than 45 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Brian E. Holian, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License

Date of Issuance: October 27, 1994

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 84 TO FACILITY OPERATING LICENSE NO. NPF-41

DOCKET NO. STN 50-528

Replace the following pages of the license with the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
6	6
6a	6a

(9) Results of Piping Vibration Test Program (Section 3.9.2, SER)

Three months following completion of the piping vibration test program performed during initial startup, APS shall submit a summary of the results which demonstrate that the vibration of piping systems is within acceptable levels.

(10) Response to Salem ATWS Event (Section 7.2, SSER 7, and Section 1.11, SSER 8)

APS shall complete implementation of the requirements of Generic Letter 83-28 on a schedule which is consistent with that given in its letter dated April 19, 1985.

(11) Supplement No. 1 to NUREG-0737 Requirements

APS shall complete the emergency response capabilities as required by Attachment 3.

(12) Radiochemistry Laboratory (Section 7.3.1.5(3), Emergency Plan)

APS shall maintain and operate the Palo Verde, Unit 2 radiochemistry laboratory as part of the Palo Verde, Unit 1 facility under this Part 50 license authorization, in accordance with the commitments made by letter ANPP-30937, dated October 24, 1984, until the Unit 2 facility is issued a Part 50 license.

(13) RCP Shaft Vibration Monitoring Program (Section 5.4.1, SSER 12)

DELETED

D. The facility requires an exemption from Paragraph III.D.2(b)(ii) of Appendix J to 10 CFR Part 50 (Section 6.2.6, SSER 7). This exemption is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest. This exemption is, therefore, hereby granted pursuant to 10 CFR 50.12. With the granting of this exemption, the facility will operate, to the extent authorized herein, in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission.

E. The licensees shall fully implement and maintain in effect all provisions of the Commission-approved physical security, guard training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Safeguard Contingency Plan is incorporated into the Physical Security Plan. The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Palo Verde Nuclear Station Physical Security Plan," with revisions submitted through December 7, 1987; and "Palo Verde Nuclear Generating Station Guard Training and Qualification Plan," with revisions submitted through December 26, 1987. Changes made in accordance with 10 CFR 73.55 shall be implemented in accordance with the schedule set forth therein.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-529

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 72
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 August 23, 1993, as supplemented by letter of July 21, 1994, 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 Part 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;

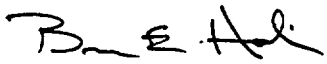
   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   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, by Amendment No. 72, the license is amended by rescinding the Confirmatory Order, dated November 19, 1982, modifying the operating license.

3. This license amendment is effective as of the date of issuance and must be fully implemented no later than 45 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Brian E. Holian, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License

Date of Issuance: October 27, 1994

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 72 TO FACILITY OPERATING LICENSE NO. NPF-51

DOCKET NO. STN 50-529

Replace the following pages of the license with the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
Confirmatory Order dated November 19, 1987	--

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

DOCKET NO. STN 50-530

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 56
License No. NPF-74

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 August 23, 1993, as supplemented by letter of July 21, 1994, 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;

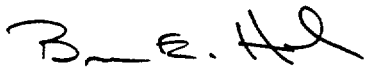
   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   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, by Amendment No. 56, the license is amended by removing License Condition 3 of Attachment 1 to the license.

3. This license amendment is effective as of the date of issuance and must be fully implemented no later than 45 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Brian E. Holian, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment:
Changes to the License

Date of Issuance: October 27, 1994

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 56 TO FACILITY OPERATING LICENSE NO. NPF-74

DOCKET NO. STN 50-530

Replace the following pages of the license with the enclosed pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
Attachment 1, pages 1 and 2	Attachment 1, pages 1 and 2

ATTACHMENT 1

PALO VERDE NUCLEAR GENERATING STATION, UNIT 3
OPERATING LICENSE NPF-74

This attachment identifies items that must be completed to the NRC staff's satisfaction in accordance with the schedule identified below.

1. Prior to entering Mode 1 for the first time, APS shall:

   a. Have completed a review of the surveillance procedures applicable to the change of mode and determined that the procedures demonstrate the operability of the required systems with respect to all acceptance criteria defined in the Technical Specifications.

   b. Have dispatched written notification to the NRC Regional Administrator, Region V, that the action defined in (a), above, has been completed for Mode 1.

