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SUBJECT: Application for amends to licenses NPF-41,NPF-51 & NPF-74, increasing spent fuel pool storage capacity by crediting soluble boron & decay time in safety analysis for spent fuel pool storage racks.

See Proposed Change to Tech Spec.

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APS

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102-04294-JML/SAB/RKR
June 8, 1999

10 CFR 50.90
10 CFR 50.91

U.S. Nuclear Regulatory Commission
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Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2 and 3
Docket Nos. STN 50-528/529/530
Request for Amendment to Technical Specifications 3.7.15, Fuel Storage Pool Boron Concentration; 3.7.17, Spent Fuel Assembly Storage; and 4.3.1, Criticality

Arizona Public Service Company (APS) requests an amendment to Technical Specifications 3.7.15, Fuel Storage Pool Boron Concentration; 3.7.17, Spent Fuel Assembly Storage; and 4.3.1, Criticality, for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3. The proposed amendment would increase spent fuel pool storage capacity by crediting soluble boron and decay time in the safety analysis for the spent fuel pool storage racks. The change is necessary to increase the spent fuel storage limit. The proposed amendment would also increase the maximum radially averaged fuel enrichment from 4.3 weight percent to 4.8 weight percent. This change will provide additional flexibility in future core designs. The revised Technical Specification Bases are also provided (see enclosure 2) as supporting information to facilitate the approval of the Technical Specification changes.

Provided in enclosure 1 to this letter are the following sections which support the proposed Technical Specification amendments:

A. Need for the Amendment
B. Description of the Proposed Technical Specification Amendment
C. Purpose of the Technical Specification
D. Safety Analysis of the Proposed Technical Specification Amendment
E. No Significant Hazards Consideration Determination
F. Environmental Consideration
G. Revised Technical Specification Pages
H. Retyped Technical Specification Pages

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Also attached to this submittal are enclosure 3 "Palo Verde Spent Fuel Pool Criticality Analysis" (CENPD-395), enclosure 4 "Palo Verde Nuclear Generating Station Spent Fuel Pool Boron Dilution Analysis" (13-NS-C44), and enclosure 5 "Additional Information Used in the Palo Verde Spent Fuel Pool Criticality Analysis."

In accordance with the PVNGS Quality Assurance Program, the Plant Review Board and Offsite Safety Review Committee have reviewed and concurred with this proposed amendment. By copy of this letter this request is being forwarded to the Arizona Radiation Regulatory Agency (ARRA) pursuant to 10 CFR 50.91(b)(1).

APS requests that the Technical Specification amendment be approved by December 31, 1999. This will allow adequate time to reconfigure the Unit 2 spent fuel pool in the new four region arrangement prior to the receipt of new fuel for the next Unit 2 refueling outage scheduled for the Fall of 2000.

APS requests that the Technical Specification amendment be effective for Units 1, 2, and, 3 on or before May 31, 2000. This date is approximately 30 days after the scheduled completion of the Unit 3 Spring 2000 refueling outage.

APS has previously received amendments to the PVNGS Technical Specifications to increase spent fuel pool storage capacity and to increase the maximum fuel assembly radially averaged enrichment. Amendments 82, 69, and 54 to the Units 1, 2, and 3 Technical Specifications, respectively, increased the storage limits in the spent fuel pool. These Technical Specification amendments separated the spent fuel pool into three regions based on fuel burnup and initial radially averaged enrichment. Amendments 24, 18, and 6 to the Units 1, 2, and 3 Technical Specifications, respectively, increased the maximum fuel assembly radially averaged enrichment from 4.0 to 4.05 weight percent U-235. Amendments 74, 60, and 46 to the Units 1, 2, and 3 Technical Specifications, respectively, increased the maximum fuel assembly radially averaged enrichment from 4.05 to 4.3 weight percent U-235.

As part of the development of this submittal, APS reviewed submittals and <u>Federal Register</u> notices for other facilities requesting similar changes to increase spent fuel pool capacity by taking credit for soluble boron. This review included submittals and <u>Federal Register</u> notices for St. Lucie Unit 2 and Prairie Island Nuclear Generating Plant.

No commitments are being made to the NRC by this letter.

Should you have any questions, please contact Scott A. Bauer at (623) 393-5978.

