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

June 3, 2013

Mr. Randall K. Edington
Executive Vice President Nuclear/
Chief Nuclear Officer
Mail Station 7602
Arizona Public Service Company
P.O. Box 52034
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 - REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO ELIMINATE THE USE OF THE TERM CORE ALTERATION (TAC NOS. ME8160, ME8161, AND ME8162)

Dear Mr. Edington:

By letter dated March 8, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12076A045), as supplemented by letters dated October 11, 2012 and January 31, 2013 (ADAMS Accession Nos. ML12286A330 and ML13039A013, respectively), Arizona Public Service Company (APS, the licensee) submitted a license amendment request (LAR) for Palo Verde Nuclear Generating Station, Units 1, 2, and 3. The proposed amendment would eliminate the use of the term CORE ALTERATION from the Technical Specifications.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information provided by the licensee and determined that the additional information identified in the enclosure to this letter is needed in order for the NRC staff to complete its review. The draft copy of the request for additional information (RAI) was provided to Mr. Robert Roehler of your staff via e-mail on March 13, 2013 (ADAMS Accession No. ML13072A182). A clarifying telephone call was held on May 16, 2013 on RAI Nos. 1 and 2. A public meeting held via conference call was noticed on May 8, 2013, to discuss RAI Nos. 3 and 4. The public conference call was held on May 29, 2013. Mr. Tom Weber agreed to respond to the RAIs by July 18, 2013.

If you have any questions, please contact me at (301) 415-1530 or via e-mail at Jennivine.Rankin@nrc.gov.

Sincerely,

Jennivine Rankin

Jennivine K. Rankin, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Enclosure:
As stated

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REQUEST FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST

TO ELIMINATE THE USE OF THE TERM CORE ALTERATION

IN THE TECHNICAL SPECIFICATIONS

ARIZONA PUBLIC SERVICE COMPANY

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

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

By letter dated March 8, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12076A045), as supplemented by letters dated October 11, 2012, and January 31, 2013 (ADAMS Accession Nos. ML12286A330 and ML13039A013, respectively), Arizona Power Service Company (APS, the licensee) submitted a license amendment request (LAR) in which it proposed to remove the use of the term CORE ALTERATION from the Technical Specifications (TSs) including TS 3.9.2, "Nuclear Instrumentation," for the Palo Verde Nuclear Generating Station, Units 1, 2, and 3 (PVNGS).

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the submitted information and has determined that the following additional information is required to complete the review.

1. Chapter 15, Section 15.4.6 of the Updated Final Safety Analysis Report (UFSAR) indicates that during operational Modes 3 through 6, the operator relies upon a high neutron flux alarm from the Boron Dilution Alarm System (BDAS) to identify and terminate a boron dilution event. Pages 3 and 4 of the supplement dated January 31, 2013, indicates that the BDAS relies on the startup channels (source range monitor, SRM) in the excore neutron flux monitoring system (ENFMS) to provide source level neutron flux information. The last paragraph on page 3 indicates that the ENFMS contains nonsafety-related channels.

   The regulations in 10 CFR 50.2 define safety-related structures, systems, and components (SSCs) as those SSCs:

   > that are relied upon to remain functional during and following design basis events to assure:
   >
   > (1) The integrity of the reactor coolant boundary
   > (2) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
   > (3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth set forth in § 50.34(a)(1) or § 100.11 of this chapter, as applicable.

Enclosure

Please confirm whether the BDAS is a safety-related or nonsafety-related system. If the BDAS is a nonsafety-related system, please justify the adequacy of use of the BDAS for mitigating the consequences of the boron dilution event, a design-basis-event (DBE).

2. Adequacy of BDAS Alarm Setpoint during Core Offload in Mode 6 with one Operable SRM

2.1 Paragraph 3 on page 4 of the supplement dated January 31, 2013, states, in part, that

> Once sufficient fuel assemblies have been removed, such that one SRM (and its associated BDAS channel) has indication of higher neutron flux level than the other SRM; the BDAS channel that is associated with the SRM that has reduced neutron flux indication will automatically reduce its setpoint to a lower value, commensurate with the lower neutron flex reading on the SRM. Thus, from this point in the core offload process until the core is entirely offloaded to the spent fuel pool, the two independent BDAS channel will have different setpoint but remain capable of indicating a boron dilution event.

The above response addresses an automatic reduction in the BDAS alarm setpoint that is limited to core offloaded conditions in Mode 6 with two operable SRMs. It is unclear if the BDAS setpoint will decrease if only one SRM is operable. Please expand the information to address the adequacy of use of one operable SRM (with the other SRM failed, as specified in Condition A of TS 3.9.2) for monitoring the core sub-criticality in Mode 6 while fuel assemblies are being removed from the core in combination with occurrence of a boron dilution event.

2.2 Paragraph 4 on page 6 of the supplement dated January 31, 2013, states:

> The proposed change would only allow the addition of soluble poison to the RCS [reactor coolant system] coolant (per TS 3.9.1 and COLR [Core Operating Limits Report] item 3.9.1) that increases the uniform RCS boron concentration. Such a change would not result in a positive change in core reactivity or a reduction in core sub-criticality.

The above response does not consider the reduction in sub-criticality resulting from a boron dilution event, which may be caused by an operator error to inject unborated water into the RCS. Please explain how this is acceptable considering the fact that a boron dilution event is a UFSAR Chapter 15 DBE and would be expected to be considered in support of a TS change to remove the term, CORE ALTERATION, from the TS.

