Attachment 6 of the Enclosure contains PROPRIETARY information to be withheld under 10 CFR 2.390

10 CFR 50.90

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102-07360-MLL/MDD
November 9, 2016

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

References:
1. Arizona Public Service Company (APS) letter number 102-07149, *License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis,* dated November 25, 2015, [Agencywide Documents Access and Management System (ADAMS) Accession Number ML15336A251]
2. NRC document *Palo Verde 1, 2, and 3 – Official RAIs from SNPB for LAR that Requested Revision of TSs to Incorporate Updated Criticality Safety Analysis,* dated July 14, 2016 (ADAMS Accession Number ML16197A006)
3. APS letter number 102-07342, *Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis, dated October 6, 2016* (ADAMS Accession Number ML16286A240)

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3
Docket Nos. STN 50-528, 50-529, and 50-530
Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis – Revised Technical Specifications and Bases and WCAP-18030, Revision 1

In Reference 1, Arizona Public Service Company (APS) submitted a license amendment request (LAR) to revise the PVNGS Technical Specifications (TS) for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3. The proposed amendment would modify TS requirements to incorporate the results of an updated criticality safety analysis for both new and spent fuel storage. In Reference 2, the NRC staff requested additional information to support the review of the LAR. The APS response to the NRC staff request for additional information (RAI) was provided in Reference 3, which indicated that the affected TS and TS Bases pages, as well as the necessary revision to WCAP-18030, *Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3,* would be submitted separately. The enclosure to this letter includes the TS pages (Attachments 1 and 2) and TS Bases markup pages (Attachment 3) and the non-proprietary and proprietary versions of the revised WCAP-18030 (Attachments 5 and 6, respectively).

Attachment 4 of the enclosure is the Westinghouse affidavit signed by Westinghouse Electric Company LLC that sets forth the basis on which the proprietary information in Attachment 6

Attachment 6 transmitted herewith contains PROPRIETARY information.
When separated from Attachment 6, this transmittal document is decontrolled.

ADD 1
NRR

of the enclosure may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in 10 CFR 2.390(b)(4). Correspondence with respect to the proprietary aspects of Attachment 6 of the enclosure or the supporting Westinghouse affidavit should reference Westinghouse letter number CAW-16-4498 and be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

The APS response does not affect the conclusion of the no significant hazards consideration determination [10 CFR 50.91(a)] provided in the original LAR, as supplemented by APS letter 102-07181, dated January 29, 2016 (ADAMS Accession Number ML16043A361).

This submittal does not contain new regulatory commitments as defined by NEI 99-04, *Guidelines for Managing NRC Commitment Changes*, Revision 0. The original target date for this response was extended to November 11, 2016, based upon communications with the PVNGS NRC Project Manager, Mr. Siva Lingam, on September 7, 2016. The need to extend the date for the response was due to an emergent Westinghouse issue that impacted available resources.

In accordance with the PVNGS Quality Assurance Program, the Plant Review Board and the Offsite Safety Review Committee have reviewed and concurred with the LAR changes proposed herein. By copy of this letter, this submittal is being forwarded to the Arizona Radiation Regulatory Agency (ARRA) pursuant to 10 CFR 50.91(b)(1). Should you have any questions concerning the content of this letter, please contact Michael D. Dilorenzo, Licensing Section Leader, at (623) 393-3495.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: November 9, 2016
(Date)

Sincerely,

Hyrum W. Anderson FOR MARIA LACAL

MLL/MDD/CJS/af

Enclosure: Response to Request for Additional Information (RAI) Regarding License Amendment Request (LAR) to Revise Technical Specifications (TS) to Incorporate Updated Criticality Safety Analysis – Nuclear Performance and Code Review Branch (SNPB) - Revised Technical Specifications and Bases and WCAP-18030, Revision 1

cc:

K. M. Kennedy	NRC Region IV Regional Administrator
S. P. Lingam	NRC NRR Project Manager for PVNGS
M. M. Watford	NRC NRR Project Manager
C. A. Peabody	NRC Senior Resident Inspector for PVNGS
T. Morales	Arizona Radiation Regulatory Agency (ARRA)

Enclosure

Response to Request for Additional Information (RAI) Regarding License Amendment Request (LAR) to Revise Technical Specifications (TS) to Incorporate Updated Criticality Safety Analysis– Nuclear Performance and Code Review Branch (SNPB)

