



Palo Verde Nuclear
Generating Station

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102-04974-CDM/TNW/RAB
July 25, 2003

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- References:
1. Letter No. 102-04641-CDM/RAB, dated December 21, 2001, from C. D. Mauldin, APS to U. S. Nuclear Regulatory Commission, "Request for a License Amendment to Support Replacement of Steam Generators and Up-rated Power Operations"
 2. Letter dated April 17, 2003 from B. M. Pham, USNRC, to G. R. Overbeck "Palo Verde Nuclear generating Station, Unit 2 (PVNGS-2) – Draft Safety Evaluation Report (SER) of Amendment on Replacement of Steam Generators and Up-rated Power Operations"
 3. Letter No. 102-04954-CDM/TNW/RAB, dated June 10, 2003, from C. D. Mauldin, APS to U. S. Nuclear regulatory Commission, "Results of Review for Factual Accuracy in Draft safety Evaluation Report (SER)"

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2, Docket No. STN 50-529
Response to Request for Additional Information Regarding
Steam Generator Replacement and Power Uprate License
Amendment Request**

In Reference 1, Arizona Public Service Company (APS) submitted a license amendment request to support steam generator replacement and uprated power operations for PVNGS Unit 2. In Reference 2, the NRC provided a draft Safety Evaluation Report (SER), and requested that APS review the SER for technical accuracy and provide comments to the NRC Staff. In Reference 3, APS provided comments to the staff. Comment 13 on Draft SER, Section 4.1 required further discussion with the Staff, and APS held further comment in abeyance until the discussion was completed.

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On June 26, 2003, a meeting was held at NRC Headquarters with APS and the Westinghouse Electric Corporation, LLC (Westinghouse). During the meeting, the Staff requested that APS provide additional information summarizing the results of a study that was performed to demonstrate the acceptability of using CENPD-137, "Calculative Methods for the ABB CE Small Break LOCA Evaluation Model," Supplement 2-P-A at the proposed uprated power level for PVNGS Unit 2. The response to this request for additional information is provided as Attachment 2 to this letter. APS is providing a revision of comment 13 to Draft SER, Section 4.1 in Attachment 3.

On July 17, 2003, a conference call was held with the NRC, APS and Westinghouse to discuss the meaning/treatment of pre-transient cladding oxidation in relation to the calculation of "total oxidation" as required by 10 CFR 50.46(b)(2), "Maximum Cladding Oxidation". APS agreed to provide additional information to clarify its position. Attachment 4 contains the additional information.

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

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

Sincerely,



CDM/TNW/RAB

cc:	Regional Administrator	(NRC Region IV)
	J. N. Donohew	(NRC Project Manager)
	B. M. Pham	(NRC Project Manager)
	N. L. Salgado	(NRC Resident Inspector)
	A. V. Godwin	(ARRA)

Attachments:

1. Notarized Affidavit
2. Response to Additional Information Requested During the Meeting Held on June 26, 2003
3. Revised Comment 13 to Draft Safety Evaluation Report, Section 4.1
4. Additional Information Requested in July 17, 2003 Conference Call

Attachment 1

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.

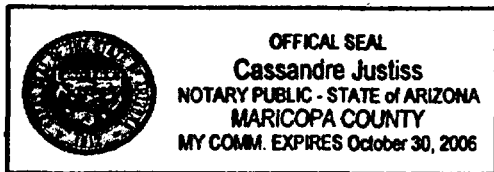


David Mauldin

Sworn To Before Me This 25th Day Of July, 2003.



Notary Public



Notary Commission Stamp

Attachment 2

**Response to Additional Information Requested
During the Meeting Held on June 26, 2003**

NRC Request for Additional Information¹

NRC acceptance of the S2M version of the Westinghouse Small Break Loss-of-Coolant Accident (SBLOCA) evaluation model for CE designed PWRs (Reference 1) was based, in part, on the results of a study that was performed for a 3400 MWt CE designed PWR (Appendix E of Reference 1). The study compared the change in peak cladding temperature (PCT) due to the model revisions introduced in the S2M methodology to the conservatism in the 10 CFR 50, Appendix K decay heat model.

In support of establishing the applicability of the S2M methodology to PVNGS-2 at the uprated power of 3990 MWt, provide a summary of the results of the study described above, repeated for the limiting break of the PVNGS S2M SBLOCA analysis described in Reference 2.

As described in Appendix E of Reference 1, the study should consist of the following three cases.

Case 1, S1M@1.2: S1M evaluation model with the multiplier on the decay heat model adjusted to achieve a PCT approximately equal to 2200°F.

Case 2, S2M@1.2: S2M evaluation model with the same decay heat multiplier used in Case 1.

Case 3, S1M@1.0: S1M evaluation model with a decay heat multiplier equal to the Case 1 and Case 2 multiplier divided by 1.2. In other words, the decay heat multiplier for Cases 1 and 2 is 1.2 times the decay heat multiplier for Case 3.

In all three cases the metal-water reaction model should be turned off to avoid the runaway response that this model introduces at high cladding temperatures. With the metal-water reaction model turned off, the difference in PCT due to the S2M model revisions can be seen and compared to the known conservatism in the Appendix K decay heat model.

References:

1. CENPD-137, Supplement 2-P-A, "Calculative Methods for the ABB CE Small Break LOCA Evaluation Model," April 1998.
2. Letter 102-04699-CDM/TNW/JAP, D. Mauldin (APS) to Document Control Desk (USNRC), "Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3,

¹ The request for additional information (RAI) was verbally made by NRC staff during a meeting held on June 26, 2003 between NRC, APS, and Westinghouse. This written statement of the RAI was prepared by APS.

