Palo Verde Nuclear
Generating Station

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102-05057-CDM/TNW/JAP
February 20, 2004

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Reference: 1) Letter 102-04999-CDM/TNW/JAP, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – License Amendment Request to Various Technical Specifications Associated with Replacement of Part Length Control Element Assemblies (CEAs)," from C. D. Mauldin, APS to USNRC, dated September 17, 2003

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Docket Nos. STN 50-528/529/530
Response to NRC Request for Additional Information
Regarding License Amendment Request to Various Technical
Specifications Associated with Replacement of Part Length
Control Element Assemblies (CEAs)**

Dear Sirs:

In Reference 1, Arizona Public Service Company (APS) submitted a license amendment request (LAR) which proposed changes to various Technical Specifications associated with the replacement of Part Length Control Element Assemblies. Telephone call discussions on January 16th and 23rd, 2004 were held between the NRC staff and members of PVNGS where additional information was requested by the NRC concerning this LAR. The responses to these questions are contained in the Enclosure to this letter.

Also contained in this letter are some revised marked up Technical Specification pages (Attachment 1) and revised retyped Technical Specification pages (Attachment 2). These pages have changed since the original submittal of the LAR due to other NRC approved amendments to the PVNGS licenses. The balance of the Technical Specification pages submitted in the LAR remain the same.

A portion of the LAR (Reference 1) proposed a change to LCO 3.1.5, Condition B, concerning Control Element Assembly (CEA) position indicators. APS is withdrawing its request for NRC approval for the proposed change to LCO 3.1.5, Condition B. If further evaluation warrants a change to this specification, APS will submit a proposed change at a future date. Technical Specification page 3.1.5-2 contained the proposed change to LCO 3.1.5, Condition B. Revised "marked up" and "retyped" versions of TS page 3.1.5-2 have been included in Attachment 1 and Attachment 2 to reflect this withdrawal request.

Additionally, an incorrect value for the Part Strength CEA length was used in the LAR (Reference 1). The correct value is listed in the Enclosure to this letter.

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

Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

CDM/TNW/JAP

Enclosure

Attachments:

1. Revised Markup of Technical Specification pages
2. Revised Retyped Technical Specification pages

cc:	B. S. Mallett	NRC Region IV Regional Administrator
	M. B. Fields	NRC NRR Project Manager
	N. L. Salgado	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)

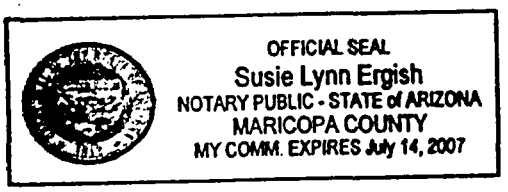
STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, 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.

David Mauldin

Sworn To Before Me This 20th Day Of February, 2004.

Notary Public



Notary Commission Stamp

Enclosure

APS Responses to Questions Concerning the Proposed LAR for Replacement of PLCEAs with PSCEAs

Arizona Public Service Company (APS) submitted a license amendment request (LAR) which proposed changes to various Technical Specifications associated with the replacement of Part Length Control Element Assemblies (Reference 1). Discussions were held between the NRC staff and members of PVNGS where additional information was requested from the NRC concerning this LAR. The responses to these questions are listed below.

NRC Question #1:

On page 11 of the amendment request, the licensee states, "Palo Verde Nuclear Generating Station (PVNGS) intends to replace the 13 existing Part Length Control Element Assemblies (PLCEAs) in each unit's reactor with Part Strength Control Element Assemblies (PSCEAs), which are functionally equivalent except for the amount and geometry of neutron absorber inserted in the core." The staff requests the licensee clarify how the rods can be "functionally equivalent" and at the same time contain a different amount of absorber in a different geometry. In addition provide: a) The methodology used to compare the PLCEAs and the PSCEAs. b) A summary of how the neighboring peaking factors, rod worths, and shutdown margin are affected by the PSCEAs in comparison to the PLCEAs under normal conditions. c) The analysis showing the insertion limits in the COLR are applicable to the new design.

