

October 19, 2001

Mr. James F. Mallay  
Director, Regulatory Affairs  
Framatome ANP, Richland, Inc.  
2101 Horn Rapids Road  
Richland, WA 99352

SUBJECT: SAFETY EVALUATION FOR BAW-1543, REVISION 4, SUPPLEMENT 4,  
"SUPPLEMENT TO THE MASTER INTEGRATED REACTOR VESSEL  
SURVEILLANCE PROGRAM" (TAC NO. MB1859)

Dear Mr. Mallay:

By letter dated April 10, 2001, the Babcock and Wilcox Owners Group (B&WOG) Reactor Vessel Working Group submitted for NRC approval BAW-1543, Revision 4, Supplement 4, "Supplement to the Master Integrated Reactor Vessel Surveillance Program." BAW-1543, Revision 4, reports the essential features of a master integrated reactor vessel surveillance program for all operating Babcock and Wilcox (B&W) 177-FA plants and those Westinghouse plants having B&W fabricated reactor vessels. The supplementary documents (Supplements 1, 2, and 3) to BAW-1543, Revision 4, contain surveillance capsule insertion and withdrawal schedules for B&W and Westinghouse surveillance capsules. Supplement 4 is a revision to and replaces Supplement 3 in its entirety. In BAW-1543, Revision 4, Supplement 4, the B&WOG incorporates the disposal plan for archive specimens, updates the status for various capsules, and incorporates current license fluence values. Previous capsule withdrawal schedules are not affected by this revision.

The NRC staff has completed its review of the subject topical report (TR) and finds that it is acceptable for referencing in licensing applications to the extent specified and under the limitations delineated in the report and in the associated safety evaluation (SE). The SE defines the basis for acceptance of the report.

We do not intend to repeat our review of the matters described in the subject report, and found acceptable, when the report appears as a reference in license applications, except to ensure that the material presented applies to the specific plant involved. Our acceptance applies only to matters approved in the report.

In accordance with procedures established in NUREG-0390, the NRC requests that the B&W Owners Group publish an accepted version of the submittal within 3 months of receipt of this letter. The accepted version shall incorporate (1) this letter and the enclosed SE between the title page and the abstract, and (2) all requests for additional information (RAI) from the staff and all associated responses, and (3) an "-A" (designating "accepted") following the report identification symbol.

Mr. James F. Mallay

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Should our criteria or regulations change so that our conclusions as to the acceptability of the report are invalidated, the B&W Owners Group and/or the applicants referencing the TR will be expected to revise and resubmit their respective documentation, or submit justification for the continued applicability of the TR without revision of their respective documentation.

Sincerely,

*/RA/*

Stuart A. Richards, Director  
Project Directorate IV  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Safety Evaluation

cc w/encl: See next page

Mr. James F. Mallay

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cc:

Mr. Guy G. Campbell, Chairman  
B&WOG Executive Committee  
Vice President - Nuclear  
FirstEnergy Nuclear Operating Company  
Davis-Besse Nuclear Power Station  
5501 North State Rt. 2  
Oak Harbor, OH 43449

Ms. Sherry L. Bernhoft, Chairman  
B&WOG Steering Committee  
Florida Power Corporation  
Crystal River Energy Complex  
15760 West Power Line St.  
Crystal River, FL 34428-6708

Mr. J. J. Kelly, Manager  
B&W Owners Group Services  
Framatome Technologies, Inc.  
P.O. Box 10935  
Lynchburg, VA 24506-0935

Mr. F. McPhatter, Manager  
Framatome Cogema Fuels  
3315 Old Forest Road  
P.O. Box 10935  
Lynchburg, VA 24506-0935

Mr. R. Schomaker, Manager  
Framatome Cogema Fuels  
3315 Old Forest Road  
P.O. Box 10935  
Lynchburg, VA 24506-0935

Mr. Michael Schoppman  
Licensing Manager  
Framatome Technologies, Inc.  
1700 Rockville Pike, Suite 525  
Rockville, MD 20852-1631