Sincerely,

JML/SAB/RKR/mah

Enclosure

cc: E. W. Merschoff (all w/Enclosure)
M. B. Fields
J. H. Moorman
A. V. Godwin

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, J. M. Levine, represent that I am Senior Vice President - Nuclear, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.

J. M. Levine

Sworn To Before Me This 8th Day Of June, 1999.

Notary Public

My Commission Expires

"OFFICIAL SEAL"
A. K. Krainik
Notary Public-Arizona
Maricopa County
My Commission Expires 5/6/2000

ENCLOSURE 1

Proposed Amendment to Units 1, 2 and 3 Technical Specifications 3.7.15, 3.7.17, and 4.3.1

9908150275

Proposed Amendment to Units 1, 2 and 3 Technical Specifications 3.7.15, 3.7.17, and 4.3.1

A. NEED FOR THE AMENDMENT

The fuel storage racks in each PVNGS spent fuel pool have a total of 1329 storage cells, each capable of holding a spent fuel assembly. Assemblies are currently stored within the fuel racks in two-out-of-four, three-out-of-four, and four-out-of-four configurations depending on the initial radially-averaged enrichment and the burnup of the assembly, with no credit taken for decay time. The PVNGS Updated Final Safety Analysis Report (UFSAR) section 9.1.2, "Spent Fuel Storage," establishes allowable storage locations in the spent fuel pool that limit the maximum number of fuel assemblies that can be stored in a spent fuel pool to no more than 1034 fuel assemblies in the Unit 1 and 3 spent fuel pools, and no more than 1033 fuel assemblies in the Unit 2 spent fuel pool. For normal operating conditions, no credit is currently taken for soluble boron in the spent fuel pool even though the spent fuel pool is always filled with borated water.

As of May 1999, Unit 1 has 648 assemblies in its pool, Unit 2 has 740 assemblies in its pool, and Unit 3 has 664 assemblies in its pool. PVNGS currently performs a full core offload (241 fuel assemblies) during refueling outages. Based on current projections for fuel assemblies permanently discharged to the spent fuel pool (an average of 100 assemblies per refueling outage), the Unit 2 spent fuel pool does not have the capacity to fully offload the core and load the new fuel for the next refueling outage (scheduled for Fall 2000). In addition, following startup from the Fall 2000 refueling outage, the Unit 2 spent fuel pool will not have the capacity to fully offload the core. The Units 1 and 3 spent fuel pools will not have the capacity to fully offload the core and load the new fuel for the Spring 2001 and Fall 2001 refueling outages, respectively. Following startup from these refueling outages, the Units 1 and 3 spent fuel pools would also not have the capacity to fully offload the core.

Palo Verde is planning on implementing dry cask storage in the second half of 2002. Since all three Units spent fuel pools will lose the capacity to fully offload the core prior to that time, Palo Verde needs to increase the maximum number of fuel assemblies that can be stored in the spent fuel pool. The proposed amendment takes credit for fuel assembly burnup, for soluble boron, and for fuel assembly configuration in the spent fuel pool criticality analysis and increases the maximum number of fuel assemblies to be stored in the spent fuel pool to 1205 fuel assemblies. The proposed amendment also allows credit to be taken for decay time to provide additional burnup credit and changes the spent fuel pool storage configuration from three regions to four regions.

The proposed amendment also increases the maximum radially averaged fuel enrichment from 4.3 weight percent to 4.8 weight percent. This change is being made to take advantage of the higher enrichment limit (4.8 weight percent) used in the criticality analysis (enclosure 3). The higher enrichment limit will also provide additional flexibility in future core designs.

