



102-08095-MDD/MSC
April 16, 2020

**Palo Verde
Nuclear Generating Station**
5871 S. Wintersburg Road
Tonopah, AZ 85354

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

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station Units 1, 2, and 3
License Nos. NPF-41, NPF-51 and NPF-74
Docket Nos. STN 50-528, 50-529, 50-530
Emergency Core Cooling System Performance Evaluation
Models, 10 CFR 50.46(a)(3)(ii) Annual Report for 2019**

Pursuant to 10 CFR 50.46(a)(3)(ii), Arizona Public Service Company (APS) is providing a summary of the cumulative effects on calculated peak cladding temperature (PCT) for the Palo Verde Nuclear Generating Station (PVNGS) due to changes or errors in Emergency Core Cooling System (ECCS) performance evaluation models.

There were no changes or errors that affected PCT in either the large break loss of coolant accident (LOCA) or the small break LOCA calculations for PVNGS Units 1, 2, and 3 for calendar year (CY) 2019. Additionally, because PCT is not calculated as part of the post-LOCA long-term cooling (LTC) analysis, there are no changes or errors in the LTC models that affect PCT.

The enclosure provides a more detailed discussion of the absolute PCT effects in the evaluation models for pressurized water reactors ECCS performance analyses in CY 2019 for PVNGS.

No commitments are being made to the NRC by this letter. Should you need further information regarding this submittal, please contact, Matthew S. Cox, Licensing Section Leader, at (623) 393-5753.

Sincerely,

Michael D. DiLorenzo
Department Leader, Regulatory Affairs

MDD/MSC/CJS

102-08095-MDD/MSC

ATTN: Document Control Desk

U. S. Nuclear Regulatory Commission

ECCS Performance Evaluation Models, 10 CFR 50.46(a)(3)(ii) Annual Report for 2019

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Enclosure: Summary of Cumulative Effects on Calculated Peak Clad
Temperature (PCT) for PVNGS Due to Changes/Errors in
Emergency Core Cooling System (ECCS) Performance
Evaluation Models

CC:

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NRC Region IV Regional Administrator

NRC NRR Project Manager for PVNGS

NRC Senior Resident Inspector for PVNGS

Enclosure

**Summary of Cumulative Effects on Calculated Peak Clad
Temperature (PCT) for PVNGS Due to Changes/Errors in
Emergency Core Cooling System (ECCS) Performance
Evaluation Models**

Enclosure

**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 1
Large Break Loss of Coolant Accident (LBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 1
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	1999 EM
EM Description:	Appendix K Large Break
Summary Status Date:	December 31, 2019

	PCT	Reference(s)	Note(s)
Analysis of Record (AOR)	2130 °F	1, 2	1

	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----

AOR + Assessments	PCT = 2130 °F
	The sum of the PCT from the most recent AOR using an acceptable evaluation model, and the estimated cumulative effects of changes and error corrections made since that AOR, remains less than the 10 CFR 50.46(b)(1) regulatory limit of 2200 °F.

References

1. CN-TLA-14-016, Revision 2, "Palo Verde Units 1, 2 and 3 LBLOCA Bounding ECCS Performance Analysis for NGF Transition," May 2017
2. WCAP-18076-P, Revision 1, "Reload Transition Safety Report for Palo Verde Nuclear Generating Station Units 1, 2 and 3 with Combustion Engineering 16x16 Next Generation Fuel," June 2016

Notes

1. Unit 1 began Calendar Year (CY) 2019 in Operating Cycle 21 with a full core of Westinghouse (formerly Combustion Engineering) standard fuel, also known as Value Added Fuel (VAF) or CE16STD. During Operating Cycle 21 the LBLOCA PCT (2106 °F) was identical to that reported herein on the Unit 2 LBLOCA PCT summary sheet. Unit 1 ended CY 2019 in Operating Cycle 22 with a transition mixed core of CE16STD and Westinghouse Next Generation Fuel, also known as CE16NGF. The PCT reported above (2130 °F) is bounding for both fuel types in the Unit 1 transition mixed core as of December 31, 2019.