2. The post-accident sampling system shall be operable prior to exceeding 5% power.

3. DELETED

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 84 TO FACILITY OPERATING LICENSE NO. NPF-41,

AMENDMENT NO. 72 TO FACILITY OPERATING LICENSE NO. NPF-51,

AND AMENDMENT NO. 56 TO FACILITY OPERATING LICENSE NO. NPF-74

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 letter dated August 23, 1993, the Arizona Public Service Company (APS or the licensee) submitted a request for changes to the licenses for the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3 (Facility Operating License Nos. NPF-41, NPF-51, and NPF-74, respectively). The Arizona Public Service Company 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 remove the Units 1 and 3 license condition regarding an augmented reactor coolant pump vibration monitoring program, and rescind the Confirmatory Order modifying the Unit 2 license regarding the same issue.

APS stated that an reactor coolant pump (RCP) monitoring system had been installed in each unit to monitor and record RCP vibration data. APS further stated that the vibration-related parameters monitored by the new system provide better quality and safety than the parameters discussed in the existing license condition and Confirmatory Order. By letter dated July 21, 1994, APS provided additional information related to the amendment and the new monitoring system, as requested by the staff during a conference call on May 17, 1994. This additional information was clarifying in nature and did not affect the staff's previously published no significant hazards determination.

2.0 BACKGROUND

By letter dated October 8, 1987, APS informed the Commission that European RCPs similar to the Palo Verde Nuclear Generating Station (PVNGS) RCPs in design and manufacture exhibited shaft cracking. APS informed the Commission of planned inspections of the pump shafts at PVNGS Unit 1 during the current refueling outage. On October 21, 1987, APS reported that ultrasonic testing

(UT) revealed that crack indications of varying depths and lengths had been identified on the shafts of the first two pumps. Subsequently, crack indications were detected on the shaft of the third pump. The depth of the indications that were identified by UT inspection on the PVNGS Unit 1 shafts exceeded those reported for the European RCP shafts which had not failed. In addition, the operating hours for PVNGS Unit 1 pumps were significantly less than for the European pumps.

No shaft failures had been experienced at PVNGS. However, since the root cause of the phenomenon had not been identified and corrected, the staff was concerned that the information indicated an increased probability of a RCP shaft failure and the possibility of even more than one RCP shaft failure. Following further meetings and discussions on inspection results for Unit 1 and 2, on November 19, 1987, NRC issued a Confirmatory Order modifying the license of PVNGS Unit 2, License No. NPF-51, to include commitments by the licensee related to the RCPs. The modification required the licensee to implement an augmented vibration monitoring program for each of the four pumps and install modified RCP shafts during the next refueling outage. The Order also allowed the Regional Administrator to relax or rescind any of the conditions upon a showing by the licensee of good cause.

The Confirmatory Order modifying the Unit 2 operating license required APS to include the following commitments:

A. Implement an augmented vibration monitoring program for each of the four RCPs that include the following activities:

   1. Every 4 hours, monitor and record the vibration data on each of the four RCPs.

   2. On a daily basis, perform an evaluation of the pump vibration data obtained in 1 above, using an appropriately qualified engineering individual.

   3. When any one vibration monitor on the RCP indicates a vibration level of 8 mils or greater, NRC shall be notified within 4 hours via the emergency notification system. In addition, when the vibration on any pump exceeds 8 mils due to a shaft crack or unknown cause, within 4 hours the affected pump shall have its orbit and spectra continuously monitored and evaluated by an appropriately qualified individual.

   4. When any one vibration monitor on the RCPs indicates a vibration level of 10 mils or greater, within 1 hour, initiate action to place the unit in at least HOT STANDBY within the next 6 hours and at least COLD SHUTDOWN within the following 30 hours. In addition the affected RCP shall be secured after entering HOT STANDBY.

   5. On a daily basis a spectrum analysis shall be performed on the RCP shaft vibration data and shall be evaluated for trends by an individual qualified in that technique. The evaluation shall

consist of comparing the running speed (1XRPM) and twice running speed (2XRPM) spectral components to limits computed from baseline vibration. The limits shall be based on the lowest of: (a) 1.6 times the baseline value; (b) the mean plus three standard deviations; (c) 2 mils for the 2XRPM component; or (d) 6 mils for the 1XRPM component[1]. When the amplitude exceeds any limit, further analysis shall be performed. The analysis shall consist of an inspection of the amplitude versus time plots for a steadily increasing trend and a review of other plant data which might explain the change in amplitude. If it is confirmed that the trend is not caused by plant or pump conditions unrelated to a shaft crack, the trend shall be extrapolated manually and/or by computer to predict the time at which the vibration is expected to reach 10 mils. If the projected time for reaching 10 mils is 1 week or less, within 1 hour initiate action to place the unit in HOT STANDBY within the next 6 hours and in at least COLD SHUTDOWN within the following 30 hours. In addition, the affected RCP shall be secured after entering HOT STANDBY.