Revised Technical Specifications and Bases and WCAP-18030, Revision 1

Table of Contents

Introduction

By letter dated November 25, 2015 [Agencywide Documents Access and Management System (ADAMS) Accession Number ML15336A087] (Reference 1), as supplemented by letters dated January 29 (Reference 2) and June 30, 2016 (Reference 3) (ADAMS Accession Numbers ML16043A361 and ML16182A519, respectively), Arizona Public Service Company (APS) submitted a license amendment request (LAR) to amend Facility Operating License Numbers NPF-41, NPF-51, and NPF-74, and revise the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3, Technical Specifications (TSs). The LAR proposes to install NETCO-SNAP-IN® neutron absorbing rack inserts into some spent fuel pool (SFP) storage rack cells coupled with six classifications of fuel (i.e., regions) by initial enrichment, burnup, and decay time in six storage configurations (i.e., arrays) for criticality control. Approval of the license amendment will establish the new licensing basis for how APS meets the effective neutron multiplication factor ($k_{effective}$ or k_{eff}) criticality control requirements.

The U.S. Nuclear Regulatory Commission (NRC) Nuclear Performance and Code Review Branch (SNPB) provided an official request for additional information (RAI) by Reference 4. The APS response to each of the NRC staff information requests of Reference 4 was provided by APS letter number 102-07342, dated October 6, 2016 (Reference 5). The APS response to the NRC staff RAI (Reference 5) indicated that the affected TS and TS Bases pages, as well as the necessary revision to WCAP-18030, *Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3*, would be submitted separately. Attachment 1 of this enclosure provides the markup TS pages and Attachment 2 provides the clean (re-typed) TS pages. The TS Bases markup pages are provided for information as Attachment 3 of this enclosure.

Attachment 4 of this enclosure is the Westinghouse affidavit signed by Westinghouse Electric Company LLC that sets forth the basis on which the proprietary information in Attachment 6 of this enclosure may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in 10 CFR 2.390(b)(4). The non-proprietary and proprietary versions of WCAP-18030, Revision 1, are provided as Attachments 5 and 6 of this enclosure, respectively.

Proposed Changes to the Technical Specifications

The following additional specific TS changes are proposed as part of the updated criticality safety analysis resulting from Reference 5 and supported by Attachments 5 and 6 of this enclosure. The remaining TS changes previously submitted in the LAR dated November 25, 2015 (Reference 1), as supplemented by APS letter dated January 29, 2016 (Reference 2), are not affected and remain applicable.

- TS 3.7.17, *Spent Fuel Assembly Storage*

    - Update Tables 3.7.17-2 through 3.7.17-5 to define the Fuel Regions
    - Update Figure 3.7.17-1 to clarify Note 2 for blocking devices

Need for Proposed Changes

The NRC SNPB provided an RAI by Reference 4. The APS response to each of the NRC staff information requests of Reference 4 was provided by Reference 5. The Attachments to this enclosure provide the updated TS markup and clean pages and TS Bases markup pages for

information, as well as the revision to WCAP-18030 resulting from the RAI, as indicated in Reference 5.

Specifically, the APS response to RAI-8 and RAI-12 resulted in changes to the TS pages that had been previously submitted to the NRC as part of the LAR, as supplemented by Reference 2. The response to RAI-8 specifically addresses increases in the burnup requirements for all enrichments due to issues such as grid growth, migration of volatile isotopes and criticality code bias and uncertainty. The coefficient values, therefore, are changed for TS Tables 3.7.17-2 through 3.7.17-5. In addition, Note 2 to Table 3.7.17-2 was altered to reflect the updated analysis such that it now reflects the decrease in initial enrichment from 2.55% to 2.50% uranium-235. Finally, Note 2 of Figure 3.7.17-1 has the phrase, *and only water in the active fuel region,* removed from the description of the cell blocking devices, consistent with the APS response to RAI-12 in Reference 5.

Markups of the changes to the TS Bases for Section 3.7.15 and 3.7.17, resulting from RAI-7, are provided in Attachment 3 of this enclosure. The changes address the updated criticality analysis required minimum boron concentration for the postulated multiple misload event. The TS required minimum boron concentration is not changing (greater than or equal to 2150 ppm), but the minimum value in the analysis is updated from 1460 ppm to 1600 ppm.

