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

March 17, 1997

Mr. James M. Levine
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. M93014), UNIT NO. 2 (TAC NO. M93015), AND UNIT NO. 3 (TAC NO. M93016)

Dear Mr. Levine:

The Commission has issued the enclosed Amendment No. 111 to Facility Operating License No. NPF-41, Amendment No. 103 to Facility Operating License No. NPF-51, and Amendment No. 83 to Facility Operating License No. NPF-74 for the Palo Verde Nuclear Generating Station, Unit Nos. 1, 2, and 3, respectively. The amendments are in response to your application dated May 2, 1995, as supplemented by letter dated March 7, 1996.

These amendments authorize you, through a license condition in each license, to incorporate changes to the description of the facilities in the Updated Final Safety Analysis Report (UFSAR), as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the enclosed Safety Evaluation, attached to these amendments. As an administrative action by the Nuclear Regulatory Commission (NRC), which only involves the format of the licenses and does not authorize any activities outside the scope of your application and supplement, the NRC has amended the licenses to include an Appendix D which lists additional license conditions. Approval of these amendments through license conditions have been discussed with your staff on February 25, 1997, in a conference call and your staff has agreed to the structure of the license for issuing these license conditions.

250035

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,

Original Signed By

James W. Clifford, Senior 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. 111 to NPF-41
2. Amendment No. 103 to NPF-51
3. Amendment No. 83 to NPF-74
4. Safety Evaluation

cc w/encls: See next page

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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. 111
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 2, 1995, as supplemented by letter dated March 7, 1996, 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 to authorize changes to the Updated Final Safety Analysis Report and add paragraph 2.C.(14) to Facility Operating License No. NPF-41 as follows:*

*Pages 6 and 7 are attached, for convenience, for the composite license to reflect this change.

(14) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. 111, are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of the date of issuance and shall be implemented within 60 days from the date of issuance. Implementation of the amendment is the incorporation in the Updated Final Safety Analysis Report of the changes to the description of the facility as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation attached to this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION

James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachments: 1. Pages 6 and 7 of License
2. Appendix D -
Additional Conditions

Date of Issuance: March 17, 1997

(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

(14) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. , are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

F. Except as otherwise provided in the Technical Specifications or the Environmental Protection Plan, APS shall report any violations of the requirements contained in Section 2.C of this license in the following manner: Initial notification shall be made within 24 hours in accordance with the provisions of 10 CFR 50.72 with written follow-up within 30 days in accordance with the procedures described in 10 CFR 50.73(b), (c) and (e);

G. The licensees shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims; and

H. This license is effective as of the date of issuance and shall expire at midnight on December 31, 2024.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosures:
1. Attachment 1 -
   Requirements for Initial Mode 1 Entry
2. Attachment 2 -
   Operating Staff Experience Requirements
3. Attachment 3 -
   Emergency Response Capabilities
4. Appendix A -
   Technical Specifications
5. Appendix B -
   Environmental Protection Plan
6. Appendix C -
   Antitrust Conditions
7. Appendix D -
   Additional Conditions

Date of Issuance: June 1, 1985

APPENDIX D

ADDITIONAL CONDITIONS

FACILITY OPERATING LICENSE NO. NPF-41

Arizona Public Service Company shall comply with the following conditions on the schedules noted below:

Amendment Number	Additional Condition	Implementation Date
111	This amendment authorizes the licensee to incorporate in the Updated Final Safety Analysis Report (UFSAR) certain changes to the description of the facility. Implementation of this amendment is the incorporation of these changes as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation dated March 17, 1997.	60 days from the date of issuance.

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. 103
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 2, 1995, as supplemented by letter dated March 7, 1996, 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 to authorize changes to the Updated Final Safety Analysis Report and add paragraph 2.C.(9) to Facility Operating License No. NPF-51 as follows:*

*Pages 5 and 6 are attached, for convenience, for the composite license to reflect this change.

(9) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. 103, are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of the date of issuance and shall be implemented within 60 days from the date of issuance. Implementation of the amendment is the incorporation in the Updated Final Safety Analysis Report of the changes to the description of the facility as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation attached to this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION

James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachments: 1. Pages 5 and 6 of License
2. Appendix D -
Additional Conditions

Date of Issuance: March 17, 1997

(6) Fire Protection Program (Section 9.5.1, SSER 6, SSER 7 and SSER 8)

APS shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility, as supplemented and amended, and as approved in the SER through Supplement 8, subject to the following provision:

APS may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

(7) Inservice Inspection Program (Sections 5.2.4 and 6.6, SER and SSER 9)

Prior to September 10, 1986, APS shall submit the inservice inspection program for Unit 2 for NRC review and approval.