B. DESCRIPTION OF THE PROPOSED TECHNICAL SPECIFICATION AMENDMENT

The Applicability of Technical Specification 3.7.15, "Fuel Storage Pool Boron Concentration" is being revised to make the LCO applicable whenever any fuel assembly is stored in the fuel storage pool. The LCO is currently applicable "When fuel assemblies are stored in the fuel storage pool and a fuel storage pool verification has not been performed since the last movement of fuel assemblies in the fuel storage pool." The new spent fuel pool criticality analysis (enclosure 3) relies on the boron concentration (900 ppm) in addition to storage configuration to maintain the spent fuel pool $k_{eff} \leq 0.95$. This is much less than the minimum 2150 ppm required by Technical Specification 3.7.15. The analysis assumes mislocation of a single new assembly into the worst case spent fuel pool storage location for determination of the minimum soluble boron concentration. Therefore, since the analysis takes credit for soluble boron whenever fuel is in the spent fuel pool, the section of the applicability that states "a fuel storage pool verification has not been performed since the last movement of fuel assemblies in the fuel storage pool" is no longer sufficient by itself to ensure spent fuel pool $k_{eff} \leq 0.95$ and is being deleted. The applicability is also being revised to be consistent with the applicability for Technical Specification 3.7.17 ("Whenever any fuel assembly is..."). Since the applicability is being revised to remove the option to exit the applicability if fuel storage pool verification has been performed, Required Action A.2.2 "Initiate action to perform a fuel storage pool verification" is no longer necessary and is also being deleted. Technical Specification 3.7.15 currently has a surveillance requirement (SR 3.7.15.1) that requires that the spent fuel pool boron concentration be verified within its limit every seven days. The proposed amendment will require that this surveillance requirement be applicable at all times when fuel is stored in the spent fuel pool.

Technical Specification 3.7.17, "Spent Fuel Assembly Storage" LCO and SR 3.7.17.1 are being revised to include decay time along with modified initial enrichment and burnup requirements to determine the region in which each fuel assembly can be stored. The current fuel assembly burnup versus initial enrichment figure used to determine storage regions does not take credit for decay time. The new spent fuel pool criticality analysis (enclosure 3) uses decay time to provide an additional burnup credit in regions 3 and 4. Because of the increase from three regions to four regions and the use of decay time to provide an additional burnup credit, Figure 3.7.17-1 "Assembly Burnup versus Initial Enrichment" (for all three zones) is being replaced with Figure 3.7.17-1 "Assembly Burnup versus Initial Enrichment for Region 2," Figure 3.7.17-2 "Assembly Burnup versus Initial Enrichment for Region 3," and Figure 3.7.17-3 "Assembly Burnup versus Initial

Enrichment for Region 4." The maximum radially averaged enrichment allowed in the figures was also increased from 4.3 weight percent to 4.8 weight percent.

Technical Specification 4.3.1, "Criticality" is being revised as follows:

1. Technical Specification 4.3.1.1.a is revised to increase the maximum radially averaged U-235 enrichment from 4.3 weight percent to 4.8 weight percent.
2. Technical Specification 4.3.1.1.b is being revised to increase the maximum k_{eff} from ≤0.95 to <1.0 if fully flooded with unborated water. The statement "allowance for uncertainties" is also being revised to state "allowance for biases and uncertainties."
3. New Technical Specification 4.3.1.1.c is added to require "k_{eff}≤0.95 if fully flooded with water borated to 900 ppm, which includes an allowance for biases and uncertainties as described in Section 9.1 of the UFSAR."
4. Technical Specification 4.3.1.1.c is renumbered as 4.3.1.1.d.
5. Technical Specification 4.3.1.1.d for region 1 is renumbered as 4.3.1.1.e. This Technical Specification is also revised to add references to new region 4 and new figures 3.7.17-2 and 3.7.17-3.
6. Technical Specification 4.3.1.1.e for region 2 is renumbered as 4.3.1.1.f. The description of region 2 is revised from "a three-out-of-four storage pattern" to "a repeating 3-by-4 storage pattern in which Region 2 (two-out-of-twelve) assemblies and Region 4 (ten-out-of twelve) assemblies are mixed...." This Technical Specification is also revised to add references to new region 4 and new figures 3.7.17-2 and 3.7.17-3. The sentence that describes what fuel can be stored in region 2 is changed from "Fuel that qualifies..." to "Only fuel that qualifies...."
7. Technical Specification 4.3.1.1.f for region 3 is renumbered as 4.3.1.1.g. This Technical Specification is also revised to add references to new region 4 and new figures 3.7.17-2 and 3.7.17-3, and to delete the reference to figure 3.7.17-1.
8. New Technical Specification 4.3.1.1.h is added for region 4.
9. Technical Specification 4.3.1.2.a is revised to increase the maximum radially averaged U-235 enrichment from 4.3 weight percent to 4.8 weight percent.
10. Technical Specifications 4.3.1.2.b and 4.3.1.2.c are being revised from stating "allowance for uncertainties" to "allowance for biases and uncertainties."

These changes satisfy the provisions of paragraphs (b)(4) and (b)(7) of 10 CFR 50.68, "Criticality accident requirements."