No Significant Hazards Consideration

The APS response does not affect the conclusion of the no significant hazards consideration determination [10 CFR 50.91(a)] provided in the original LAR (Reference 1), as supplemented by Reference 2.

Conclusion

APS concludes that operation of the facility in accordance with the proposed amendment, as supplemented, does not involve a significant hazards consideration and, accordingly, a finding of "no significant hazards consideration" is justified. Based on the considerations discussed above and in the referenced APS supplemental responses, (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 amendment will not be inimical to the common defense and security or the health and safety of the public.

References

1. APS letter number 102-07149, *License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis,* dated November 25, 2015, (ADAMS Accession Numbers ML15336A251 and ML15336A087)
2. APS letter number 102-07181, *Supplemental Information Regarding License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis,* dated January 29, 2016 (ADAMS Accession Number ML16043A361)
3. APS letter number 102-07275, *Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis,* dated June 30, 2016 (ADAMS Accession Number ML16182A519)

4. NRC document *Palo Verde 1, 2, and 3 – Official RAIs from SNPB for LAR that Requested Revision of TSs to Incorporate Updated Criticality Safety Analysis,* dated July 14, 2016 (ADAMS Accession Number ML16197A006)
5. APS letter number 102-07342, *Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications to Incorporate Updated Criticality Safety Analysis, dated October 6, 2016* (ADAMS Accession Number ML16286A240)

Attachment 1

Technical Specifications Markup Pages

Revised inserts for Tables 3.7.17-2 through 3.7.17-5

Figure 3.7.17-1

Insert Revised Table 3.7.17-2 here

Table 3.7.17-2

Fuel Region 3: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	-1.5473	15.5395	-39.0197	24.1121
5	-1.4149	13.9760	-33.6287	18.3369
10	-1.3012	12.6854	-29.2539	13.6879
15	-1.0850	10.4694	-22.1380	6.3673
20	-0.9568	9.1487	-17.9045	2.0337

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2.50

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between ~~2.55~~ wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below ~~2.55~~ wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Insert Revised Table 3.7.17-3 here

Table 3.7.17-3

Fuel Region 4: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.4260	-6.2766	40.9264	-54.6813
5	0.2333	-4.1545	32.9080	-46.1161
10	0.4257	-6.2064	39.0371	-51.5889
15	0.5315	-7.3777	42.5706	-54.7524
20	0.5222	-7.3897	42.6587	-54.8201

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.75 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.75 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Insert Revised Table 3.7.17-4 here

Table 3.7.17-4

Fuel Region 5: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	-0.1114	-0.4230	20.9136	-32.8551
5	-0.1232	-0.4463	20.8337	-32.6068
10	-0.2357	0.4892	18.0192	-30.0042
15	-0.1402	-0.4523	20.3745	-31.7565
20	-0.0999	-0.8152	21.0059	-31.9911

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.65 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.65 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Insert Revised Table 3.7.17-5 here

Table 3.7.17-5

Fuel Region 6: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.7732	-9.3583	49.6577	-54.6847
5	0.7117	-8.4920	45.1124	-49.7282
10	0.6002	-7.2638	40.2603	-44.9348
15	0.5027	-6.2842	36.6715	-41.4934
20	0.2483	-3.7639	28.8269	-34.6419

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.45 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.45 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Revised Tables 3.7.17-2 and 3.7.17-3

Table 3.7.17-2

Fuel Region 3: Burnup Requirement Coefficients				
Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	-0.8100	6.5551	-2.9050	-21.0499
5	-0.9373	7.6381	-6.0246	-18.0299
10	-0.8706	6.8181	-3.1913	-21.0299
15	-0.7646	5.6311	0.7657	-25.1599
20	-0.7233	5.1651	2.3084	-26.7499

Table 3.7.17-3

Fuel Region 4: Burnup Requirement Coefficients				
Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.0333	-2.1141	27.4985	-41.8258
5	-0.2105	0.2472	19.7919	-34.2641
10	0.0542	-2.5298	28.0953	-41.7092
15	0.3010	-5.0718	35.6966	-48.5494
20	0.4829	-6.9436	41.3118	-53.6182

Revised Tables 3.7.17-4 and 3.7.17-5

Table 3.7.17-4

Fuel Region 5: Burnup Requirement Coefficients				
Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.1586	-3.0177	28.7074	-39.8636
5	-0.2756	1.3433	14.5578	-26.4388
10	-0.2897	1.3218	14.6176	-26.4160
15	-0.0736	-0.9107	21.2118	-32.1887
20	0.1078	-2.7684	26.6911	-36.9873