Docket Nos. STN 50-528/529/530, 10 CFR 50.46(a)(3)(ii) 30-Day Report for Changes in LOCA/ECCS Performance Evaluation Models," May 3, 2002.

APS Response

The following is a summary of the requested study.

The study was performed for the limiting break of the PVNGS S2M SBLOCA analysis described in Reference 2 of the Request for Additional Information (RAI), i.e., a 0.05 ft² break in the Reactor Coolant Pump discharge leg. The study was performed for Zircaloy-4 cladding since the S1M version of the Westinghouse SBLOCA evaluation model for CE designed PWRs does not contain models for ZIRLO™ cladding. Other than modeling Zircaloy-4 cladding and the changes required for the study (i.e., turning off the metal-water reaction rate model and modifying the decay heat model multiplier), no changes were made to the analysis described in Reference 2 of the RAI in performing the study. Note that the PVNGS SBLOCA analysis described in Reference 2 of the RAI was performed for a core power level of 3990 MWt (4070 MWt including the power measurement uncertainty).

The following table lists the PCTs for the three cases that comprise the study.

Case No.	Description	PCT (°F)
1	S1M@1.2	2183
2	S2M@1.2	1813
3	S1M@1.0	1263

The difference in the PCTs between Cases 1 and 2 is 370°F. This is the change in PCT associated with the model revisions introduced in the S2M methodology. The difference in PCT between Cases 1 and 3 is 920°F. This is a measure of the margin in the 10 CFR 50, Appendix K decay heat model under the conditions of the study (i.e., PCT near 2200°F and the metal-water reaction model turned off).

The ratio of these two differences is 0.40. In the context of the study, this ratio is interpreted as meaning that, for PVNGS-2 at 3990 MWt, the margin generated by the model revisions introduced in the S2M methodology is equivalent to approximately 40% of the margin of the 10 CFR 50, Appendix K decay heat model in the S1M analysis. The value of 40% equates to a retained decay heat multiplier of 1.120 (i.e., $1.0 + (100\% - 40\%) \cdot 0.20$). Of course, 100% of the margin of the 10 CFR 50, Appendix K decay heat model is retained in the PVNGS-2 S2M analysis, since, like all S2M analyses, it was performed with the 1.2 multiplier required by 10 CFR 50, Appendix K.

For comparison, the study reported in Appendix E of Reference 1 of the RAI resulted in a retained decay heat multiplier of 1.148. That study was performed for a 3400 MWt CE designed PWR. Thus, both studies resulted in comparable values for the retained

decay heat multiplier. The results of the study for PVNGS-2 further support the following conclusion from Appendix E of Reference 1 of the RAI:

“...the analysis margin provided by the S2M relative to the S1M with a 1.2 decay heat multiplier and no metal-water reaction is not significantly different at higher power levels or at higher peak cladding temperature levels...”

Therefore, use of the S2M methodology at the uprated power condition is acceptable and continues to provide conservative results for the Palo Verde units.

Attachment 3

**Revised Comment to Draft Safety Evaluation Report (SER),
Section 4.1**

4.1 Emergency Core Cooling System Performance Analysis

The second to the last paragraph states:

“The staff concludes that the licensee’s LOCA analyses are acceptable and demonstrate that the PVNGS-2 plant complies with the requirements of 10 CFR 50.46 (b)(1-4). This conclusion, however, is subject to the following limitation: The staff’s findings are based in part on licensee analyses using CENPD-137 Supplement 1-P-A. Accordingly the licensee must continue to include CENPD-137 Supplement 1-P-A in the PVNGS-2 Technical Specification COLR References.”

The paragraph should state:

“The staff concludes that the licensee’s LOCA analyses are acceptable and demonstrate that the PVNGS-2 plant complies with the requirements of 10 CFR 50.46 (b)(1-4).”

Attachment 4

**Additional Information Requested in July 17, 2003
Conference Call**

The Westinghouse (then Combustion Engineering) Emergency Core Cooling System (ECCS) Performance Evaluation Model (EM) for Large Break Loss of Coolant Accident (LBLOCA) analysis describes the models for determining Maximum Cladding Oxidation (MCO) percentage in topical report CENPD-132-P¹. This EM was reviewed and approved for use by the NRC in June 1974². Neither the methodology nor its application for determining MCO has changed since its approval. The EM starts the analysis with a thin pre-transient oxide layer, which is conservative from the point of maximizing the oxidation rate during the LBLOCA transient. The EM calculates the oxidation on the external cladding surface and following cladding rupture (should it occur) on the internal cladding surface. The combination of internal and external oxidation results in the total MCO used for comparison to the 10 CFR 50.46(b)(2) acceptance criterion.

APS, with the assistance of its fuel vendor (Westinghouse) has performed the PVNGS-2 power uprate LBLOCA analysis in conformance with the NRC approved EM for CE designed NSSSs/fuel (i.e., CENPD-132). Therefore, the analysis results submitted in support of the PVNGS-2 power uprate are acceptable with no changes or revisions necessary.

¹ CENPD-132, Volumes 1(P) and 2(P), "Calculative Methods for the C-E Large Break LOCA Evaluation Model", August 1974

² Letter, O. D. Parr (NRC) to F. M. Stern (CE), "NRC Staff Review of the Combustion Engineering ECCS Evaluation Model", June 13, 1975