10 CFR 50.71(a)

aps

Palo Verde
Nuclear Generating Station
5801 S. Wintersburg Road
Tonopah, AZ 85354

102-07090-TNW/CJS
July 28, 2015

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: **Palo Verde Nuclear Generating Station**
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
First Use Report for Startup Test Activity Reduction (STAR) Program

Dear Sirs:

On March 30, 2015, the NRC staff issued License Amendment 195 to Arizona Public Service Company (APS) for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3. The amendments modified the moderator temperature coefficient (MTC) Technical Specification Surveillance Requirements associated with implementation of Westinghouse Electric Company LLC's topical report WCAP-16011-NP-A, Revision 0, *Startup Test Activity Reduction Program*, dated February 2005. The changes are consistent with NRC-approved Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler TSTF-486, Revision 2, *Revise MTC Surveillance for Startup Test Activity Reduction (STAR) Program (WCAP-16011)*.

APS committed in letter number 102-06784, dated November 20, 2013, to provide a First Use Report within 90 days of completion of the first application of STAR at PVNGS. This commitment was confirmed as a license condition in License Amendment 195. PVNGS Unit 3, Refueling Outage 18 (3R18) was the first unit to apply the STAR Program. The Unit 3 refueling outage ended on May 3, 2015. The Enclosure to this letter, entitled, *Summary Report for Implementation of the STAR Program at PVNGS during Unit 3 Refueling Outage 18 (3R18),* completes the commitment and license condition.

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

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NRR

Should you need further information regarding this submittal, please contact me at (623) 393-5764.

Sincerely,

Thomas N. Weber
Nuclear Regulatory Affairs Department Leader

TNW/CJS

Enclosure: *Summary Report for Implementation of the STAR Program at PVNGS during Unit 3 Refueling Outage 18 (3R18)*

cc:

M. L. Dapas	NRC Region IV Regional Administrator
M. M. Watford	NRC NRR Project Manager for PVNGS
C. A. Peabody	NRC Senior Resident Inspector for PVNGS

Enclosure

Summary Report for Implementation of the STAR Program at PVNGS during Unit 3 Refueling Outage 18 (3R18)

Enclosure
Summary Report for Implementation of the STAR Program at PVNGS during Unit 3 Refueling Outage 18 (3R18)

Core Design Method

The Palo Verde Nuclear Generating Station (PVNGS), Unit 3 Operating Cycle 19 reload core used CASMO-4/SIMULATE-3 as the design method. This method has been reviewed and approved by the NRC (Reference 1).

Comparison of Measured to Calculated Values

Application of the Startup Test Activity Reduction (STAR) Program for Operating Cycle 19 (implemented during startup from Refueling Outage 3R18) allowed the elimination of Control Element Assembly (CEA) worth measurements from the low power physics testing program and allowed for alternate moderator temperature coefficient (MTC) surveillance. The elimination of this measurement and the use of the alternate surveillance are acceptable since the STAR Applicability Requirements have been satisfied and documented.

Tables 1, 3, and 4 provide the results from the Operating Cycle 19 STAR Program tests. Each of the STAR program test criterion were met. Therefore, the STAR Program was successfully implemented for the PVNGS Unit 3 Operating Cycle 19 reload core.

Where applicable, Table 1 also provides a comparison of the difference between the measured and calculated values. As illustrated, the differences were within the test criteria.

STAR Applicability Requirements

Table 5-2, *PVNGS STAR Program Applicability Requirements*, of WCAP-17787 as contained in Reference 2 and approved by the NRC in Reference 3, lists the applicability requirements for the use of the STAR Program. The STAR applicability requirements provide compensatory measures that ensure the core can be operated as designed when used in conjunction with the STAR Program Tests outlined in Table 5-1 of WCAP-17787 as contained in Reference 2. The STAR applicability requirements involve the following areas:

- Core Design
- Fabrication
- Refueling
- Startup Testing
- CEA Lifetime

Conformance with the STAR applicability requirements was documented in accordance with plant processes and procedures. Comparison to an independent qualified core physics method showed acceptable reconciliation results and is

summarized in Table 2. Reference 4 specifically documents the conformance of Unit 3 Operating Cycle 19 with the STAR applicability requirements.

Conclusions

It was demonstrated that the conditions and limitations listed in Reference 2 and approved in Reference 3 were successfully met for the startup of PVNGS Unit 3 for Operating Cycle 19, following 3R18.

References

1. NRC letter dated March 20, 2001, Jack N. Donohew, Senior Project Manager (NRC) to Gregg R. Overbeck, Senior Vice President (APS), *Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3 – Issuance of Amendments on CASMO-4/SIMULATE-3* (ADAMS Accession No. ML010860187)

2. APS letter number 102-06785, dated November 20, 2013, *Palo Verde Nuclear Generating Station Units 1, 2, and 3 Docket Nos. STN 50-528/529/530 Transmittal of Proprietary Documents for Startup Test Activity Reduction (STAR) Program License Amendment Request (LAR)* (ADAMS Accession No. ML13329A700)

3. NRC letter dated March 30, 2015, Balwant K. Singal, Senior Project Manager (NRC) to Randall K. Edington, Executive Vice President Nuclear/Chief Nuclear Officer (APS), *Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Issuance of Amendments RE: Technical Specification Change Regarding Moderator Temperature Coefficient Surveillance for Startup Test Activity Reduction Program* (ADAMS Accession No. ML15070A124)

4. Procedure 72PY-9RX06, *Low Power Physics Testing Using STAR*, Revision 0, as performed in 3R18 on May 3, 2015 under Work Order 4647997

Table 1
PVNGS Unit 3 Operating Cycle 19 STAR Program Test Results

TEST[1]	POWER	MEASURED VALUE	CALCULATED VALUE	DIFFERENCE	TEST CRITERIA
CEA Drop Time	Shutdown	Individual 2.377 to 3.023 seconds	NA	NA	Individual ≤ 3.996 seconds
CBC	HZP	1991 ppm	1978 ppm	13 ppm (94 pcm)	± 50 ppm or the CBC equivalent of 500 pcm
MTC Alternate Surveillance	HZP	-0.0853E-4Δk/k/°F	NA	NA	< 0.5 E-4Δk/k/°F
Incore Flux Symmetry	~19%	Maximum difference between quadrant symmetric assemblies with average RPD greater than 1. 4.3%	NA	NA	The maximum difference between the measured powers in rotationally symmetric assemblies is within 9.1% of the symmetric group average.

