



Palo Verde Nuclear
Generating Station

David Mauldin
Vice President
Nuclear Engineering
and Support

TEL (623) 393-5553
FAX (623) 393-6077

Mail Station 7605
P.O. Box 52034
Phoenix, AZ 85072-2034

102-04989-CDM/TNW/RMW
August 22, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555

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. ABB Combustion Engineering Nuclear Fuel Topical Report CEN-386-P-A, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kgU for Combustion Engineering 16x16 PWR Fuel", dated August 1992.
3. NRC Letter from Ashok C. Thadani, USNRC, to Mr. A. E. Scherer, Combustion Engineering, dated June 22, 1992, "Generic Approval of C-E Topical Report CEN-386-P-A, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kgU for Combustion Engineering 16x16 PWR Fuel" (TAC NO. M82192)".

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 up-rated power operations for PVNGS Unit 2. During a conference call held between the NRC staff and APS on August 15, 2003, the staff requested additional information regarding cladding oxidation for zircaloy-clad fuel. This information can be obtained from Figure 4.1.2.a-1, Oxide vs. Burnup, page 8, of Reference 2. Please note the following with respect to the information provided in this figure and Reference 2:

A member of the **STARS** (Strategic Teaming and Resource Sharing) Alliance

Callaway • Comanche Peak • Diablo Canyon • Palo Verde • South Texas Project • Wolf Creek

ADD!

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Response to Request for Additional Information Regarding Steam Generator
Replacement and Power Uprate License Amendment Request
Page 2

1. The information contained in Reference 2 is ABB Combustion Engineering Nuclear Fuel (now Westinghouse Electric Company LLC) proprietary information,
2. Reference 2 has received generic NRC approval as documented in Reference 3,
3. Fuel rod details are provided on page 73 of Reference 2, Table 4.2.7.a-1, and
4. The oxide information provided in Figure 4.1.2.a-1 must be converted from oxide thickness into the percent amount of zircaloy cladding wastage that occurs when oxidation occurs. This conversion process is described below.

Oxide thickness, in microns, can be converted into the percent amount of zircaloy cladding wastage using the following equations:

Zircaloy cladding wastage (μm) = oxide thickness (μm)/1.56 (based on information taken from Figure 4.1.2.a-1 of Reference 2, and the volumetric difference between zircaloy cladding oxide and pure zircaloy cladding. One oxide molecule occupies 1.56 times as much volume as one pure zircaloy cladding molecule)

Original zircaloy cladding thickness (μm) = original zircaloy cladding thickness (mils) x 25.4 (original zircaloy cladding thickness can be determined from information provided in Table 4.2.7.a-1 of Reference 2, and on the conversion factor of 1 mil = 25.4 μm)

Percent zircaloy cladding wastage = (zircaloy cladding wastage (μm)/original zircaloy cladding thickness (μm))x100

An example of the above conversion process is provided below. Assume that the initial zircaloy cladding thickness is 25 mils and that the oxide thickness, in microns, for a rod average burnup of 40 MWD/kgU has been determined to be 40 μm from Figure 4.1.2.a-1. Note that these assumed values are for illustration purposes only and they may not be representative of the actual values provided in Reference 2.

Zircaloy cladding wastage (μm) = 40 μm /1.56 = 25.64 μm

Original zircaloy cladding thickness (μm) = 25 mils x 25.4 $\mu\text{m}/\text{mil}$ = 635 μm

Percent zircaloy cladding wastage = (25.64 μm /635 μm)x100 = 4.04%

As can be seen from this example, determining the percent amount of zircaloy cladding wastage from the information provided in Reference 2 is a straightforward conversion process.

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Response to Request for Additional Information Regarding Steam Generator
Replacement and Power Uprate License Amendment Request
Page 3

This letter does not contain any proprietary information, nor are any commitments being made to the NRC in this letter.

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

Sincerely,

David Mauldin

CDM/TNW/RMW

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

Attachment:

1. Notarized Affidavit

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.

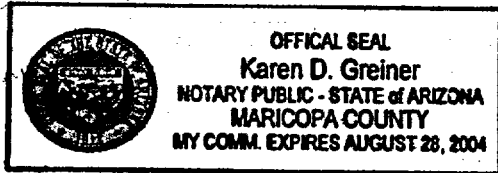
David Mauldin

David Mauldin

Sworn To Before Me This 22nd Day Of August, 2003.

Karen D. Greiner

Notary Public



Notary Commission Stamp