C. PURPOSE OF THE TECHNICAL SPECIFICATION

Technical Specifications 3.7.15, "Fuel Storage Pool Boron Concentration" and 3.7.17, "Spent Fuel Assembly Storage" ensure that fuel assemblies stored in the spent fuel pool will remain subcritical during normal operating conditions and postulated accident scenarios.

Technical Specification 4.3.1, "Criticality" provides applicable design features for fuel assemblies, spent fuel pool storage racks, and new fuel storage racks. These design features ensure that fuel assemblies in these locations will remain subcritical during normal operating conditions and postulated accident scenarios.

D. SAFETY ANALYSIS OF THE PROPOSED TECHNICAL SPECIFICATION AMENDMENT

Background discussion

The spent fuel storage racks at Palo Verde are designed to store up to 1329 fuel assemblies as described in Technical Specification 4.3.3, Bases for Technical Specification 3.7.17, and UFSAR sections 9.1.2 and 9.1.3. The design basis of the spent fuel cooling system, however, is to provide adequate cooling during all operating conditions (including full core offload) for only 1205 fuel assemblies (UFSAR section 9.1.3). This change does not affect the design basis spent fuel pool heat load calculation since the spent fuel pool will be limited to the design basis limit of 1205 fuel assemblies.

Prior to fuel assembly removal from the reactor vessel, the CEAs are removed from the fuel assemblies (UFSAR section 9.1.4.2.3.3). The spent fuel assemblies are loaded and stored in the spent fuel pool, without control element assemblies (CEAs) installed. Therefore, Palo Verde does not take credit for the CEAs in the spent fuel pool criticality analysis (UFSAR 9.1.2.3.1). Palo Verde does not use poison inserts in the spent fuel pool. Blocking devices are used in locations that are prohibited from containing any fuel assemblies (UFSAR 9.1.2.2.2). The location of fuel assemblies in the spent fuel pool is controlled by procedure 72DP-9NF01, "Control of SNM Transfer and Inventory."

Enclosure 3, "Palo Verde Spent Fuel Pool Criticality Analysis" (CENPD-395) describes the criticality analysis performed to credit soluble boron in the spent fuel pool and to increase the maximum radially averaged enrichment for fuel assemblies stored in the spent fuel pool. The spent fuel pool is currently licensed with a maximum effective multiplication factor (k_{eff}) of 0.95 without taking credit for soluble boron in the spent fuel pool. Technical Specification 4.3.1.1.b currently requires a $k_{eff} \leq 0.95$ with the spent fuel pool fully flooded with unborated water. The proposed amendment revises Technical Specification 4.3.1.1.b to require a $k_{eff} < 1.0$ (including all biases and uncertainties) with

the spent fuel pool fully flooded with unborated water and adds new Technical Specification 4.3.1.1.c requiring a $k_{eff} \leq 0.95$ (including all biases and uncertainties) with the spent fuel pool fully flooded with water borated to 900 ppm. The criticality analysis shows that the spent fuel pool will remain subcritical even if the boron concentration was reduced to zero assuming all fuel is loaded in accordance with the burnup versus enrichment curves. This satisfies the requirements of revised Technical Specification 4.3.1.1.b. The 900 ppm boron, which is sufficient to compensate for positive reactivity associated with the most limiting single fuel assembly mishandling accident, is much less than the 2150 ppm minimum concentration required by Technical Specification 3.7.15. Additional information relating to fuel assembly design is included in UFSAR section 4.2 "Fuel System Design."

Enclosure 4, "Palo Verde Nuclear Generating Station Spent Fuel Pool Boron Dilution Analysis" (13-NS-C44) evaluates the spent fuel pool for the possibility of a spent fuel pool boron dilution due to operational or accidental events. The analysis was performed to verify that the Palo Verde design has sufficient margin to detect and mitigate the boron dilution prior to exceeding the spent fuel pool k_{eff} limit of 0.95. The analysis determined that the most limiting boron dilution event was a fire in the fuel building. Assuming a spent fuel pool average bulk boron concentration of 2150 ppm (Technical Specification 3.7.15), this event would result in boron dilution to an average bulk boron concentration of 1900 ppm. This is greater than the 900 ppm boron concentration required by new Technical Specification 4.3.1.1.c.