Table 3.7.17-5

Fuel Region 6: Burnup Requirement Coefficients				
Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.4890	-6.7447	42.7619	-49.3143
5	0.5360	-6.9115	41.1003	-46.6977
10	0.4779	-6.1841	37.6389	-43.0309
15	0.4575	-5.8844	35.8656	-41.0274
20	0.3426	-4.7050	31.8126	-37.2800

Figure 3.7.17-1
Allowable Storage Arrays

Array A Two Region 1 assemblies (1) checkerboarded with two blocked cells (X). The Region 1 assemblies are each in a cell with a stainless steel L-insert. No NETCO-SNAP-IN® inserts are credited.	1	X
	X	1
Array B Two Region 1 assemblies (1) checkerboarded with two cells containing trash cans (TC). The Region 1 assemblies are each in a cell with a stainless steel L-insert. Every cell without a stainless steel L-insert must contain a NETCO-SNAP-IN® insert.	1	TC
	TC	1
Array C Two Region 2 assemblies (2) checkerboarded with one Region 3 assembly (3) and one blocked cell (X). The Region 2 assemblies are each in a cell with a stainless steel L-insert. The Region 3 assembly is in a cell containing a NETCO-SNAP-IN® insert.	2	X
	3	2
Array D One Region 2 assembly (2) checkerboarded with three Region 4 assemblies (4). The Region 2 assembly and the diagonally located Region 4 assembly are each in a storage cell with a stainless steel L-insert. The two storage cells without a stainless steel L-insert contain a NETCO-SNAP-IN® insert.	2	4
	4	4
Array E Four Region 5 assemblies (5). Two storage cells contain a stainless steel L-insert. One cell contains a NETCO-SNAP-IN® insert. One storage cell contains no insert.	5	5
	5	5
Array F Four Region 6 assemblies (6). Two storage cells contain a stainless steel L-insert. The other two cells contain no inserts.	6	6
	6	6

Notes:
1. The shaded locations indicate cells which contain a stainless steel L-insert.
2. A blocked cell (X) contains a blocking device ~~and only water in the active fuel region~~.
3. NETCO-SNAP-IN® inserts must be oriented in the same direction as the stainless steel L-inserts.
4. NETCO-SNAP-IN® inserts are only located in cells without a stainless steel L-insert.
5. Any cell containing a fuel assembly or a TC may instead be an empty (water-filled) cell in all storage arrays.
6. Any storage array location designated for a fuel assembly may be replaced with non-fissile material.
7. Interface requirements: Each cell is part of up to four 2x2 arrays and each cell must simultaneously meet the requirements of all those arrays of which it is a part.

Attachment 2

Technical Specifications Clean Pages

Tables 3.7.17-2 through 3.7.17-5

Figure 3.7.17-1

Table 3.7.17-2

Fuel Region 3: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	-0.8100	6.5551	-2.9050	-21.0499
5	-0.9373	7.6381	-6.0246	-18.0299
10	-0.8706	6.8181	-3.1913	-21.0299
15	-0.7646	5.6311	0.7657	-25.1599
20	-0.7233	5.1651	2.3084	-26.7499

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 2.50 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 2.50 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Table 3.7.17-3

Fuel Region 4: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.0333	-2.1141	27.4985	-41.8258
5	-0.2105	0.2472	19.7919	-34.2641
10	0.0542	-2.5298	28.0953	-41.7092
15	0.3010	-5.0718	35.6966	-48.5494
20	0.4829	-6.9436	41.3118	-53.6182

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.75 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.75 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Table 3.7.17-4

Fuel Region 5: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.1586	-3.0177	28.7074	-39.8636
5	-0.2756	1.3433	14.5578	-26.4388
10	-0.2897	1.3218	14.6176	-26.4160
15	-0.0736	-0.9107	21.2118	-32.1887
20	0.1078	-2.7684	26.6911	-36.9873

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.65 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.65 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Table 3.7.17-5

Fuel Region 6: Burnup Requirement Coefficients

Decay Time (yr.)	Coefficients			
	A_1	A_2	A_3	A_4
0	0.4890	-6.7447	42.7619	-49.3143
5	0.5360	-6.9115	41.1003	-46.6977
10	0.4779	-6.1841	37.6389	-43.0309
15	0.4575	-5.8844	35.8656	-41.0274
20	0.3426	-4.7050	31.8126	-37.2800