B. The licensees shall install modified reactor coolant pump shafts during the next refueling outage currently scheduled to start in February 1988. The shafts shall include the modifications described in Figure DES-3 of the attachments to the licensee's November 5, 1987, letter.

The Unit 3 license condition was incorporated into the full-power license issued on November 25, 1987, and the Unit 1 license condition was incorporated into the license by Amendment 32, dated May 10, 1988.

3.0 DISCUSSION

APS dedicated several individuals to monitor and record the vibration data on each of the four RCPs every 4 hours. Also, a qualified engineering individual was assigned to perform an evaluation of the RCP vibration data on a daily basis. Since November 19, 1987, APS has dedicated thousands of man-hours monitoring and recording RCP vibration data and performing a daily spectrum analysis, which is a manpower intensive task.

The installed RCP orbital monitoring system monitors the critical vibration related parameters, such as overall vibration, synchronous 1XRPM and 2XRPM amplitude, and phase angle for deviation from acceptable values defined as an acceptance region on the monitor. The RCPs are continuously monitored by an analog vibration monitoring system with two proximity probes mounted just above the seal housing and an accelerometer mounted on the motor base. The analog monitors have two set points for each channel which sound an alarm and flash an alarm window in the control room. In addition to the analog alarm, a

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[1]In the event new limits (or methods) are chosen, they shall be evaluated by the licensee to assure that the new methods are equal to or better than the above method. The Commission shall be advised within 1 week if new methods are chosen.

computer system is installed which, approximately twice per minute, analyzes the vibration from the proximity probes for the amplitude and phase of the 1XRPM and 2XRPM components. These vector components are compared to an acceptance region, and if they are outside the region, the computer sounds an alarm in the control room. The computer also monitors the condition of the analog monitor every 3 seconds and provides status reports, alarm logs, and 21 days of trend data for the overall vibration, 1XRPM and 2XRPM amplitudes and phase and gap voltage.

The requirement to shutdown a unit on a low-amplitude vibration trend which cannot be identified as an indication of a cracked shaft puts the unit at risk of being shutdown for reasons other than a cracked shaft. Also, because low-amplitude symptoms of shaft cracks are similar to other nonsignificant pump conditions, the unit is at risk of being unnecessarily shutdown. The data collector alarms need to be set very low in order to be sensitive; however, this may cause many false alarms that must be manually evaluated. APS considers the new monitoring system sensitive to fairly low amplitude trends and more realistic than most other plants'. Further, the risk of shaft cracks has been greatly reduced, and the value of detecting low amplitude trends is also greatly reduced. However, APS intends to continue to use the data collector at least once a month.

The original shafts that experienced cracking were martensitic steel, chrome plated over their entire length to facilitate the assembly/disassembly of the impeller from the shaft. The APS root cause analysis determined that the shaft cracking was the result of a reduction in the fatigue strength of the shaft material due to the presence/application of chrome plating. Microcracks initiate in the chrome plate during normal operation, due to superimposed mechanical and thermal stresses, and propagate into the shaft base material.

APS has replaced all of the original shafts. The replacement shafts in Unit 1 are spare shafts modified to address the cause of cracking. The chrome plate has been removed in the keyway areas except where needed for assembling the impeller on the shaft, a thermal barrier to the shaft keyway area is provided, and stress concentrations are reduced in the diameter change areas. The replacement shafts installed in Unit 2 and 3 are newly manufactured shafts of essentially the same design as Unit 1 replacements with enhancements. The shafts are surface-rolled to increase their endurance fatigue strength and coated with chromium carbide instead of chrome plating, and a center bore is provided for UT examination access.

Since replacement of the original RCP shafts in the three units, no cracks have been detected by UT examination during each of the units past refueling outages.

In addition to the previously-discussed advantages, APS believes the newly-installed computer system will reduce the manpower burden and personnel radiation exposure. APS will continue to monitor RCP vibration data through the use of the installed system, and intends to use the data collector at least once a month, and perform periodic RCP shaft UT inspections.

4.0 EVALUATION

Pursuant to the requirements of 10 CFR 2.204 and 10 CFR Part 50, the NRC issued the confirmatory order modifying the license of PVNGS Unit 2, License No. NPF-51, based on the licensee's reports of cracks of varying length and depth found in the RCP shafts, a lack of any root cause analysis identification and correction of the cracking phenomenon, concern over an increased probability of a RCP shaft failure, and the potential for more than one RCP shaft failure. Although shaft failure is an analyzed event which had not been experienced at the facility, and considering that the reactor protection system would shut down the reactor upon a pump shaft failure, the increased probability of a shaft failure at the time raised immediate concerns relative to potential challenges to the reactor protection and emergency core cooling systems. The license condition was subsequently incorporated into PVNGS Unit 1 and Unit 3 licenses.