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

BAW-1543, REVISION 4, SUPPLEMENT 4,

"SUPPLEMENT TO THE MASTER INTEGRATED REACTOR VESSEL

SURVEILLANCE PROGRAM"

PROJECT NO. 693

1.0 INTRODUCTION

By letter dated April 10, 2001, the Babcock and Wilcox Owners Group (B&WOG) Reactor Vessel Working Group submitted for NRC approval BAW-1543, Revision 4, Supplement 4, "Supplement to the Master Integrated Reactor Vessel Surveillance Program." BAW-1543, Revision 4, reports the essential features of a master integrated reactor vessel surveillance program for all operating Babcock and Wilcox (B&W) 177-FA plants and those Westinghouse plants having B&W-fabricated reactor vessels. The supplementary documents (Supplements 1, 2, and 3) to BAW-1543, Revision 4, contain surveillance capsule insertion and withdrawal schedules for B&W and Westinghouse surveillance capsules. Supplement 4 is a revision to and replaces Supplement 3 in its entirety. In BAW-1543, Revision 4, Supplement 4, the B&WOG incorporates the disposal plan for archive specimens, updates the status for various capsules, and incorporates current license fluence values. Previous capsule withdrawal schedules are not affected by this revision.

2.0 BACKGROUND

By letter dated October 12, 1989, the B&WOG submitted for staff approval BAW-1543, Revision 3, "The B&W Owners Group Materials Committee Master Integrated Reactor Vessel Surveillance Program." This report described a program which was designed to provide the data required to monitor the neutron embrittlement of the reactor vessel beltline region of 16 reactor vessels fabricated by Babcock and Wilcox (B&W). These reactor vessels included 7 B&W-designed 177-fuel assembly (FA) plants and 9 Westinghouse-designed plants with B&W fabricated reactor vessels. The program was built upon the integrated surveillance program developed by the B&WOG for the B&W 177-FA plants. All 16 reactors are of the same basic design concept: pressurized water reactor, operating at 550°F and 2250 psi nominal inlet temperature and pressure, and with low enrichment fuel (approximately 2-4 percent enrichment).

The irradiation schedules for the B&WOG Master Integrated Reactor Vessel Surveillance Program (MIRVP) include the plant-specific capsules for the B&W and Westinghouse-designed vessels and the supplementary weld metal surveillance capsules (SUPCAPS) and higher fluence supplementary weld metal surveillance capsules (HUPCAPS). All of the irradiations, with the exception of Capsule W1 and the Westinghouse plant-specific capsules, are performed in the B&W host reactors, Crystal River-3 and Davis-Besse. Capsule W1, an irradiation capsule of the Westinghouse-design, is being irradiated in Surry Unit 2. The Westinghouse plant-specific capsules are irradiated in their respective plants. An updated list of the status of

the Westinghouse and B&W plant-specific/integrated surveillance capsules is provided in the Attachment to this safety evaluation (SE).

The staff evaluated the B&WOG's basis for the integrated program concept. The criteria as provided by Appendix H to 10 CFR Part 50 were met; therefore, the staff determined the MIRVP to be acceptable. By letter dated June 11, 1991, BAW-1543, Revision 3, was approved by the NRC. The staff noted that the discussions of BAW-1543, Revision 4, were essentially the same as those found in BAW-1543, Revision 3, except for an update of some of the units' withdrawal schedules. BAW-1543, Revision 4, Supplement 1, contained quantitative information which was, in general, fluence dependent and, therefore, subject to change. This revision reflected revised fluence values for some units and revised some withdrawal schedules to comply with ASTM E 185. It was anticipated that future revisions to BAW-1543 would only involve the Revision 4 Supplement. BAW-1543, Revision 4, Supplement 2, reflected the revised fluence values and the revised withdrawal schedules, and, therefore, replaced BAW-1543, Revision 4, Supplement 1.