Enclosure 5 provides additional information in support of enclosure 3. Based on a review of submittals for other facilities, Palo Verde identified additional information that is needed to support the discussion and analysis in enclosure 3. The information is presented in a question and answer format based on this review.

There are three events of concern related to the changes described in the proposed amendment that were reviewed. They are:

1) Fuel handling accident,
2) Fuel misloading, and
3) Boron dilution event.

Fuel handling accident

The fuel handling accident is discussed in UFSAR section 15.7.4.1, "Fuel Handling Accident Outside Containment." The fuel handling accident that is of concern in the UFSAR is the dropping of a single fuel assembly during fuel handling. Changing the fuel assembly storage array and burnup versus enrichment criteria, crediting soluble boron in the spent fuel pool, and increasing enrichment does not effect the method of handling spent fuel or the design of the fuel handling equipment. The fuel assembly design (clad material and structural components) is not affected by this change. The

current fuel handling accident analysis for Palo Verde assumes a TID-14844 (Technical Information Document), "Calculation of Distance Factors for Power and Test Reactor Sites," equilibrium source term. The TID-14844 equilibrium source term is based on rated core thermal power and an infinite cycle. Therefore, the existing source term is independent of fuel assembly enrichment and fuel cycle length. As such, the proposed increase in maximum radially averaged enrichment for fuel assemblies stored in the spent fuel storage racks and the new fuel storage racks from 4.3 weight percent to 4.8 weight percent does not affect the dose calculation for the Palo Verde fuel handling accident analysis. Changing the fuel assembly storage array and burnup versus enrichment criteria, crediting soluble boron in the spent fuel pool, and increasing enrichment does not affect the spent fuel pool water level, water depth over a damaged fuel assembly, or the systems (e.g., fuel building essential ventilation system and radiation monitoring system) that may be available to reduce the doses associated with the current fuel handling accident analysis for Palo Verde. Therefore, the radiological consequences of the fuel handling accident discussed in UFSAR section 15.7.4.1 remain bounding with these changes and are less than 10CFR100 limits.

Fuel misloading

Section 4.4.4, "Fuel Mishandling Calculational Results" of enclosure 3 provides the results of the analysis of a single limiting fuel assembly misloaded into regions in the spent fuel pool intended for less reactive fuel assemblies. The maximum increase in spent fuel pool k_{eff} due to a single misloaded fuel assembly was one of the factors used to determine the minimum soluble boron credit requirement (see section 5.0, "Soluble Boron Requirements" of enclosure 3). The minimum soluble boron credit required to maintain $k_{eff} \leq 0.95$ (including all biases and uncertainties) assuming the most limiting single fuel assembly misloading event was determined to be 900 ppm. This is much less than the Technical Specification 3.7.15 minimum boron requirement of 2150 ppm. Therefore, taking credit for soluble boron in the spent fuel pool to offset an increase in the number of fuel assemblies to be stored in the spent fuel pool and increasing the maximum radially averaged enrichment does not affect the consequences of a fuel assembly misloading event since the k_{eff} for the spent fuel pool remains less than 0.95 (including all biases and uncertainties).

Boron dilution event

Enclosure 4 evaluates the spent fuel pool for the possibility of a spent fuel pool boron dilution due to operational events or accidents. The analysis was performed to verify that the Palo Verde design has sufficient margin to detect and mitigate the boron dilution prior to exceeding the spent fuel pool k_{eff} limit of 0.95. The analysis determined that the most limiting boron dilution event was a fire in the fuel building. Assuming a spent fuel pool average bulk boron concentration of 2150 ppm (Technical Specification 3.7.15), this event would result in dilution to an average bulk boron concentration of 1900 ppm. This is much greater than the minimum 900 ppm boron concentration required to maintain

k_{eff}≤0.95 and required by new Technical Specification 4.3.1.1.c. Therefore, increasing the capacity of the spent fuel pool by taking credit for soluble boron and increasing the fuel assembly radially averaged enrichment will not result in a criticality as a result of a boron dilution event.

Additional analyses

In addition to the three events discussed above, additional analyses were also performed to verify that the increase in the maximum radially averaged enrichment for fuel assemblies from 4.3 weight percent to 4.8 weight percent did not affect the requirements for the new fuel storage racks, the new fuel elevator, the fuel upender and transfer machine, and the intermediate fuel storage rack.