PVNGS Response:

The outer physical geometry of the PSCEA fingers, which are inserted within the Power Dependent Insertion Limits (PDIL) (i.e., up to 50% insertion), is the same as the PLCEAs. The aspects of the top assembly design, which connects the fingers to each control element drive mechanism (CEDM), are the same for all 4-finger control element assemblies (CEAs). Formal Westinghouse analyses concluded that reactor operation with the new PSCEAs would be the same as the existing PLCEAs since the similarity in physical design requires no change to any operating limitations (e.g., the PDIL) (Reference 2). This analysis addressed concerns associated with seismic/Loss of Coolant Accident (LOCA), weight stress on threaded joints, fatigue damage, stress on the control rod design, clad welds, impact on CEA scram, stress impact on associated parts such as the spider spring, the plenum spring within each finger, the clad strain, resistance to physical collapse, and thermal affects.

The reactivity difference between the PLCEAs and PSCEAs within the PDIL region is very small due to the similarity between the PLCEA and PSCEA designs. The PSCEAs use Inconel slugs within Inconel clad as the neutron absorber. Within the PDIL region, the PLCEAs use solid Inconel rods. As a result, only a minor reactivity difference is present due to the 0.009-in. gap between the clad and slugs within the PSCEA fingers. The difference between

PLCEA and PSCEA worth was tested using SIMULATE-3 and was found to vary between 1-3 pcm (< 2.0% difference) depending on amount inserted and time in core life. This difference is negligible. As a result, the PSCEAs are expected to function within the PDIL in a manner equivalent to the PLCEAs.

PVNGS Response 1.a:

A formal Westinghouse analysis (Reference 3) was completed to assess the physical differences between the PLCEA and PSCEA designs. This analysis explicitly identifies the design differences between the PLCEAs and the PSCEAs. All mechanical design differences were addressed. The PSCEAs satisfied all existing mechanical design criteria. The impact on safe operation is addressed in separate APS analyses (Reference 4) and revisions to licensing bases documents. The analyses concluded that the existing reactor control system could accommodate the new PSCEAs with no impact on safe operation. In addition, the reactivity difference between the new design, which uses Inconel slugs within Inconel clad, and the current design which uses solid Inconel is negligible and has no impact on safe operation.

PVNGS Response 1.b:

During normal operation, insertion of the PSCEAs is limited to the same PDIL as currently required in the Technical Specifications and defined in the Core Operating Limits Report (COLR) for PLCEAs. This PDIL is dependent on the reactor power level but is limited to 50% insertion. In addition, the principal design difference between the PLCEAs and PSCEAs is associated with the solid Inconel design of the PLCEAs as compared to the Inconel slugs encased within the Inconel clad. However, this design involves a difference in the inner radius of the Inconel tubes of only 0.009 inches which was analyzed in comparison to the PLCEAs. Only a very small difference in rod worths (1-3 pcm) was found in an assortment of test cases and was found not to introduce a significant change in the neighboring peaking factors and other CEA reactivity worths. Typical SIMULATE-3 k_{eff} convergence criteria is set between 2-5 pcm. As such, since the difference between two SIMULATE-3 cases (in this case part-length verse part-strength) is only 1-3 pcm, this difference is considered to be negligible.

Additionally, ANSI/ANS -19.6.1-1997, Reload Startup Physics Tests for Pressurized Water Reactors, states in Table A-1 that acceptable rod worth differences (i.e., predicted versus measured) for individual groups is ±15% or ±100 pcm, whichever is greater. This criteria applies to rod groups used to ensure adequate shutdown margin and typically does not apply to part-length rods (Section 6.4.1) used only for ASI control. For PVNGS, low worth banks like the part length or part strength CEA banks, the "±100 pcm" criteria would be used. Even though the criterion does not apply in this case, the small reactivity difference between the PLCEAs and PSCEAs easily meets this ±100 pcm criterion.

PVNGS Response 1.c:

Due to the similarity in design of the PLCEAs and PSCEAs within the PDIL, an explicit technical analysis for the insertion limits in the COLR for the PSCEAs was not performed. All of the licensing basis documents which address the approved safety-related aspects of system design and operation were reviewed in detail to document any impact that the new PSCEAs would have on the current technical basis of safe plant operation. The change to the COLR involved only the revision of the title of the graph, which provides the PDIL operating criteria since the nuclear design of the PLCEAs and PSCEAs are similar within this region.

NRC Question #2:

TS 3.1.5 currently reads, "All full length CEAs shall be OPERABLE, and all full and part length CEAs shall be aligned to within 6.6 inches (indicated position) of all other CEAs in their respective groups." The staff requests the licensee provide the analytical justification that proves the 6.6 inches alignment is applicable to the new part strength design and the new part strength design remains bounded by this limit.