[1] Table 5-1 of the STAR topical report (Reference 2) provides descriptions of the tests
[2] Technical Specification limit

Table 1
PVNGS Unit 3 Operating Cycle 19 STAR Program Test Results
(Continued)

TEST[1]	POWER	MEASURED VALUE	CALCULATED VALUE	DIFFERENCE	TEST CRITERIA
Incore Power Distribution	69%	See Table 3			RMS Errors ≤ 5%, Radial Error <0.1, Axial Error <0.1, Fxy, Fr, Fz within ±10%
ITC	HFP	-1.27E-4 Δk/k/°F	-1.33E-4Δk/k/°F	0.06E-4 Δk/k/°F	None
MTC Surveillance	HFP	-1.13E-4 Δk/k/°F	NA	NA	< 0.0 E-4Δk/k/°F [2] and within COLR limits
Incore Power Distribution	HFP	See Table 4			RMS Errors ≤ 5%, Radial Error <0.1, Axial Error <0.1, Fxy, Fr, Fz within ±10%
ΔCBC HZP-HFP	HFP	574 ppm	561 ppm	13 ppm	± 50 ppm

[1] Table 5-1 of the STAR topical report (Reference 2) provides descriptions of the tests
[2] Technical Specification limit

Table 2
Predicted Parameter Reconciliation Results

Parameter	Units	Method	Predicted Value		
			SIMULATE (Design Method)	ROCS (Alternate Method)	Difference*
Regulating Groups Worth	%Δρ	Cycle 19 (Proposed Core)	2.893	2.965	2.5%
		Cycle 18 (Measured Core)	2.953	3.033	2.7%
	%	Difference**	-2.1	-2.3	
All Groups Worth	%Δρ	Cycle 19 (Proposed Core)	12.438	12.834	3.2%
		Cycle 18 (Measured Core)	12.322	12.711	3.2%
	%	Difference**	+1.0	+1.0	
ARO MTC	E-4 Δρ / °F	Cycle 19 (Proposed Core)	-0.090	-0.013	+0.077
		Cycle 18 (Measured Core)	-0.085	-0.014	+0.071
		Difference**	-0.005	+0.001	

Difference = Alternate – Design for MTC. Difference = 100(Alternate-Design)/(Design) for CEA worth.
**Difference = Proposed – Measured for MTC. Difference = 100*(Proposed – Measured)/(Proposed) for CEA worth

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Summary Report for Implementation of the STAR Program at PVNGS during Unit 3 Refueling Outage 18 (3R18)

Table 3 – 69% Power Distribution

Snapshot C1583272

TEST RESULTS SUMMARY

MEASURED PARAMETER	MAXIMUM DIFFERENCE (PRED-CECOR)	ACCEPTANCE CRITERIA
RADIAL PWR DISTRIBUTION ERROR (PRED-CECOR)	0.0326	< + OR - 0.1
RADIAL PWR DISTRIBUTION RMS ERROR (PRED-CECOR)	0.0152	< + OR - 0.05
AXIAL PWR DISTRIBUTION ERROR (PRED-CECOR)	-0.0436	< + OR - 0.1
AXIAL PWR DISTRIBUTION RMS ERROR (PRED-CECOR)	0.0219	< + OR - 0.05

MEASURED PARAMETER	CECOR MEASURED VALUE	PREDICTED VALUE	PERCENT DIFFERENCE ((PRED-CECOR)/PRED)*100	ACCEPTANCE CRITERIA
FXY	1.4867	1.4310	-3.890	1.2879 TO 1.5741
FR	1.4105	1.3820	-2.062	1.2438 TO 1.5202
FZ	1.2071	1.1810	-2.207	1.0629 TO 1.2991
FQ	1.7452	1.6480	-5.898	1.4832 TO 1.8128

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Table 4 – 100% Power Distribution

Snapshot C1583639

TEST RESULTS SUMMARY

MEASURED PARAMETER	MAXIMUM DIFFERENCE (PRED-CECOR)	ACCEPTANCE CRITERIA
RADIAL PWR DISTRIBUTION ERROR (PRED-CECOR)	-0.0305	< + OR - 0.1
RADIAL PWR DISTRIBUTION RMS ERROR (PRED-CECOR)	0.0109	< + OR - 0.05
AXIAL PWR DISTRIBUTION ERROR (PRED-CECOR)	-0.0351	< + OR - 0.1
AXIAL PWR DISTRIBUTION RMS ERROR (PRED-CECOR)	0.0171	< + OR - 0.05

MEASURED PARAMETER	CECOR MEASURED VALUE	PREDICTED VALUE	PERCENT DIFFERENCE ((PRED-CECOR)/PRED)*100	ACCEPTANCE CRITERIA
FXY	1.4676	1.4190	-3.425	1.2771 TO 1.5609
FR	1.3923	1.3680	-1.776	1.2312 TO 1.5048
FZ	1.1783	1.1660	-1.056	1.0494 TO 1.2826
FQ	1.6779	1.6250	-3.255	1.4625 TO 1.7875