Notes:

1. Relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty or enrichment uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Region, the assembly burnup must exceed the "minimum burnup" (GWd/MTU) given by the curve fit for the assembly "decay time" and "initial enrichment." The specific minimum burnup (BU) required for each fuel assembly is calculated from the following equation:

$$BU = A_1 * En^3 + A_2 * En^2 + A_3 * En + A_4$$

2. Initial enrichment, En, is the maximum radial average ^{235}U enrichment. Any En value between 1.45 wt% ^{235}U and 4.65 wt% ^{235}U may be used. Burnup credit is not required for an En below 1.45 wt% ^{235}U.

3. It is acceptable to linearly interpolate between calculated BU limits based on decay time.

4. The 20-year coefficients must be used to calculate the minimum BU for an assembly with a decay time of greater than 20 years.

Figure 3.7.17-1
Allowable Storage Arrays

Array A Two Region 1 assemblies (1) checkerboarded with two blocked cells (X). The Region 1 assemblies are each in a cell with a stainless steel L-insert. No NETCO-SNAP-IN® inserts are credited.	1	X
	X	1
Array B Two Region 1 assemblies (1) checkerboarded with two cells containing trash cans (TC). The Region 1 assemblies are each in a cell with a stainless steel L-insert. Every cell without a stainless steel L-insert must contain a NETCO-SNAP-IN® insert.	1	TC
	TC	1
Array C Two Region 2 assemblies (2) checkerboarded with one Region 3 assembly (3) and one blocked cell (X). The Region 2 assemblies are each in a cell with a stainless steel L-insert. The Region 3 assembly is in a cell containing a NETCO-SNAP-IN® insert.	2	X
	3	2
Array D One Region 2 assembly (2) checkerboarded with three Region 4 assemblies (4). The Region 2 assembly and the diagonally located Region 4 assembly are each in a storage cell with a stainless steel L-insert. The two storage cells without a stainless steel L-insert contain a NETCO-SNAP-IN® insert.	2	4
	4	4
Array E Four Region 5 assemblies (5). Two storage cells contain a stainless steel L-insert. One cell contains a NETCO-SNAP-IN® insert. One storage cell contains no insert.	5	5
	5	5
Array F Four Region 6 assemblies (6). Two storage cells contain a stainless steel L-insert. The other two cells contain no inserts.	6	6
	6	6

Notes:
1. The shaded locations indicate cells which contain a stainless steel L-insert.
2. A blocked cell (X) contains a blocking device.
3. NETCO-SNAP-IN® inserts must be oriented in the same direction as the stainless steel L-inserts.
4. NETCO-SNAP-IN® inserts are only located in cells without a stainless steel L-insert.
5. Any cell containing a fuel assembly or a TC may instead be an empty (water-filled) cell in all storage arrays.
6. Any storage array location designated for a fuel assembly may be replaced with non-fissile material.
7. Interface requirements: Each cell is part of up to four 2x2 arrays and each cell must simultaneously meet the requirements of all those arrays of which it is a part.

Attachment 3

Technical Specifications Bases Markup Pages

Revised inserts for TS Bases
Sections 3.7.15 and 3.7.17

B 3.7 PLANT SYSTEMS

B 3.7.15 Fuel Storage Pool Boron Concentration

BASES

, and decay time.

,

BACKGROUND

As described in LCO 3.7.17, "Spent Fuel Assembly Storage," fuel assemblies are stored in the spent fuel racks in accordance with criteria based on initial enrichment and discharge burnup. ~~Although the water in the spent fuel pool is normally borated to ≥ 2150 ppm, the criteria that limit the storage of a fuel assembly to specific rack locations is conservatively developed without taking credit for boron. In order to maintain the spent fuel pool k_{eff} < 1.0, a~~ soluble boron concentration of ~~900~~ ppm is required to maintain the spent fuel pool $k_{eff} \leq 0.95$ assuming the most limiting ~~single~~ fuel mishandling accident.

