SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT □ 6201 S Street, P.O. Box 15830, Sacramento CA 95852-1830, (916) 452-3211
AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

RJR 85-358

August 2, 1985

DIRECTOR OF NUCLEAR REACTOR REGULATION
ATTENTION JOHN F STOLZ CHIEF
OPERATING REACTORS BRANCH 4
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON D C 20555

DOCKET NO. 50-312
LICENSE NO. DPR-54
ANSWERS TO QUESTIONS ON PROPOSED AMENDMENT 126

In your letter of June 13, 1985 you requested additional information on SMUD's submittal of March 18, 1985.

The attachment to this letter contains the requested information.

Should you have any questions concerning this proposal, please contact Mr. R. W. Colombo at Rancho Seco Nuclear Generating Station.

R. J. RODRIGUEZ
ASSISTANT GENERAL MANAGER,
NUCLEAR

Attachment

Sworn to and subscribed before me this 2nd day of August, 1985.

Patricia K. Geisler
Notary Public

PATRICIA K. GEISLER
NOTARY PUBLIC—CALIFORNIA
PRINCIPAL OFFICE IN
SACRAMENTO COUNTY
My Commission Expires February 16, 1988

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Question 1:

Your submittal of March 18, 1985 states that a boron concentration of 1974 ppm will "...sustain a reactivity condition of keff = 0.95 or less with all control rods removed from the core." (underlining added). Neither the Rancho Seco Updated Safety Analysis Report (containing nuclear data for Cycle 6) or the Reload Report for Cycle 7, however, provide a basis for confirming the correctness of this concentration. Therefore, please provide a copy of the analysis that resulted in this estimate. If the analysis utilized information from reference documents, please provide applicable extracts from the references.

Response:

The following calculation is the basis for the Rancho Seco Cycle 7 Technical Specification requirement of 1974 ppmb to sustain a reactivity of keff = 0.95 or less with all control rods removed from the core.

Refueling Boron Concentration (RBC) was calculated with a 1-zone (coarse mesh) PDQ model, which has extensive fitted cross sections at cold conditions and is B&W's standard model for these calculations. Because physics calculations for the reload licensing of cycle 7 were performed with the NOODLE code, appropriate normalization of 1-zone PDQ to NOODLE calculated reactivity was made. This normalization includes the reactivity effects of the axial blanket which was modeled in NOODLE, and maintains consistency with all of the other reported physics data for cycle 7.

Because the RBC is to be specified with all control rods removed from the core, the base 1-zone case used for the calculation was run with all rods withdrawn, including Bank 8. The RBC was then calculated as follows:

$$RBC = BC + IBW(\rho + \text{Model } \Delta + \text{Criticals} + NUAB + \phi R + ZR + SDR)$$

where

RBC = The Refueling Boron Concentration for keff = 0.95 with all control rods removed from the core.

BC = The boron concentration of the base 1-zone PDQ case used to calculate RBC. (BC = 2000 ppmb)

IBW = The cold inverse boron worth in the boron concentration range of the RBC, calculated with 1-zone PDQ. (IBW = 89.2 ppmb/% $\Delta k/k$)

ρ = The reactivity of the base 1-zone PDQ case at 2000 ppmb with all-rods-out. (ρ = -5.55% $\Delta k/k$)

Model Δ = The adjustment for the reactivity difference between a NOODLE case with axial blanket modeling and an equivalent 1-zone PDQ case without axial blanket modeling. (Model Δ = -.449% $\Delta k/k$)

Criticals = The constant-valued standard B&W model correction which accounts for observed biases between PDQ calculations and measured critical experiment data. (Criticals = +.4% Δk/k)

NUAB = A standard B&W generic model correction to reactivities calculated with 2-D PDQ, which accounts for non-uniform axial burnup effects not seen in the 2-D calculations. (NUAB = -.69% Δk/k for BOC-7)

ϕR = The standard generic flux redistribution model correction for 2-D calculations to account for the reactivity worth of axial flux shifts. (ϕR = .54% Δk/k for BOC-7 refueling conditions)

ZR = The reactivity worth of the Zirc grid relative to Inconel grids which are the basis for the fitted PDQ cross sections. (ZR = .2% Δk/k)

SDR = The Tech Spec shutdown requirement of a keff of .95, converted to units of reactivity. (SDR = 5.26% Δk/k)

This analysis results in a refueling boron concentration of:

RBC = 2000 + 89.2(-5.55 - .449 + .4 - .69 + .54 + .2 + 5.26)
= 1974 ppmb

Question 2:

If your review of the information needed for this submittal should reveal an error in the analysis that would increase the required concentration, please provide an appropriate revision to your request and to LER 85-03.

Response:

The calculation presented in the response to Question 1 has been reviewed and found correct.