PVNGS Response:

The limit of 6.6 inches for misalignment prevents the limit on the departure from nucleate boiling ratio (DNBR) from being exceeded for any CEA misalignment. Since the PSCEAs have essentially the same reactivity as the PLCEAs, applying the same alignment limit is appropriate. Furthermore, since the PSCEAs are much less reactive than the FSCEAs and would result in lower peaking factors, the 6.6-inch insertion limit is conservative for the PSCEAs.

NRC Question #3:

The required action for proposed TS 3.1.5 Condition B, "Control Element Assembly Alignment," is to restore at least two position indicator channels to OPERABLE status within six hours when only one CEA position indicator channel is OPERABLE for one or more CEA(s)." The licensee states the only credible single failure that would result in more than one CEA per group having only one operable position indication channel is the failure of Vital Instrument Bus Channel 'C' or 'D'. The licensee also states that the most limiting TS requirement would not be for CEA position indication, but loss of a vital instrument bus which would require the vital instrument bus to be restored within two hours (TS 3.8.9). The staff requests the licensee provide justification that this is the only credible single failure and no additional condition exists that would become the most

limiting. Please describe other system faults that would result in loss of more than one indicator per CEA and would cause entry into the proposed amended TS 3.1.5 Condition B without entering TS 3.8.9. Also, demonstrate six hours is adequate completion time when more than one CEA has only one CEA position indicator channel operable.

PVNGS Response:

PVNGS is withdrawing from consideration the proposed change to LCO 3.1.5, Condition B. After further evaluation, PVNGS may consider re-submitting a change to this specification at a later date. Therefore, PVNGS is not submitting a response to this question at this time since this portion of the License Amendment Request is being withdrawing from consideration.

NRC Question #4:

In Technical Specification (TS) 3.1.5, "Control Element Assembly Alignment," PVNGS states replacing the PLCEAs with the PSCEAs will eliminate the [axial] flux redistribution resulting from misalignment of the PLCEA. PVNGS also states the design of the new PSCEAs is similar to the Full Length Control Element Assemblies (FLCEAs) except for a weaker neutron absorber, which effectively prevents the PSCEAs from being more limiting than the FLCEAs for any accident scenario currently analyzed in the Updated Final Safety Analysis Report. The staff requests the licensee provide additional technical justification for these statements, such as a description of the analyses performed and summary of the results (peaking factors, rod worths, and shutdown margin), and the conclusion that shows the FLCEA drop event remains the bounding event for the Chapter 15 accident analyses.

PVNGS Response:

All safety-related concerns for the new PSCEA design are addressed in licensing basis documents which focus on the mitigation of the accidents addressed in the UFSAR. The current UFSAR Chapter 15 analyses were reviewed to assess the impact of the new PSCEA design. A review of the physics and transient analyses was performed and modifications to the core reload process were made as appropriate (see below for additional detail). As an example, the most significant impact is the CEA drop event associated with the PLCEAs when inserted past the PDIL. The installation of the PSCEAs will eliminate this event since they use a uniform neutron absorber in the entire active region, which prevents the core axial flux redistribution following a PLCEA drop event. This axial flux redistribution to the top of the core would cause increasing local power, LHR, and decreasing DNBR. Since the PSCEA design is similar to the FSCEAs in uniformity but has much less negative reactivity, the CEA drop event that focuses on the FSCEAs will bound a PSCEA drop. This type of evaluation was

performed for all safety-related design concerns. The results were confirmed to remain bounded by UFSAR Chapter 15 events.

Additional Supporting Information:

Listed below are specific modifications resulting from replacing PLCEAs with PSCEAs. The items below involve input modifications to reload analyses or setpoint Reload Data Block (RDB) constants; no reload analysis methodology, Core Operating Limit Supervisory System (COLSS) or Core Protection Calculator (CPC) software changes are necessary to implement the items below.

1. Model PSCEAs as full length Inconel (i.e., 150 inches) in the ROCS physics design model. This ensures that downstream reload analysis implicitly accounts for any differences when P-bank (the rod control group designator for all 13 PSCEAs) is inserted below 50% core height (see item 2 below).