A

1600

~~1460~~

APPLICABLE SAFETY ANALYSES

A fuel assembly could be inadvertently loaded into a spent fuel rack location not allowed by LCO 3.7.17 (e.g., an unirradiated fuel assembly or an insufficiently depleted fuel assembly). Another type of postulated accident is associated with a fuel assembly that is dropped onto the fully loaded fuel pool storage rack or between a rack and the pool walls. These incidents could have a positive reactivity effect, decreasing the margin to criticality. However, the negative reactivity effect of the soluble boron compensates for the increased reactivity caused by these postulated accident scenarios.

There could also be a misload of multiple fuel assemblies into fuel rack locations not allowed by LCO 3.7.17.

The concentration of dissolved boron in the fuel pool satisfies Criterion 2 of 10 CFR 50.36 (c)(2)(ii).

LCO

The specified concentration of dissolved boron in the fuel pool preserves the assumptions used in the analyses of the potential accident scenarios described above. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the fuel pool.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the spent fuel pool in order to comply with the TS 4.3.1.1.c design requirement that $k_{eff} \leq 0.95$.

(continued)

BASES (continued)

ACTIONS

A.1 and A.2

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

When the concentration of boron in the spent fuel pool is less than required, immediate action must be taken to preclude an accident from happening or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. This does not preclude the movement of fuel assemblies to a safe position. In addition, action must be immediately initiated to restore boron concentration to within limit.

If moving fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.15.1

This SR verifies that the concentration of boron in the spent fuel pool is within the required limit. As long as this SR is met, the analyzed incidents are fully addressed. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR, Section 9.1.2.
2. ~~PVNGS Operating License Amendments 82, 69 and 54 for Units 1, 2 and 3, respectively, and associated NRC Safety Evaluation dated September 30, 1994.~~
3. ~~13-N-001-1900-1221-1, "Palo Verde Spent Fuel Pool Criticality Analysis," ABB calculation A-PV-FE-0106, revision 3, dated January 15, 1999.~~

"Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3" (Proprietary), WCAP-18030-P, ~~Revision 0~~, ~~September 2015~~.

Revision 1, October 2016

B 3.7 PLANT SYSTEMS

B 3.7.17 Spent Fuel Assembly

. The design basis of the spent fuel pool cooling system is to provide adequate cooling to the spent fuel pool during all operating conditions (including full core offload) for up to 1205 fuel assemblies (UFSAR Section 9.1.3).

BASES

pool

and

BACKGROUND The spent fuel ~~storage~~ is designed to store ~~either~~ new (nonirradiated) ~~nuclear~~ fuel assemblies~~, or~~ burned (irradiated) fuel assemblies in a vertical configuration underwater. The storage pool was originally designed to store up to 1329 fuel assemblies ~~in a borated fuel storage mode. The current storage configuration, which allows credit to be taken for boron concentration, burnup, and decay time, and does not require neutron absorbing (boraflex) storage cans, provides for a maximum storage of 1209 fuel assemblies in a four-region configuration. The design basis of the spent fuel cooling system, however, is to provide adequate cooling to the spent fuel during all operating conditions (including full core offload) for only 1205 fuel assemblies (UFSAR section 9.1.3). Therefore, an additional four spaces are mechanically blocked to limit the maximum number of fuel assemblies that may be stored in the spent fuel storage pool to 1205.~~

~~Region 1 is comprised of two 9x8 storage racks and one 12x8 storage rack. Cell blocking devices are placed in every other storage cell location in Region 1 to maintain a two-out-of-four checkerboard configuration. These cell blocking devices prevent inadvertent insertion of a fuel assembly into a cell that is not allowed to contain a fuel assembly.~~

~~Region 3 is comprised of three 9x8 storage racks and one 9x9 storage rack in Units 2 and 3. Region 3 is comprised of four 9x8 storage racks and one 9x9 storage rack in Unit 1. Since fuel assemblies may be stored in every Region 3 cell location, no cell blocking devices are installed in Region 3.~~

~~Regions 2 and 4 are mixed and are comprised of seven 9x8 storage racks and three 12x8 storage racks in Units 2 and 3. Regions 2 and 4 are mixed and are comprised of six 9x8 storage racks and three 12x8 storage racks in Unit 1. Regions 2 and 4 are mixed in a repeating 3x4 storage pattern in which two-out-of-twelve cell locations are designated Region 2 and ten-out-of-twelve cell locations are designated Region 4 (see UFSAR Figures 9.1-7 and 9.1-7A). Since fuel assemblies may be stored in every Region 2 and Region 4 cell location, no cell blocking devices are installed in Region 2 and Region 4.~~