Technical Specification 4.3.1.2 requires that the new fuel storage racks be designed and maintained with a k_{eff}≤0.95 when fully flooded with unborated water and k_{eff}≤0.98 if moderated with aqueous foam. The current analysis of record assumed a maximum radially averaged fuel enrichment of 4.3 weight percent to determine that the k_{eff} for the new fuel storage racks met these limits. A new analysis was performed to determine that the proposed increase in maximum radially averaged enrichment (up to 4.8 weight percent) would still meet the limits. The new analysis conservatively assumed a maximum radially averaged enrichment of 5.0 weight percent U-235. Using a maximum radially averaged fuel enrichment of 5.0 weight percent U-235, the new analysis determined that the k_{eff} for the new fuel storage racks would continue to be ≤0.95 when fully flooded with unborated water and ≤0.98 if moderated by aqueous foam (including all biases and uncertainties). Therefore, the increased radially averaged enrichment will not affect the requirement to maintain the new fuel subcritical (Technical Specification 4.3.1.2.b and c) when stored in the new fuel storage racks.

The current analysis of record for the new fuel elevator, the fuel upender and transfer machine, and the intermediate fuel storage rack assumes a maximum radially averaged fuel enrichment of 4.3 weight percent with a resultant k_{eff} in unborated water of ≤0.95. Using a radially averaged enrichment of 5.0 weight percent U-235, the new analysis determined that the k_{eff} in unborated water would continue to be ≤0.95 (including all biases and uncertainties). Therefore, the increased radially averaged enrichment will not affect the requirement to maintain the fuel subcritical when in the new fuel elevator, the fuel upender and transfer machine, or the intermediate fuel storage rack.

The enclosure 3 analysis also provides additional burnup credit for fuel assemblies stored in regions 3 and 4 based on decay time. Following its discharge from the reactor, the reactivity of a spent fuel assembly will decrease due to the decay of long half-life isotopes products. The most important decay chain involves the decay of Plutonium-241 into Americium-241. Plutonium-241 is a fissile isotope that contributes to positive reactivity in high burnup assemblies, whereas Americium-241 is primarily a neutron absorber that contributes to negative reactivity. With a half-life of

approximately 14 years, Plutonium-241 decay over the duration that a fuel assembly is stored in the spent fuel pool is significant and provides a reduction in fuel assembly k_{eff} over time. Therefore, increasing decay time reduces fissile inventory and increases poison inventory (a negative effect on k_{eff}). As such, for a given decay time, the burnup requirement (for Regions 3 and 4) can be reduced to maintain the same k_{eff} limit.

E. <u>NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION</u>

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility involves no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involve a significant reduction in a margin of safety. A discussion of these standards as they relate to this amendment request follows:

<u>Standard 1</u> -- Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

No. Analyses to support the proposed amendment have been developed using conservative methodology. An analysis and review of relevant plant operations shows that there is no significant increase in the probability of an accident previously evaluated. The analysis of the potential events and of the increase in fuel enrichment discussed below also show that there is no significant increase in the consequences of an accident previously evaluated.

The fuel handling accident described in the Updated Final Safety Analysis Report (UFSAR) section 15.7.4, "Radiological Consequences of Fuel Handling Accidents" was reviewed for this proposed amendment. The fuel handling accident that is of concern in the UFSAR is the dropping of a single fuel assembly during fuel handling. Changing the fuel assembly storage array and burnup versus enrichment criteria, crediting soluble boron in the spent fuel pool, and increasing enrichment does not effect the method of handling spent fuel or the design of the fuel handling equipment. The fuel assembly design (clad material and structural components) is not affected by this change. Therefore, this change will not increase the probability that a fuel handling accident will occur.

The current fuel handling accident analysis for Palo Verde assumes a TID-14844 (Technical Information Document), "Calculation of Distance Factors for Power and Test Reactor Sites" equilibrium source term. The TID-14844 equilibrium source term is based on rated core thermal power and an infinite cycle. Therefore, the source term is independent of fuel assembly enrichment and fuel cycle length. As such, the proposed

increase in maximum radially averaged enrichment for fuel assemblies stored in the spent fuel storage racks and the new fuel storage racks from 4.3 weight percent to 4.8 weight percent does not affect the dose calculation for the Palo Verde fuel handling accident analysis. Changing the fuel assembly storage array and burnup versus enrichment criteria, crediting soluble boron in the spent fuel pool, and increasing enrichment does not affect the spent fuel pool water level, water depth over a damaged fuel assembly, or the systems (e.g., fuel building essential ventilation system and radiation monitoring system) that may be available to reduce the doses associated with the current fuel handling accident analysis for Palo Verde. The radiological consequences of the fuel handling accident discussed in UFSAR section 15.7.4.1 remain bounding with these changes and are less than 10CFR100 limits, and therefore, this change will not increase the consequences of a fuel handling accident.