The B&WOG later revised and replaced Supplement 2 of Revision 4 of the subject report, with Supplement 3. In Supplement 3, the B&WOG deleted Rancho Seco, R.E. Ginna, and Zion Units 1 and 2 from the program. In addition, the B&WOG updated the capsule status and the peak end-of-license fluences for several plants. This evaluation will only focus on the staff's review of the B&WOG's disposal plan for archive specimens, updated status of various capsules, and incorporation of current license fluence values, as provided in BAW-1543, Revision 4, Supplement 4.

### 3.0 EVALUATION

Appendix H to 10 CFR Part 50, "Reactor Vessel Material Surveillance Program Requirements," includes requirements to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region of light water nuclear power reactors which result from exposure of these materials to neutron irradiation and the thermal environment. Appendix H to 10 CFR Part 50 endorses ASTM E 185, "Surveillance Tests for Nuclear Reactor Vessels." Appendix H states that "the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of ASTM E 185 that is current on the issue date of the ASME Code to which the reactor vessel was purchased. Later editions of ASTM E 185 may be used, but including only those editions through 1982."

ASTM E 185-82 and -66, "American Society for Testing and Materials, Practice for Surveillance Tests for Nuclear Reactor Vessels," cover procedures for monitoring the radiation-induced changes in the mechanical properties of ferritic materials in the beltline of light-water cooled nuclear power reactor vessels. These practices include guidelines for designing a minimum surveillance program, selecting materials, and evaluating test results.

The staff evaluated the disposal plan for archive specimens, the status for various capsules, and the incorporation of current license fluence values for each of the B&W and Westinghouse plant-specific reactor vessel surveillance programs, as provided in BAW-1543, Revision 4, Supplement 4, and determined that the information was prepared in accordance with ASTM E 185-82 for each of the subject units.

Information on future plans for standby surveillance capsules in Turkey Point Units 3 and 4 were provided in various tables in BAW-1543, Revision 4, Supplement 4. However, the tables do not reflect recent revisions proposed by the licensee with regard to the ongoing license renewal review. By letter dated February 1, 2001, the NRC requested additional information in support of the Turkey Point Units 3 and 4 license renewal application review. Specifically, the staff requested that the applicant provide information regarding how the current reactor vessel surveillance program, which was designed based on a 40-year license, will be modified to accommodate a 60-year license.

By letter dated April 19, 2001, the applicant stated that the 48 effective full power years (EFPY) peak neutron fluence (inside wall) for the Turkey Point circumferential welds is projected to be less than  $4.5 \times 10^{19}$  n/cm<sup>2</sup> which is equivalent to approximately  $2.8 \times 10^{19}$  n/cm<sup>2</sup> at the 1/4T location (48 EFPY corresponds to 60 years of operation). The Turkey Point Unit 4 "X" capsule is currently projected to be removed in 2007 at a fluence of  $3.85 \times 10^{19}$  n/cm<sup>2</sup> which is greater than the 1/4T fluence at 48 EFPY. In addition, there are nine remaining standby capsules in the Turkey Point vessels from which to gather data on fluence, spectrum, temperature, and neutron flux. Table V (page 15) and Table VII (page 20) of BAW-1543, Revision 4, Supplement 4 should be revised to reflect the Turkey Point specific information.

#### 4.0 CONCLUSION

Based on the staff's review of the B&WOG MIRVP, the staff found that the disposal plan for archive specimens, the updates to the status of various capsules, and the incorporation of current license fluence values, as indicated in BAW-1543, Revision 4, Supplement 4, are acceptable for the B&W-designed 177-FA plants and the Westinghouse-designed plants with B&W-fabricated reactor vessels. The proposed revisions satisfy the ASTM E 185-82 Standard for all plants participating in the B&WOG MIRVP, and Turkey Point Units 3 and 4 satisfy the ASTM E 185-66 Standard. As discussed, the staff notes that the appropriate Tables in Supplement 4 should be revised to reflect the Turkey Point specific information which resulted from the ongoing license renewal review activities.