Insert 1 →

~~(continued)~~

Insert 1 for TS Bases 3.7.17 page B 3.7.17-1

1600

The spent fuel storage cells are installed in parallel rows with a nominal center-to-center spacing of 9.5 inches. This spacing, a minimum soluble boron concentration of ~~1460~~ ppm, the use of neutron-absorbing panels, and the storage of fuel in the appropriate region based on fuel assembly initial enrichment, discharge burnup, and decay time in accordance with TS Tables 3.7.17-1 through 3.7.17-5 is sufficient to maintain $k_{eff} \leq 0.95$ for fuel of initial maximum radially averaged enrichment of up to 4.65 wt%.

Disused CEAs, in-core instruments, and other material is stored in trash cans. A trash can may be stored in any location that is approved to store a fuel assembly. No special nuclear material (SNM) may be stored in a trash can.

BASES

~~SURVEILLANCE REQUIREMENTS (continued)~~

- ~~that a fuel assembly that does not meet the burnup requirement for Region 2 must be stored in Region 1,~~
- ~~that any fuel assembly may be stored in Region 1,~~
- ~~that any fuel assembly may be stored in a lower numbered region than the region for which it qualifies because burnup requirements decrease as region numbers decrease (refer also to Tech Spec 4.3.1.1),~~
- ~~and that comparing actual burnup to the burnup requirement for zero decay time will always be correct or conservative.~~

REFERENCES

1. UFSAR, Sections 9.1.2 and 9.1.3.
2. ~~PVNGS Operating License Amendments 82, 69, and 54 for Units 1, 2, and 3 respectively, and associated NRC Safety Evaluation, dated September 30, 1994.~~
3. ~~Letter to T. E. Collins, U.S. NRC to T. Greene, WOG, "Acceptance for Referencing of Licensing Topical Report WCAP-14416-P, Westinghouse Spent Fuel Rack Methodology (TAC NO. M93254)", October 25, 1996.~~
4. ~~13-N-001-1900-1221-1, "Palo Verde Spent Fuel Pool Criticality Analysis," ABB calculation A-PV-FE-0106, revision 03, dated January 15, 1999.~~
5. ~~Westinghouse letter NF-APS-10-19, "Criticality Safety Evaluation of the Spent Fuel Pool Map with a Proposed Region 3 Increase," dated February 25, 2010.~~

"Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3" (Proprietary), WCAP-18030-P, ~~Revision 0, September 2015.~~

Revision 1, October 2016

ATTACHMENT 4

Westinghouse *Application for Withholding Proprietary Information from Public Disclosure*

CAW-16-4498, October 27, 2016

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USA

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CAW-16-4498

October 27, 2016

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: WCAP-18030-P, Revision 1, "Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3" (Proprietary)

The Application for Withholding Proprietary Information from Public Disclosure is submitted by Westinghouse Electric Company LLC ("Westinghouse"), pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-16-4498 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The Affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Arizona Public Service Company.

Correspondence with respect to the proprietary aspects of the Application for Withholding or the Westinghouse Affidavit should reference CAW-16-4498 and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

James A. Gresham, Manager
Regulatory Compliance

CAW-16-4498

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

I, James A. Gresham, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC ("Westinghouse"), and that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

James A. Gresham, Manager
Regulatory Compliance

Date: 10/27/16

(1) I am Manager, Regulatory Compliance, Westinghouse Electric Company LLC ("Westinghouse"), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute Westinghouse policy and provide the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(iii) There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, is to be received in confidence by the Commission.

(v) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in WCAP-18030-P, Revision 1, "Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3" (Proprietary), dated October 2016, for submittal to the Commission, being transmitted by Arizona Public Service Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with Westinghouse's request for NRC approval of WCAP-18030, and may be used only for that purpose.

(a) This information is part of that which will enable Westinghouse to obtain NRC approval of WCAP-18030, Revision 1, "Criticality Safety Analysis for Palo Verde Nuclear Generating Station Units 1, 2, and 3."

(b) Further, this information has substantial commercial value as follows:

(i) Westinghouse plans to sell the use of similar information to its customers for the purpose of demonstrating the sub-criticality of the spent fuel pool.

(ii) Westinghouse can sell support and defense of industry guidelines and acceptance criteria for plant-specific applications.

(iii) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and non-proprietary versions of a document, furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the Affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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