SEP 12 1977

MEMORANDUM FOR: D. B. Vassallo, Assistant Director for Light Water Reactors, DPM

THRU: P. S. Check, Chief, Core Performance Branch, DSS

FROM: R. O. Meyer, Leader, Reactor Fuels Section, Core Performance Branch, DSS

SUBJECT: SUPPLEMENT FOR BSAR-205 CONCERNING B_4C CONTROL RODS

Plant Name:	BSAR-205
Docket Number:	50-561
Milestone Number:	24-24
Licensing Stage:	PDA
Responsible Branch and Project Manager:	LWR-1 T. Cox
Systems Safety Branch Involved:	Core Performance Branch
Description of Review:	SER Supplement Input
Requested Completion Date:	August 25, 1977
Review Status:	Complete

The Reactor Fuels Section of the Core Performance Branch has prepared the attached supplement to the BSAR-205 SER. The supplement describes our review of the new B_4C control rod design. We conclude that the design is acceptable for a PDA, but we will require licensees who use B_4C control rods to submit plans for surveillance to assure that conrtol rod reactivity is not decreased through some common mode failure mechanism. In addition, we are requesting B&W to submit a topical report on this new control rod design.

Ralph O. Meyer, Section Leader
Reactor Fuels Section
Core Performance Branch
Division of Systems Safety

Enclosure:
As stated

DOCKET FILES
NRR Reading File
CPB Reading File

DSS:CPB	DSS:CPB	DSS:CPB
MTokar/cc	RMeyer	PCheck
9/ /77	9/ /77	9/ /77

cc: S. Hanauer
R. Mattson
R. Boyd
F. Schroeder
J. Stolz
T. Cox
D. Ross
P. Check
W. McDonald
W. Brooks
D. Houston
M. Tokar

B-SAR-205 B_4C CONTROL ROD ASSEMBLY

MATERIALS AND MECHANICAL - THERMAL DESIGN EVALUATION

As noted in Section 4.2.3.2.1 of B-SAR-205, the control rod assemblies (CRAs) will be comprised of B_4C neutron absorber material clad with cold-worked, type 304 austenitic stainless steel tubing. B-SAR-205 plants will be the first B&W reactors to use B_4C absorber material in their control rods; earlier plants have used Ag-In-Cd.

Although the probability of cladding failure appears to be quite low, we have considered the behavior of the B_4C CRAs in the postulated case of cladding perforation or failure. Experimental evidence exists to show that irradiated B_4C has a higher solubility rate in water than does the unirradiated material. Moreover, a manufacturing error recently led to failure of some Zircaloy-clad Al_2O_3-B_4C burnable poison rods in St. Lucie 1. Approximately 10% of the initial boron loading was lost over a 2-month period as a result of partial dissolution of the slightly irradiated Al_2O_3-B_4C in the PWR primary coolant. Although the resulting change in core nuclear characteristics was detected by in-core instrumentation in the St. Lucie plant, we are concerned that many of the B-SAR-205 B_4C CRAs will be in safety banks which are held out of the core for emergency situations; they are not normally used and, therefore, their reactivity worth is not normally observed. Since it seems unwise to permit safety rods containing soluble poison to remain in the reactor coolant for years without checking their reactivity worth or integrity, we will require licensees who use B_4C CRAs to

submit plans for routine surveillance designed to assure that the reactivity invested in the control rods is not being lost through some common mode failure mechanism. An acceptable program might include several rod reactivity checks during the first core cycle and worth measurements of all the rod banks at refueling outages thereafter. Another possibility involves the use of an isotopic "tag" material, which could signal the initiation and location of CRA cladding perforation.

In addition, we are requesting a topical report from B&W on design, testing, and material performance of B_4C CRAs. This topical report should be submitted at least one year prior to submittal of an FSAR on a B&W reactor incorporating B_4C absorber material in its CRAs.