Enclosure

**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 2
Large Break Loss of Coolant Accident (LBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 2
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	1999 EM
EM Description:	Appendix K Large Break
Summary Status Date:	December 31, 2019

	PCT		Reference(s)	Note(s)
Analysis of Record (AOR)	2106 °F		1, 2	1
	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----
AOR + Assessments	PCT = 2106 °F			
	The sum of the PCT from the most recent AOR using an acceptable evaluation model, and the estimated cumulative effects of changes and error corrections made since that AOR, remains less than the 10 CFR 50.46(b)(1) regulatory limit of 2200 °F.			

References

1. CN-LAM-09-33, Revision 0, "LBLOCA ECCS Performance Analysis for Palo Verde Units 1, 2, and 3 for RSG and SHA Implementation," August 2009
2. CVER-09-62, "Analysis of Record for Large Break LOCA ECCS Performance Analysis Including Replacement Steam Generators and Simplified Head Implementation for PVNGS Units 1, 2, and 3," August 2009

Notes

1. Unit 2 began and ended Calendar Year (CY) 2019 in Operating Cycle 22 with a full core of Westinghouse (formerly Combustion Engineering) standard fuel, also known as Value Added Fuel (VAF) or CE16STD.

Enclosure

**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 3
Large Break Loss of Coolant Accident (LBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 3
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	1999 EM
EM Description:	Appendix K Large Break
Summary Status Date:	December 31, 2019

	PCT	Reference(s)	Note(s)	
Analysis of Record (AOR)	2130 °F	1, 2	1	
	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----
AOR + Assessments				
PCT = 2130 °F				
The sum of the PCT from the most recent AOR using an acceptable evaluation model, and the estimated cumulative effects of changes and error corrections made since that AOR, remains less than the 10 CFR 50.46(b)(1) regulatory limit of 2200 °F.				

References

1. CN-TLA-14-016, Revision 2, "Palo Verde Units 1, 2 and 3 LBLOCA Bounding ECCS Performance Analysis for NGF Transition," May 2017
2. WCAP-18076-P, Revision 1, "Reload Transition Safety Report for Palo Verde Nuclear Generating Station Units 1, 2 and 3 with Combustion Engineering 16x16 Next Generation Fuel," June 2016

Notes

1. Unit 3 began Calendar Year (CY) 2019 in Operating Cycle 21 with a full core of Westinghouse (formerly Combustion Engineering) standard fuel, also known as Value Added Fuel (VAF) or CE16STD. During Operating Cycle 21 the LBLOCA PCT (2106 °F) was identical to that reported herein on the Unit 2 LBLOCA PCT summary sheet. Unit 3 ended CY 2019 in Operating Cycle 22 with a transition mixed core of CE16STD and Westinghouse Next Generation Fuel, also known as CE16NGF. The PCT reported above (2130 °F) is bounding for both fuel types in the Unit 3 transition mixed core as of December 31, 2019.

Enclosure

**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 1
Small Break Loss of Coolant Accident (SBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 1
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	S2M
EM Description:	Appendix K Small Break
Summary Status Date:	December 31, 2019

	PCT		Reference(s)	Note(s)
Analysis of Record (AOR)	1678 °F		1, 2	1, 2
	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----
AOR + Assessments		PCT = 1678 °F		
		The sum of the PCT from the most recent AOR using an acceptable evaluation model, and the estimated cumulative effects of changes and error corrections made since that AOR, remains less than the 10 CFR 50.46(b)(1) regulatory limit of 2200 °F.		

References

1. CN-TLA-14-020, Revision 1, "Palo Verde Units 1, 2 and 3 SBLOCA Bounding ECCS Performance Analysis for NGF Transition," January 2016
2. WCAP-18076-P, Revision 1, "Reload Transition Safety Report for Palo Verde Nuclear Generating Station Units 1, 2 and 3 with Combustion Engineering 16x16 Next Generation Fuel," June 2016