Fuel assembly placement in the spent fuel pool will continue to be controlled by approved procedures and in accordance with the Technical Specification fuel storage configuration limits as it currently is. Therefore, this change will not increase the probability of an accidental misloading of a fuel assembly in the spent fuel pool.

The consequences of a single fuel assembly misloaded into a region in the spent fuel pool intended for a less reactive fuel assembly were reviewed based on the proposed amendment. The maximum increase in the spent fuel pool effective multiplication factor (k_{eff}) due to a single misloaded fuel assembly was one of the factors used to determine the minimum soluble boron credit requirement. The minimum soluble boron credit required to maintain $k_{eff} \leq 0.95$ (including all biases and uncertainties) assuming the most limiting single fuel assembly misloading event was determined to be 900 ppm. This is much less than the Technical Specification 3.7.15, "Fuel Storage Pool Boron Concentration" minimum boron requirement of 2150 ppm. Therefore, taking credit for soluble boron in the spent fuel pool to offset an increase in the number of fuel assemblies stored in the spent fuel pool and increasing maximum radially averaged enrichment does not effect the consequences of a fuel assembly misloading event since the k_{eff} for the spent fuel pool remains less than 0.95.

The spent fuel pool cooling requirements are described in UFSAR section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System." The design basis of the spent fuel cooling system is to provide adequate cooling to the spent fuel during all operating conditions (including full core offload) for up to 1205 fuel assemblies. The proposed amendment will increase the spent fuel pool storage limit of 1205 assemblies. This change does not affect the design basis spent fuel pool heat load calculation since the spent fuel pool will be limited to the design basis limit of 1205 fuel assemblies. This change does not affect the operation or function of the spent fuel pool cooling system. Therefore, since the design basis and operation of the spent fuel pool cooling system are not affected by this change, this change will not increase the probability or the consequences of a loss of spent fuel pool cooling event.

Technical Specification 4.3.1.2 requires that the new fuel storage racks be designed and maintained with a $k_{eff} \leq 0.95$ when fully flooded with unborated water and $k_{eff} \leq 0.98$ if moderated with aqueous foam (including all biases and uncertainties). The current analysis of record assumes a maximum radially averaged fuel enrichment of 4.3 weight percent to determine that the k_{eff} for the new fuel storage racks met these limits. A new analysis was performed to determine that the proposed increase in maximum radially averaged enrichment (i.e., from 4.3 to 4.8 weight percent) would still meet the limits. The new analysis conservatively assumed a radially averaged enrichment of 5.0 weight percent U-235. Using a maximum radially averaged fuel enrichment of 5.0 weight percent U-235, the new analysis determined that the k_{eff} for the new fuel storage racks would continue to be ≤0.95 when fully flooded with unborated water and ≤0.98 if moderated by aqueous foam (including all biases and uncertainties). The increased radially averaged enrichment will not affect the requirement to maintain the new fuel subcritical (Technical Specification 4.3.1.2.b and c) when stored in the new fuel storage racks. There will be no dose consequences associated with these changes, since the new fuel will continue to remain subcritical at all times. Therefore, since the criticality requirements are maintained, this change will not involve a significant increase in the probability or consequences of a criticality event in the new fuel storage racks.

The current analysis of record for the new fuel elevator, the fuel upender and transfer machine, and the intermediate fuel storage rack assumes a maximum radially averaged fuel enrichment of 4.3 weight percent with a resultant k_{eff} in unborated water of ≤0.95. Using a radially averaged enrichment of 5.0 weight percent, the new analysis determined that the k_{eff} in unborated water would continue to be ≤0.95 (including all biases and uncertainties). The increased radially averaged enrichment will not affect the requirement to maintain the fuel subcritical when in the new fuel elevator, the fuel upender and transfer machine, or the intermediate fuel storage rack. There will be no dose consequences associated with these changes, since the fuel will continue to remain subcritical at all times. Therefore, since the criticality requirements are maintained, this change will not involve a significant increase in the probability or consequences of a criticality event in this equipment.