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

APS shall complete the items listed in Attachment 2.

(9) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. , are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

D. (1) APS has previously been granted an exemption from Paragraph III.D.2(b)(ii) of Appendix J to 10 CFR Part 50. This exemption was previously granted in Facility Operating License NPF-46 pursuant to 10 CFR 50.12.

(2) APS has previously been granted a partial exemption from those portions of General Design Criterion 4 of Appendix A to 10 CFR Part 50 which require protection of structures, systems, and components against certain dynamic effects associated with postulated reactor coolant system pipe breaks. This exemption was granted on November 29, 1985 (50 FR 50020) pursuant to 10 CFR 50.12 for a period ending with the completion of the second refueling outage for PVNGS-2 or the adoption of the proposed rulemaking for modification of GDC 4 whichever occurs first.

With the granting of these exemptions, 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.

F. Except as otherwise provided in the Technical Specifications or the Environmental Protection Plan, APS shall report any violations of the requirements contained in Section 2.C of this license in the following manner: Initial notification shall be made within 24 hours to the NRC Operations Center via the Emergency Notification System with written follow-up within 30 days in accordance with the procedures described in 10 CFR 50.73(b), (c) and (e);

G. The licensees shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims; and

H. This license is effective as of the date of issuance and shall expire at midnight on December 9, 2025.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By

Darrell G. Eisenhut, Acting Director
Office of Nuclear Reactor Regulation

Attachments:
1. Attachment 1
2. Attachment 2
3. Appendix A -
   Technical Specifications
4. Appendix B -
   Environmental Protection Plan
5. Appendix C -
   Antitrust Conditions
6. Appendix D -
   Additional Conditions

Date of Issuance: April 24, 1986

APPENDIX D

ADDITIONAL CONDITIONS

FACILITY OPERATING LICENSE NO. NPF-51

Arizona Public Service Company shall comply with the following conditions on the schedules noted below:

Amendment Number	Additional Condition	Implementation Date
103	This amendment authorizes the licensee to incorporate in the Updated Final Safety Analysis Report (UFSAR) certain changes to the description of the facility. Implementation of this amendment is the incorporation of these changes as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation dated March 17, 1997.	60 days from the date of issuance.

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. 83
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 May 2, 1995, as supplemented by letter dated March 7, 1996, 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 to authorize changes to the Updated Final Safety Analysis Report and add paragraph 2.C.(5) to Facility Operating License No. NPF-74 as follows:*

*Pages 4 and 5 are attached, for convenience, for the composite license to reflect this change.

(5) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. 83, are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of the date of issuance and shall be implemented within 60 days from the date of issuance. Implementation of the amendment is the incorporation in the Updated Final Safety Analysis Report of the changes to the description of the facility as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation attached to this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION

James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachments: 1. Pages 4 and 5 of License
2. Appendix D -
Additional Conditions

Date of Issuance: March 17, 1997

(1) Maximum Power Level

Arizona Public Service Company (APS) is authorized to operate the facility at reactor core power levels not in excess of 3876 megawatts thermal (100% power) in accordance with the conditions specified herein and in Attachment 1 to this license. The items identified in Attachment 1 to this license shall be completed as specified. Attachment 1 is hereby incorporated into this license.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. , 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) Antitrust Conditions

This license is subject to the antitrust conditions delineated in Appendix C to this license.

(4) Initial Test Program (Section 14, SER and SSER 2)

Any changes in the initial test program described in Section 14 of the FSARs (Palo Verde and CESSAR) made in accordance with the provisions of 10 CFR 50.59 shall be reported in accordance with 50.59(b) within one month of such change.

(5) Additional Conditions

The Additional Conditions contained in Appendix D, as revised through Amendment No. , are hereby incorporated into this license. Arizona Public Service Company shall operate the facility in accordance with the Additional Conditions.

D. APS has previously been granted an exemption from Paragraph III.D.2(b)(ii) of Appendix J to 10 CFR Part 50. This exemption was previously granted in Facility Operating License NPF-65 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.