Oconee Units 1, 2, and 3 and ANO Unit 1 have been granted extended licenses for an additional 20 years of operation. These units have sufficient surveillance capsule data to monitor radiation embrittlement for the new license term of 60 years of operation. For the remaining units discussed in this SE, the MIRVP changes described in BAW-1543, Revision 4, Supplement 4 are approved for 40 years of operation. Requests for extended licenses may require revision to the surveillance capsule withdrawal schedules.

The staff concluded that the proposed revisions of BAW-1543, Revision 4, Supplement 4, comply with Appendix H to 10 CFR Part 50. Therefore, the staff approves the revisions for each of the plants included in the B&WOG MIRVP.

Attachment: Status of Westinghouse and Babcock and Wilcox Plant-Specific Surveillance Capsules

Principal Contributor: A. Lee

Date: October 19, 2001

STATUS OF WESTINGHOUSE PLANT-SPECIFIC SURVEILLANCE CAPSULES

PLANT	CAPSULE ID	TARGET FLUENCE	STATUS
POINT BEACH 1	N P R,S,T,V	4.5E19	STANDBY ● NOT TESTED@ TESTED
POINT BEACH 2	N P R,S,T,V	5.0E19	STANDBY ● NOT TESTED@ TESTED
SURRY 1	S	3.9E19	STANDBY #
	U	3.0E19	STANDBY #
	W		TESTED ○
	X		TESTED
	Y	4.3E19	STANDBY #
SURRY 2	Z	5.2E19	STANDBY ● TESTED
	T,V		
	V,X		TESTED
	S		TESTED ○
	T	3.8E19	STANDBY ●
	U	3.6E19	STANDBY ●
	W		TESTED ○
Y	3.2E19	TRANSFERRED *	
TURKEY POINT 3***	Z	3.4E19	STANDBY #
	S,T,V		TESTED
	U,W,Y,Z		STANDBY ***
TURKEY POINT 4***	X	2.6E19	STANDBY ***
	S,T		TESTED
	X	3.7E19	STANDBY ***
	U,V,W,Y,Z		STANDBY ***

● To Be Withdrawn and Stored

@ Withdrawn and Stored

\* To Be Withdrawn and Tested

# Will Remain for Life Extension

○ Dosimetry

\*\*\* During the Turkey Point license renewal review, the applicant stated that the standby capsules can be used to gather data on fluence, spectrum, temperature, and neutron flux during the license renewal period.

Attachment



STATUS OF BABCOCK AND WILCOX PLANT-SPECIFIC (INTEGRATED)  
SURVEILLANCE CAPSULES

PLANT	CAPSULE ID	TARGET FLUENCE	STATUS
OCONEE 1	F,E,A,C B D	9.0E18	TESTED NOT TESTED % STANDBY %
OCONEE 2	C,A,E B D,F	9.6E18	TESTED NOT TESTED % STANDBY %
OCONEE 3	A,B,D C E,F	1.6E19	TESTED ~ NOT TESTED ~ STANDBY ~
TMI 1	E,C B A F,D		TESTED NOT TESTED % NOT TESTED @ NOT TESTED %
CRYSTAL RIVER 3	B,C,D,F A,E		TESTED NOT TESTED
ANO 1	E,B,A,C D,F		TESTED NOT TESTED %
DAVIS-BESSE 1	F,B,A,D C E		TESTED NOT TESTED NOT TESTED

% Capsule contains only base metal specimens, so will be disposed of in accordance with the March 17, 2000 letter from D.L. Howell to the USNRC Document Control Desk.

~ Weld data already exists at the expected/received capsule fluences or data is available at fluences greater than the expected/received capsule fluences, so will be disposed of in accordance with the March 17, 2000 letter from D.L. Howell to the USNRC Document Control Desk.

@ Withdrawn and Stored