Notes

1. Unit 1 began Calendar Year (CY) 2019 in Operating Cycle 21 with a full core of Westinghouse (formerly Combustion Engineering) standard fuel, also known as Value Added Fuel (VAF) or CE16STD. During Operating Cycle 21 the SBLOCA PCT (1618 °F) was identical to that reported herein on the Unit 2 SBLOCA PCT summary sheet. Unit 1 ended CY 2019 in Operating Cycle 22 with a transition mixed core of CE16STD and Westinghouse Next Generation Fuel, also known as CE16NGF. The PCT reported above (1678 °F) is bounding for both fuel types in the Unit 1 transition mixed core as of December 31, 2019.
2. Arizona Public Service Company's annual 10 CFR 50.46 report for CY 2018 [NRC Agencywide Documents Access and Management System (ADAMS) Accession No. ML19136A409] reported a preliminary SBLOCA PCT value of 1586 °F for the planned implementation of CE16NGF in CY 2019. The value above (1678 °F) corresponds to an AOR case that included the effects of increased spillage of injected coolant out of the break, and is consistent with the final licensing basis value reviewed by the NRC in its January 2018 Safety Evaluation [NRC ADAMS Accession No. ML17319A107].

Enclosure

**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 2
Small Break Loss of Coolant Accident (SBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 2
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	S2M
EM Description:	Appendix K Small Break
Summary Status Date:	December 31, 2019

	PCT		Reference(s)	Note(s)
Analysis of Record (AOR)	1618 °F		1, 2	1
	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----
AOR + Assessments	PCT = 1618 °F			
	The sum of the PCT from the most recent AOR using an acceptable evaluation model, and the estimated cumulative effects of changes and error corrections made since that AOR, remains less than the 10 CFR 50.46(b)(1) regulatory limit of 2200 °F.			

References

1. A-PV-FE-0149, Revision 1, "Palo Verde Units 1, 2 and 3 S2M Bounding SBLOCA ECCS Performance Analysis," March 2002
2. V-2002-047, "Revision 001 to Quality Assured Small Break LOCA Analysis and Revision 005 to ECCS Performance Analysis Comprehensive Checklist for Palo Verde," March 2002

Notes

1. Unit 2 began and ended Calendar Year (CY) 2019 in Operating Cycle 22 with a full core of Westinghouse (formerly Combustion Engineering) standard fuel, also known as Value Added Fuel (VAF) or CE16STD.

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**Summary of Cumulative Effects on Calculated PCT for PVNGS
Due to Changes/Errors in ECCS Performance Evaluation Models**

**Palo Verde Unit 3
Small Break Loss of Coolant Accident (SBLOCA)
Peak Cladding Temperature (PCT) Summary Sheet**

Plant Name:	Palo Verde Nuclear Generating Station, Unit 3
Utility Name:	Arizona Public Service Company
Evaluation Model (EM):	S2M
EM Description:	Appendix K Small Break
Summary Status Date:	December 31, 2019

	PCT	Reference(s)	Note(s)
Analysis of Record (AOR)	1678 °F	1, 2	1, 2

	Net PCT Effect	Absolute PCT Effect	Reference(s)	Note(s)
Assessments				
A. Cumulative 10 CFR 50.46 Changes and Error Corrections – Previously Reported	+ 0 °F	+ 0 °F	-----	-----
B. 10 CFR 50.46 Changes and Error Corrections – New for CY 2019	+ 0 °F	+ 0 °F	-----	-----
C. Absolute Sum of Cumulative 10 CFR 50.46 Changes and Error Corrections	-----	+ 0 °F	-----	-----

AOR + Assessments	PCT = 1678 °F
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References

1. CN-TLA-14-020, Revision 1, "Palo Verde Units 1, 2 and 3 SBLOCA Bounding ECCS Performance Analysis for NGF Transition," January 2016
2. WCAP-18076-P, Revision 1, "Reload Transition Safety Report for Palo Verde Nuclear Generating Station Units 1, 2 and 3 with Combustion Engineering 16x16 Next Generation Fuel," June 2016

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2. Arizona Public Service Company's annual 10 CFR 50.46 report for CY 2018 [NRC Agencywide Documents Access and Management System (ADAMS) Accession No. ML19136A409] reported a preliminary SBLOCA PCT value of 1586 °F for the planned implementation of CE16NGF in CY 2019. The value above (1678 °F) corresponds to an AOR case that included the effects of increased spillage of injected coolant out of the break, and is consistent with the final licensing basis value reviewed by the NRC in its January 2018 Safety Evaluation [NRC ADAMS Accession No. ML17319A107].