F. APS shall implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility, as supplemented and amended, and as approved in the SER through Supplement 11, subject to the following provision:

> APS may make changes to the approved fire protection program without approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

G. Except as otherwise provided in the Technical Specifications or the Environmental Protection Plan, APS shall report any violations of the requirements contained in Section 2.C of this license in the following manner: Initial notification shall be made within 24 hours to the NRC Operations Center via the Emergency Notification System, with written follow-up within 30 days in accordance with the procedures described in 10 CFR 50.73(b), (c), and (e);

H. The licensees shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims; and

I. This license is effective as of the date of issuance and shall expire at midnight on March 25, 2027.

FOR THE NUCLEAR REGULATORY COMMISSION

Original Signed By

Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Attachments:
1. Attachment 1
2. Appendix A -
   Technical Specifications
3. Appendix B -
   Environmental Protection Plan
4. Appendix C -
   Antitrust Conditions
5. Appendix D -
   Additional Conditions

Date of Issuance: November 25, 1987

APPENDIX D

ADDITIONAL CONDITIONS

FACILITY OPERATING LICENSE NO. NPF-74

Arizona Public Service Company shall comply with the following conditions on the schedules noted below:

Amendment Number	Additional Condition	Implementation Date
83	This amendment authorizes the licensee to incorporate in the Updated Final Safety Analysis Report (UFSAR) certain changes to the description of the facility. Implementation of this amendment is the incorporation of these changes as described in the licensee's application dated May 2, 1995, as supplemented by letter dated March 7, 1996, and evaluated in the staff's Safety Evaluation dated March 17, 1997.	60 days from the date of issuance.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-41,

AMENDMENT NO. 103 TO FACILITY OPERATING LICENSE NO. NPF-51,

AND AMENDMENT NO. 83 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 application dated May 2, 1995, as supplemented by letter dated March 7, 1996, the Arizona Public Service Company (APS or the licensee) requested a modification to License Nos. NPF-41, NPF-51, and NPF-74, respectively 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 modify the licenses to authorize revision of the Updated Final Safety Analysis Report (UFSAR) to incorporate certain changes. The changes describe a revised large-break loss of coolant accident (LOCA) analysis that addresses a previously unanalyzed release path through the steam generators to the atmosphere.

2.0 BACKGROUND

The Arizona Public Service Company, the licensee for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 and 3, identified a potential release path that had not been previously evaluated for a design-basis large-break LOCA. The licensee calculated the radiological consequences of the large-break LOCA that included the potential release path and compared the results to previous large-break LOCA dose calculations that are contained in the UFSAR. The licensee determined that radioactivity contributions from the potential release path increased the radiological doses, but the total radiological doses from a large-break LOCA remained within the acceptance criteria presented in 10 CFR Part 100 for the exclusion area boundary and low population zone and General Design Criterion 19 for the control room.

In accordance with the provisions of 10 CFR 50.59, the licensee evaluated the changes in their large-break LOCA analysis and determined that it constituted an unreviewed safety question, which required prior NRC review and approval of

an amendment to the license. In letters dated May 2, 1995, and March 7, 1996, the licensee proposed changes to UFSAR Sections 6.2.4, 6.2.6, and 15.6.5, for the PVNGS Units 1, 2, and 3. The proposed changes are to the large-break LOCA dose consequence analysis and include a previously unanalyzed release path to the environment.

3.0 EVALUATION

3.1 Description of the Event

Following a large-break LOCA, steam generator pressure will remain high until pressure is relieved by the operators. The emergency operating procedures instruct the operators to depressurize the steam generators following the reflood stage of a large-break LOCA with the atmospheric dump valves or turbine bypass valves. When the operators perform this action, there is the potential that the steam generator pressure will reduce to a point lower than containment pressure while the steam generators are open to atmosphere and the steam generator tubes are uncovered. When the pressure in the containment is higher than the pressure in the steam generators, there could be flow of the containment atmosphere through the pre-existing cracks in the steam generator tubes into the steam generators. With the steam generators open to atmosphere, that flow could be available to be released into the atmosphere through the open atmospheric dump valves. This release path had not been analyzed previously by the licensee for the large-break LOCA. The licensee's revised calculations assume a single failure of an isolation valve (GDC 57 valve) or a stuck open atmospheric dump valve; therefore, no credit is taken for these valves for containment isolation. The staff agrees with the licensee's conclusion that these valves can continue to be excluded from 10 CFR 50 Appendix J Type C leakage rate testing.

3.2 Leakage Flow Calculation

The licensee has attempted to calculate the flow rate of the potential leakage through the steam generator after a design-basis large-break LOCA by assuming the maximum leak rate permitted by plant technical specifications (TSs) during normal operation and then predicting the maximum leakage that could be attained after the accident, when the steam generator secondary pressures are reduced below the containment pressure. The calculated flow rates were then used by the licensee to determine the radiological consequences of a large-break LOCA.