2. Components of the Overall Uncertainty Analysis (OUA) that determine the addressable uncertainty constants for CPCs will need to be modified. The case that centers the PLCEA about the core mid-plane will need to be modified to fully insert the PSCEA. Additionally, three cases used to model PLCEA insertion beyond the PDILs can be deleted as the stainless steel/water "follower" region is eliminated in the PSCEA design. Modifying the OUA input deck, in conjunction with modeling the PSCEAs as full length Inconel in the ROCS design model, assures generation of the appropriate CPC radial peaking factors (RPFs) and CEA shadowing factors (CSFs).

3. The different active length of the PSCEAs relative to the PLCEAs will require changes to two CEA related parameters in the COLSS database. The two constants both specify the active region length of the PLCEA (i.e., 75 inches). As the PSCEAs are full length (i.e., no water follower region) these constants must be changed to reflect 150 inches. Once these parameters have been modified in the database, COLSS will lookup and apply the correct RPFs and CSFs for PSCEAs.

4. The different active length of the PSCEAs relative to the PLCEAs will change one CEA related parameter in the CPC database. The constant, which defines active length, must be changed from 50% to 100% core height for the PSCEAs. Once this constant is changed CPC will look up and apply the correct RPFs and CSFs for PSCEAs.

Correction to listed value of PSCEA length:

On page 14 of the LAR (Reference 1), in the table "PLCEAs vs. PSCEAs Design Criteria", the Total Neutron Absorber Length for the PSCEAs was reported as "149.000 ± **0.005** in. of Inconel". The correct length for the PSCEA is "149.000 ± **0.500** in. of Inconel".

References:

1. Letter 102-04999-CDM/TNW/JAP, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – License Amendment Request to Various Technical Specifications Associated with Replacement of Part Length Control Element Assemblies (CEAs)," from C. D. Mauldin, APS to USNRC, dated September 17, 2003

2. Westinghouse Physics Evaluation (CAD-03-168) and the Transient Analysis and Setpoint Evaluation (LTR-TAS-03-71) are attachments to Westinghouse letter NF-03-W-APS-70, dated July 25, 2003.

3. Westinghouse letter NF-03-W-APS-85, dated September 2, 2003, Enclosure 1, "CN-NFPPT-03-39, Rev. 1- Design Verification Of Part Strength Control Element Assemblies (CEAs)"

4. Summary of Transients for Full Length Part Strength CEA Installation – Analysis Number TA-13-C00-2003-004, Rev. 1, dated August 5, 2003

ATTACHMENT 1

REVISED MARKUP OF TECHNICAL SPECIFICATION PAGES

NOTE:

The attached marked up Technical Specification pages (1.1-6, 3.1.5-2, 3.3.3-2, and 3.3.3-6) replace those that were previously submitted and are the only pages that are different from the original LAR submittal for the replacement of Part Length CEAs. [Letter 102-04999-CDM/TNW/JAP, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – License Amendment Request to Various Technical Specifications Associated with Replacement of Part Length Control Element Assemblies (CEAs)," from C. D. Mauldin, APS to USNRC, dated September 17, 2003]. The balance of the Technical Specification pages submitted in the original LAR remains the same.

1.1 Definitions (continued)

RATED THERMAL POWER (RTP)	RTP shall be a total reactor core heat transfer rate to the reactor coolant of 3876 MWt for Units 1 and 3, and 3990 MWt for Unit 2.
REACTOR PROTECTIVE SYSTEM (RPS) RESPONSE TIME	The RPS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RPS trip setpoint at the channel sensor until electrical power to the CEAs drive mechanism is interrupted. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.
SHUTDOWN MARGIN (SDM)	SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming: a. All full ~~length~~ strength CEAs (shutdown and regulating) are fully inserted except for the single CEA of highest reactivity worth, which is assumed to be fully withdrawn. With any full ~~length~~ strength CEAs not capable of being fully inserted, the withdrawn reactivity worth of these CEAs must be accounted for in the determination of SDM and b. There is no change in part length or part strength CEA position.