The licensee performed a root cause analysis as described in APS letter dated May 20, 1988. The root cause of the shaft cracking was determined to be a reduction in fatigue strength of the shaft material due to the presence and application of chrome plating. Microcracks initiate in the chrome plating during normal operation, due to superimposed mechanical and thermal stresses, and propagate into the base metal as a result of high cycle fatigue loading. In laboratory tests it has been found that the presence of chrome plating significantly reduced the fatigue strength of the shaft material. Hydrogen embrittlement of the plating could occur during the shaft manufacturing and plating process as a result of released hydrogen being trapped between the base material and chrome plate. Local shaft fatigue stress loading is also heightened by stress concentrations found in the design of keyways and abrupt changes in shaft diameter.

APS replaced all of the original RCP shafts. The replacement shafts in Unit 1 are spare shafts modified to address the cause of cracking. The replacement shafts installed in Units 2 and 3 are newly manufactured shafts of the same basic design as the Unit 1 replacement shafts with additional fatigue reduction enhancements. The replacement shafts were provided with a center bore to allow entry of a UT probe to facilitate and improve UT inspections. The Unit 1 shafts will be UT-inspected during each refueling and the Unit 2 and 3 shafts will be UT-inspected during RCP mechanical seal replacements. APS indicated that, if abnormal monitoring data trends are detected during any refueling outage, the trends will be evaluated on a case by case basis to determine if a UT shaft inspection is warranted. Since replacement of the original RCP shafts in the three units, no cracks have been detected by UT inspection during each of the units' past refueling outages.

In the amendment request, APS provided a summary of its safety analysis of a RCP shaft break and an evaluation of the potential for multiple shaft failures. Based on the safety analysis, APS concluded that a single sheared shaft would result in an uncomplicated shutdown with no fuel failure. APS also stated that multiple shaft failures would not occur since the failure of one pump shaft will result in the reduction of other pumps' loads and subsequent reduction in their shafts' stresses and prompt shutdown of the

unit. Further, it was concluded that there would be no break in the reactor pressure boundary and the pump shaft seal would remain intact. APS noted that the RCP shaft break event with a concurrent loss of offsite power has been previously evaluated in the Updated Final Safety Analysis Report, Subsection 15.3.4.

APS installed a new monitoring system to monitor critical RCP-related vibration parameters. APS considers that the proposed alternative of using the newly installed computer system provides a better level of quality and safety than existing license condition and Confirmatory Order requirements since it monitors the 1XRPM and 2XRPM components, phase, and ~~decreases~~ amplitude every few seconds, and can quickly access trend data for fast evaluation. The RCPs are continuously monitored by the system, which analyzes the monitored parameters, compares the results with acceptance limits, and sounds and flashes an alarm window in the control room if unacceptable conditions are detected. The computer also monitors the system condition, provides status reports, alarm logs, and 21 days of trend data of overall vibration levels. The new system reduces manpower burden and radiation exposure of personnel.

In summary, the licensee's amendment request proposes to remove the Units 1 and 3 license condition regarding an augmented RCP vibration monitoring program and rescind the Confirmatory Order modifying the Unit 2 license regarding the same issue. Additionally, the staff noted that two additional items related to RCP vibration that are contained in the Unit 3 license have been completed. The licensee discussed these items with the staff on October 25, 1994, and requested their removal. The first item required the licensee to submit a report to the staff following the first Unit 2 refueling outage detailing RCP inspection findings. This report was submitted by letter dated May 20, 1988, and the staff evaluation was issued by letter dated January 4, 1989. The second item required the installation of modified RCP shafts. The licensee's letter dated August 23, 1993, states that all shafts have been replaced. Accordingly, these additional items are deleted from the Unit 3 license.

The licensee has proposed to continue to monitor RCP vibration data through the use of the newly-installed computer system, use the data collector at least once a month for very low amplitude trend assessments, and perform periodic UT inspections of the RCP shafts. The staff finds the amendment acceptable based on (1) licensee's root cause analysis, (2) corrective action and safety analysis, (3) proposed continuing monitoring program and inspection actions, and (4) burden and exposure reductions considerations inherent with the proposed alternatives.

6.0 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.

7.0 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. 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 (58 FR 50963). 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.

8.0 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.

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