Because of the complexity of the calculations, the licensee frequently made conservative or bounding assumptions to ensure that the results are conservative. Thus, the results of the leakage flow calculations are not considered accurate or a best estimate of the true flow rate. The plant TSs allow a leak rate of 1 gpm of water (total) through the steam generator tubes. This flow rate occurs from any number of cracks in the steam generator tubes from the primary coolant system to the secondary main steam system. The steam generator tubes are water-filled in the primary system and water-covered in the secondary system during normal operation to create a water-to-water interface. The pressure differential during normal operation is about 1255

psi, whereas after a design-basis large-break LOCA, the maximum pressure differential is 60 psi, which corresponds to the design pressure of containment with the steam generators open to the atmosphere. Due to the pressure difference between containment and the depressurized steam generators following a large-break LOCA, the containment atmosphere or air flows across the leak paths in the steam generator tubes and into the steam generator, which is open to the atmosphere.

To extrapolate the containment atmospheric flow rate through the leaking steam generators, the licensee established a set of five calculations with five unknowns and solved the equations using a range of friction loss coefficients. First, the steam generator tube leak area was calculated as a function of the friction loss coefficient using the TS leakage rate with the normal operating pressure using the energy equations. The ideal gas law relationships were then used to calculate the flow of the containment atmosphere (a compressible fluid) through the leak path.

To simplify the equations to the point where there were only five unknowns, the licensee made some bounding assumptions. The friction loss coefficient was unknown, so the licensee plotted the loss coefficient versus the resulting containment atmosphere flow rate through the tubes and chose a limiting loss coefficient. For the flow rate used in the licensee's dose assessment, the corresponding loss coefficient was 1700. This value is high, and at that point on the plot, an increase in loss coefficient does not result in a significant increase in flow rate because the curve is essentially asymptotic. Although the loss coefficient for the crack is unknown, the value chosen is clearly conservative. To make the calculations simpler, the licensee chose to characterize the post-accident containment atmosphere flow as fully choked flow with sonic velocity at the exit. The equations were simplified because the Mach number at the exit equals one in this instance. Although the equations were simplified, it is not expected that the flow is fully choked; rather, it is expected that the velocity would be less than Mach one. However, assuming fully choked flow is conservative.

Conservative inputs to the calculations were also chosen. The specific heat for air was chosen to characterize the post-accident containment atmosphere. This was conservative because the use of steam or an air steam mixture, as would be expected in containment after an accident, would have yielded less limiting results. The TS leak rate was used for the normal operating primary to secondary leakage rather than the lower administrative leak rate. The containment pressure used for the calculations was the design limit rather than the peak calculated containment pressure. The maximum peak containment pressure calculated for a large-break LOCA is less than the design pressure of 60 psi. If the peak containment pressure was used, the results would have been lower.

In performing this calculation, the licensee used fundamental engineering principles and equations. The modeling assumptions were chosen conservatively and the inputs to these calculations were also conservatively chosen. As a result, the licensee's calculated flow rate (0.9 SCFM) should reasonably bound the true flow rate that could occur after a large-break LOCA and are

appropriate to use in assessing the offsite dose consequences. Although the staff did not independently recalculate the flow rates, the staff finds the approach acceptable for this application.

3.3 Radiological Consequences Analysis

Previous radiological consequences analysis of a large-break LOCA did not consider a release path from the primary system to the environment through a depressurized secondary system. The licensee subsequently revised the large-break LOCA dose calculation to include the assumption of a release path to the environment through the secondary system. The licensee calculated radiological doses and compared the results to previous large-break LOCA doses and the acceptance criteria presented in 10 CFR Part 100 for the exclusion area boundary and low population zone and General Design Criterion 19 for the control room. The licensee stated in its applications that calculated doses are below the acceptance criteria presented in 10 CFR 100 and General Design Criterion 19.