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Only one CEA position indicator channel OPERABLE for one CEA per CEA Group.	B.1 Restore at least two position indicator channels to OPERABLE status. OR B.2 Verify the CEA Group(s) with the inoperable position indicators are fully withdrawn or fully inserted while maintaining the insertion limits of LCO 3.1.6, LCO 3.1.7 and LCO 3.1.8.	6 hours 6 hours AND Once per 12 hours thereafter.
C. Required Action and associated Completion Time of Condition A or B not met OR One or more full ~~length~~ strength CEAs untrippable.	C.1 Be in MODE 3.	6 hours
D. Two or more CEAs trippable and misaligned from their group by > 9.9 inches.	D.1 Open the reactor trip breakers.	Immediately

ACTIONS

CONDITION		REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2	Verify all full ~~length~~ strength and part length or part strength control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 or for control, when CEA group #5 may be inserted to a maximum of 127.5 inches withdrawn.	4 hours
	AND		
	B.3	Verify the "RSPT/CEAC Inoperable" addressable constant in each core protection calculator (CPC) is set to indicate that both CEACs are inoperable.	4 hours
	AND		
	B.4	Verify the Control Element Drive Mechanism Control System is placed in "STANDBY MODE" and maintained in "STANDBY MODE," except during CEA motion permitted by Required Action B.2.	4 hours
	AND		
	B.5	Perform SR 3.1.5.1.	Once per 4 hours
	AND		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2.1 Verify the departure from nucleate boiling ratio requirement of LCO 3.2.4, "Departure from Nucleate Boiling Ratio (DNBR)," is met. AND B.2.2 Verify all full ~~length~~ strength and part length or part strength control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 or for control, when CEA group #5 may be inserted to a maximum of 127.5 inches withdrawn. AND B.2.3 Verify the "RSPT/CEAC Inoperable" addressable constant in each affected core protection calculator (CPC) is set to indicate that both CEACs are inoperable. AND	4 hours 4 hours (continued)

ATTACHMENT 2

REVISED RETYPED TECHNICAL SPECIFICATION PAGES

NOTE:

The attached retyped Technical Specification pages (1.1-6, 3.1.5-2, 3.3.3-2, and 3.3.3-6) replace those that were previously submitted and are the only pages that are different from the original LAR submittal for the replacement of Part Length CEAs. [Letter 102-04999-CDM/TNW/JAP, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – License Amendment Request to Various Technical Specifications Associated with Replacement of Part Length Control Element Assemblies (CEAs)," from C. D. Mauldin, APS to USNRC, dated September 17, 2003]. The balance of the Technical Specification pages submitted in the original LAR remains the same.

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SHUTDOWN MARGIN (SDM)	SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming: a. All full strength CEAs (shutdown and regulating) are fully inserted except for the single CEA of highest reactivity worth, which is assumed to be fully withdrawn. With any full strength CEAs not capable of being fully inserted, the withdrawn reactivity worth of these CEAs must be accounted for in the determination of SDM and b. There is no change in part length or part strength CEA position.

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Only one CEA position indicator channel OPERABLE for one CEA per CEA Group.	B.1 Restore at least two position indicator channels to OPERABLE status. OR B.2 Verify the CEA Group(s) with the inoperable position indicators are fully withdrawn or fully inserted while maintaining the insertion limits of LCO 3.1.6, LCO 3.1.7 and LCO 3.1.8.	6 hours 6 hours AND Once per 12 hours thereafter.
C. Required Action and associated Completion Time of Condition A or B not met OR One or more full strength CEAs untrippable.	C.1 Be in MODE 3.	6 hours
D. Two or more CEAs trippable and misaligned from their group by > 9.9 inches.	D.1 Open the reactor trip breakers.	Immediately

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued)	B.2	Verify all full strength and part length or part strength control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 or for control, when CEA group #5 may be inserted to a maximum of 127.5 inches withdrawn.	4 hours
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	AND		
	B.5	Perform SR 3.1.5.1.	Once per 4 hours
	AND		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2.1 Verify the departure from nucleate boiling ratio requirement of LCO 3.2.4, "Departure from Nucleate Boiling Ratio (DNBR)," is met. AND B.2.2 Verify all full strength and part length or part strength control element assembly (CEA) groups are fully withdrawn and maintained fully withdrawn, except during Surveillance testing pursuant to SR 3.1.5.3 or for control, when CEA group #5 may be inserted to a maximum of 127.5 inches withdrawn. AND B.2.3 Verify the "RSPT/CEAC Inoperable" addressable constant in each affected core protection calculator (CPC) is set to indicate that both CEACs are inoperable. AND	4 hours 4 hours (continued)