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SUBJECT: Forwards rept re transfer of high burnup fuel rods,as part of fuel performance program.Site-specific data will ultimately be used to support efforts to achieve economic benefits of higher burnup fuel cycles consistent w/approval.

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November 19, 1993

WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
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Reference: Letter from A. C. Thadani, NRC, to A. E. Scherer, Combustion Engineering Inc., Generic Approval of C-E Topical Report CEN-386-P, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kg for Combustion Engineering 16X16 PWR Fuel," (TAC No. M82192), dated June 22, 1992.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 1
Docket No. STN 50-528
Fuel Rod Transfer
File: 93-056-026

Arizona Public Service Company (APS) and ABB Combustion Engineering have been collaborating in an ongoing fuel performance program at PVNGS. This program is designed to help APS achieve higher fuel rod burnups by evaluating the oxide film thickness of standard and improved fuel rod cladding compositions that have been subject to reactor coolant temperatures and water chemistry at PVNGS. This site-specific data will ultimately be used to support efforts to achieve the economic benefits of higher burnup fuel cycles consistent with the generic NRC approval for higher burnups described in the referenced letter.

As a part of the fuel performance program, 15 fuel rods with several Zircaloy-4 cladding variants were transferred from a D fuel assembly to an E assembly during the Palo Verde Unit 1 fourth refueling outage. These 15 fuel rods were irradiated for three cycles in the D fuel assembly, and will be irradiated for one additional cycle in the E assembly. The purpose of the rod transfer is to demonstrate acceptable corrosion resistance of the cladding to exposures up to 60,000 megawatt-days per metric tons of uranium (MWd/MTU) rod average burnup. This burnup is greater than the 52,000 MWd/MTU described in section 4.3.1.1 of the PVNGS Updated Final Safety Analysis Report. However, safety and design analyses have shown that the performance of the transferred fuel rods is non-limiting and is bounded by the results of the Unit 1 Cycle 5 safety analysis. In accordance with 10 CFR 50.59, no unreviewed safety question is involved.

A001

Enclosed is a description of the rod transfer.

This rod transfer has been evaluated as part of the Unit 1 Cycle 5 reload using NRC approved methodologies, with predicted performance bounded by the safety analysis results. This letter is being provided to the NRC for information; no response is requested.

Should you have any questions, please contact Richard A. Bernier at (602) 393-5882.

Sincerely,

WFC/RAB/GAM/kl

Enclosure

cc: B. H. Faulkenberry
J. A. Sloan

ENCLOSURE

TRANSFER OF HIGH BURNUP FUEL RODS IN PVNGS UNIT 1

Transfer of High Burnup Fuel Rods in PVNGS Unit 1

A small number of fuel rods (15) in PVNGS Unit 1 that have been irradiated in Fuel Assembly P1D001 for three cycles were transferred into Assembly P1E001 during the Palo Verde Unit 1 end-of-cycle-four (EOC-4) refueling outage. Assembly P1E001 has been returned to the Unit 1 core for irradiation during Cycle 5. These 15 fuel rods are clad with several different Zircaloy-4 cladding variants. The purpose of the rod transfer is to demonstrate acceptable corrosion resistance of the fuel rod cladding to exposures up to 60,000 megawatt-days per metric ton of uranium (MWd/MTU) rod average burnup. The rod average burnups of the 15 fuel rods from P1D001 transferred to P1E001 will exceed 52,000 MWd/MTU during Cycle 5 and a few of these rods will approach 60,000 MWd/MTU.

All 15 fuel rods from P1D001 transferred to P1E001 were visually examined and measured for oxide thickness during the Unit 1 EOC-4 refueling outage, with the results confirming expected performance. Twelve of these same 15 fuel rods had also been measured for oxide thickness during the EOC-3 refueling outage. Non-linear regression analysis was used to estimate the projected oxide thicknesses on these 15 fuel rods at the end of Cycle 5. The analysis determined that, based upon the measured and projected oxide thicknesses for these fuel rods, corrosion on the 15 rods through Cycle 5 is expected to be lower than 120 microns.

Safety and design analysis of the 15 transferred rods has shown no impact on the results contained in the Unit 1 Cycle 5 safety analysis. A fuel performance calculation performed using FATES3B (References 1-1, 1-2 and 1-3) shows that predicted results for fuel rod internal pressures, fuel temperatures, and power to fuel centerline melting for these 15 rods are bounded by the results calculated for the rest of the core. Also, LOCA and non-LOCA transient analysis results remain bounding and applicable for these 15 rods. Furthermore, the mechanical performance of the cladding, considering allowable cladding stresses, strains, fatigue, and cladding collapse, was found to be acceptable. Consequently, the performance of this small number of fuel rods is non-limiting and is bounded by the results in the Unit 1 Cycle 5 safety analysis.

References:

1-1. CENPD-139-P-A, "C-E Fuel Evaluation Model," Combustion Engineering, Inc., July, 1974.

1-2. CEN-161-(B)-P-A, "Improvements to the Fuel Evaluation Model," August 1989.

1-3. CEN-161-(B)-P-A, "Improvements to the Fuel Evaluation Model," August 1989, Supplement 1-P-A, January 1992.