Therefore, the proposed change crediting soluble boron and the increased maximum radially averaged enrichment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

<u>Standard 2</u> -- Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

No. The proposed amendment credits the negative reactivity associated with some of the soluble boron present in the spent fuel pool. Based on these changes, an analysis was performed to verify that the Palo Verde design has sufficient margin to detect and mitigate a boron dilution of the spent fuel pool prior to exceeding the spent fuel pool k_{eff} limit of

0.95 (including all biases and uncertainties). The analysis determined that the most limiting boron dilution event was a fire in the fuel building. Assuming a spent fuel pool average bulk boron concentration of 2150 ppm (Technical Specification 3.7.15), this event would result in boron dilution to a minimum average bulk boron concentration of 1900 ppm. This is much greater than the minimum 900 ppm boron concentration required to maintain $k_{eff} \leq 0.95$ (assuming the most limiting single fuel assembly misloading event). Therefore, the spent fuel pool will remain subcritical following a boron dilution event. The analysis shows that there is no credible boron dilution event that would result in an inadvertent criticality in the spent fuel pool. In addition, the criticality analysis shows that even if the spent fuel pool were filled with unborated water, the spent fuel pool would remain subcritical.

Taking credit for soluble boron does not make any change to the design or operation of the spent fuel racks, fuel assemblies, fuel handling equipment, or plant systems that can deliver non-borated water to the spent fuel pool. Increasing the maximum allowable radially averaged enrichment of the fuel assemblies in storage does not make any change to the design or operation of the fuel assemblies except to increase the allowed reactivity and fission product inventory of future assemblies, both of which are bounded by the new criticality analyses and the current fuel handling accident analysis (UFSAR 15.7.4). Since system interfaces and operating characteristics remain the same, no new fuel handling-related accident can be postulated.

Therefore, the proposed change crediting soluble boron and the increased maximum radially averaged enrichment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Standard 3 -- Does the proposed change involve a significant reduction in a margin of safety?

No. The Technical Specification changes in the proposed amendment, the proposed spent fuel pool storage configuration, and the Technical Specification 3.7.15 requirement for minimum spent fuel boron concentration provide sufficient safety margin to ensure that the fuel assemblies stored in the spent fuel pool will remain subcritical. The criticality analysis, performed using the approved NRC methodology, shows that the minimum spent fuel pool soluble boron concentration in current Technical Specifications (2150 ppm) will maintain k_{eff} less than the maximum limit of 0.95. The criticality analyses determined that even with the spent fuel pool filled with unborated water, k_{eff} would remain below 1.0 (including all biases and uncertainties). Soluble boron is used to offset uncertainties, tolerances, and off-normal conditions and to provide subcritical margin so that the spent fuel pool k_{eff} will remain less than or equal to 0.95 at all times. A boron dilution was also evaluated and it was determined that the spent fuel pool boron concentration could not be reduced below the minimum boron concentration (900 ppm)

required by the criticality analysis. Therefore, even with a boron dilution event the spent fuel pool k_{eff} will remain less than or equal to 0.95.

Therefore, the proposed change crediting soluble boron and the increased maximum radially averaged enrichment does not involve a significant reduction in a margin of safety.

Based on the responses to these three criterions, APS has concluded that the proposed amendment involves no significant hazards consideration.

F. ENVIRONMENTAL CONSIDERATION

APS has determined that the proposed amendment involves no changes in the amount or type of effluent that may be released offsite, and results in no increase in individual or cumulative occupational radiation exposure. As described above, the proposed Technical Specification amendment involves no significant hazards consideration and, as such, meets the eligibility criteria for categorical exclusion set forth in 10CFR 51.22(c)(9).

G. REVISED TECHNICAL SPECIFICATIONS PAGES

Units 1, 2, and 3: Pages 3.7.15-1, 3.7.17-1, 3.7.17-2, 3.7.17-3, 3.7.17-4, 4.0-2, and 4.0-3

H. RETYPED TECHNICAL SPECIFICATION PAGES

Units 1, 2, and 3: Pages 3.7.15-1, 3.7.17-1, 3.7.17-2, 3.7.17-3, 3.7.17-4, 4.0-2, and 4.0-3