2.3 Paragraph 6 on page 6 of the supplement dated January 31, 2013 states:

> Should the remaining operable SRM (when there is reduced numbers of fuel assemblies in the core) experience a failure, such that it is inoperable, then TS Bases 3.3.12, Action B.1, describes the redundant

> methods that are to be implemented when both independent channels of BDAS are inoperable. The use of redundant methods to monitor the RCS boron concentration provides alternate indications of inadvertent boron dilution. This will allow detection with sufficient time for termination of a boron dilution event before the reactor achieves criticality, consistent with the objectives of the SRP.

The above response discussed the use of the sampling technique to monitor the RCS boron concentration as alternate indications of inadvertent boron dilution. The information does not discuss the frequency of the sampling and time to complete the sampling to assure that the operator can detect and terminate the boron dilution event before the core reaches criticality in 30 minutes, which is specified as an acceptance criterion in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," (SRP) Section 15.4.6, "Inadvertent Decrease in Boron Concentration in the Reactor Coolant System (PWR)," for a boron dilution event during the Mode 6 operation.

Please provide information to show the adequacy of the BDAS alarm setpoint based on input from only one operable SRM for conditions where the fuel assemblies are being removed from the core during the Mode 6 operation. Please (1) discuss identification of the worst case, with fuel assembly removal in a configuration that results in the least effectiveness of the operable SRM to detect neutron fluxes, and the least time available for detection and termination of a boron dilution event; and (2) show that for the identified worst case, the BDAS based on one operable SRM provides adequate, reliable, and un-ambiguous signals for the operator to detect and terminate the boron dilution event before the core reaches criticality in the required 30 minutes in the Mode 6 operation.

Also, please provide information to show that the frequency of the sampling of the RCS boron concentration is adequate and the time of completion of the sampling are sufficient in providing signals for the operator to detect and terminate the boron dilution event before the core reaches criticality in 30 minutes as specified in SRP Section 15.4.6.

3. The NRC staff's RAI dated January 3, 2013 (ADAMS Accession No. ML12362A292) states, in part, that

> Based on the SRP summarized above, please state whether a dropped source or component (or any other item allowed to be moved by CORE ALTERATIONS) can damage a fuel assembly or break and create a radioactive source term. If so, please provide the analysis that shows that the dose consequences of these scenarios are less limiting than the current fuel handling accident. Provide the assumptions, inputs and results of these analyses.

The APS supplement dated January 31, 2013 states, in part:

> Based on the conservative assumptions outlined above, the consequences of a dropped source or component (or any other item allowed to be moved by core alterations) are bounded by the current fuel handling accident analysis.
>
> Under routine plant operation, there are no sources present, other than used and new fuel assemblies. In the case of a prolonged shutdown, where a startup neutron source may be needed (e.g., all transuranium has decayed and there is not sufficient neutron flux to start-up using used fuel), the time since shutdown will be sufficiently long that the amount of the critical isotope present (i.e., iodine), is negligible. As a result, a drop of a source is bounded by the current fuel handling accident dose consequence analysis. Therefore, no specific analyses have been performed for other non-bounding drop events.
>
> PVNGS procedures control movement of heavy loads consistent with the current licensing basis with regard to NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants*. Non-bounding load drop events do not meet the criteria of 10 CFR 50.36, *Technical specifications*, subsection (c)(1)(ii) for inclusion in the TS limiting conditions for operation (LCOs). As a result, it is appropriate to remove TS controls for such non-bounding events, as proposed by the LAR elimination of the term CORE ALTERATION.

Currently, the term CORE ALTERATIONS would prohibit certain movement of loads over the reactor vessel if certain mitigating systems are not operable. It is unclear how the items listed as conservatisms in the RAI response would offset the relaxations proposed for mitigating systems (i.e., not requiring operable control room filtration or containment penetrations during CORE ALTERATIONS). The "conservatisms" listed in the RAI response either appear to be allowed operational parameters (i.e., uncertainty in core power, allowed time to offload (72 hours)) or would likely not change the calculated dose results significantly (i.e., 4.8 weight percent versus. 5.0 weight percent enrichment). Conversely, the proposed changes may have significant effects on the dose consequences. The control room filtration significantly decreases control room doses by filtering a source term and the lack of containment penetration operability can change the location of the release from containment and, therefore, change the atmospheric dispersion factors.

From a qualitative standpoint, it is not apparent how the stated assumptions would offset the increases in dose due to the proposed changes. Therefore, the staff requests a quantitative assessment of the impact of the proposed changes on the PVNGS design basis radiological analyses (i.e., control room habitability, offsite dose).

Please state whether a dropped source or component (or any other item allowed to be moved by CORE ALTERATIONS) can damage a fuel assembly or break and create a

radioactive source term. If so, please provide the analysis that shows that the dose consequences of these scenarios are less limiting than the current fuel handling accident. Provide the assumptions, inputs, methodology, and results of these analyses.

Also, please state what is meant by "non-bounding" load drop events. Please explain how a drop of a load that is not a "heavy load" is determined to be bounded by a drop of a fuel assembly.

4. The APS response dated January 31, 2013, to NRC Request 3 stated, in part, that

> In the PVNGS reactor design, control components (CEAs) are removed from the reactor vessel with the upper guide structure, so a drop of these components is not postulated, and excluded in the definition of CORE ALTERATION.

The term CORE ALTERATION is defined in the PVNGS Technical Specifications as:

> CORE ALTERATION shall be the movement or manipulation of any fuel, sources, or reactivity control components [excluding control element assemblies (CEAs) withdrawn into the upper guide structure], within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.

Please explain if the CEAs can be decoupled into a fuel assembly or removed from the upper guide assembly and moved over the reactor core. If so, please justify why these CEA drop scenarios are not considered.

If you have any questions, please contact me at (301) 415-1530 or via e-mail at Jennivine.Rankin@nrc.gov.

Sincerely,

/ra/

Jennivine K. Rankin, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Enclosure:
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ADAMS Accession No.: ML13150A081 *via email

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