The staff has verified the licensee's dose calculations by performing an independent radiological consequence analysis that accounts for the increase in radioactivity released to the environment from a new release path through the depressurized secondary system. The staff calculated radiological doses to the thyroid, which are more limiting than whole body doses in terms of compliance with acceptance criteria, based on the results of previous staff LOCA analyses for PVNGS and information contained in the licensee's submittals. For the large-break LOCA dose calculation, the staff accounted for the increased release of radioactivity (0.9 SCFM) by assuming a fifty percent increase in the containment leak rate (1.8 SCFM) previously used in Supplement No. 5 of NUREG-0857, "Safety Evaluation Report Related to the Operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3," November 1983, and the staff's SE supporting Amendment Nos. 64, 50, and 37 to Facility Operating License Nos. NPF-41, NPF-51, and NPF-74, respectively, dated September 8, 1992. The results of the large-break LOCA dose calculation indicate that a fifty percent increase in radioactivity release through a new pathway are within the acceptance criteria presented in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (SRP) Sections 6.4, 15.6.5, and Appendices A and B. The revised assumptions used to calculate the large-break LOCA doses are listed in Table 1 and the results are listed in Table 2.

3.4 Conclusion

The staff has reviewed the licensee's analyses and verified the licensee's dose calculations by performing an independent radiological consequence analysis. We conclude that the radiological consequences of a large-break LOCA with a new release pathway that increases radioactivity releases by fifty percent of the containment leak rate are within the acceptance criteria presented in SRP 6.4, 15.6.5, and Appendices A and B. The staff also concludes that the new release pathway is credible and that the licensee's calculated flow rates through the new release pathway are conservative and appropriate for assessing the radiological consequences of a large-break LOCA.

Therefore, the staff finds the licensee's revised large-break LOCA radiological consequence analysis 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

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact was published in the Federal Register on March 14, 1997 (62 FR 12255).

Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of the amendments will not have a significant effect on the quality of the human environment.

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.

Attachments: 1. Table 1
2. Table 2

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TABLE 1

INPUT PARAMETERS FOR PALO VERDE UNITS 1, 2, AND 3
EVALUATION OF A LARGE BREAK LOSS-OF-COOLANT ACCIDENT

Power level, Mwt	3954
Fraction of core inventory available for leakage, %	
Iodines	25
Noble Gases	100
Initial iodine composition in containment, %	
Elemental	91
Organic	4
Particulate	5
Primary Containment volumes, ft^3	
Main sprayed	2.27×10^6
Auxiliary sprayed	0.20×10^6
Unsprayed	0.15×10^6
Primary containment leak rate, %/day	
0-24 hours after accident	0.15*
After 24 hours	0.075*
Containment spray iodine removal efficiencies, hr^{-1}	
Elemental (main sprayed region)	20
(auxiliary sprayed region)	10.3
Organic	0
Particulate (main sprayed region)	0.34
(auxiliary sprayed region)	0.11
Decontamination factor	
Elemental iodine	6.51
Particulate iodine	50
ECCS leak rate, cc/hr	1500**
Containment sump volume, ft^3	56,532

* includes 50% increased leak rate to account for new release path
** based on licensee's TMI Action Plan III.D.1.1 leakage reduction program

TABLE 1

INPUT PARAMETERS FOR PALO VERDE UNITS 1, 2, AND 3
EVALUATION OF A LARGE BREAK LOSS-OF-COOLANT ACCIDENT
(continued)

Atmospheric dispersion factors		sec/m^3
Exclusion area boundary	(0-2 hrs)	3.10×10^{-4}
Low population zone	(0-8 hrs)	5.10×10^{-5}
	(8-24 hrs)	3.80×10^{-5}
	(1-4 days)	2.00×10^{-5}
	(4-30 days)	8.30×10^{-6}
Control room	(0-8 hrs)	2.19×10^{-3}
	(8-24 hrs)	1.29×10^{-3}
	(1-4 days)	5.04×10^{-4}
	(4-30 days)	1.45×10^{-4}
Control room parameters		
Volume (ft^3)		161,000
Makeup flow (cfm)		1,000
Makeup and recirculation flow (cfm)		25,740
Makeup and recirculation filter efficiency (%)		
elemental, organic iodines		95
particulate iodine		99
Unfiltered inleakage (cfm)		10
Occupancy factor	(0-24 hrs)	1.0
	(1-4 days)	0.6
	(4-30 days)	0.4

TABLE 2

CALCULATED THYROID DOSES FOR PALO VERDE UNIT 1, 2, AND 3 LOSS-OF-COOLANT ACCIDENT

	DOSE (rem)		
LOCATION	Containment Leakage	ESF Leakage	Total
EAB	191.1	0.2	191.3*
LPZ	217.5	0.6	218.1*
Control Room	20.4	0.1	20.5**

* NUREG-0800 Acceptance Criterion = 300 rem thyroid
** NUREG-0800 Acceptance Criterion = 30 rem thyroid