May 16, 2005

Mr. Jerald S. Holm
Director, Regulatory Affairs
Framatome ANP
3815 Old Forest Road
Lynchburg, VA 24501

SUBJECT: FINAL SAFETY EVALUATION FOR BABCOCK AND WILCOX OWNERS GROUP TOPICAL REPORT BAW-1543(NP), REVISION 4, SUPPLEMENT 5, "SUPPLEMENT TO THE MASTER INTEGRATED REACTOR VESSEL SURVEILLANCE PROGRAM" (TAC NO. MC1762)

Dear Mr. Holm:

By letter dated December 19, 2003, Babcock and Wilcox Owners Group (B&WOG) submitted BAW-1543(NP), Revision 4, Supplement 5, "Supplement to the Master Integrated Reactor Vessel Surveillance Program" to the U. S. Nuclear Regulatory Commission (NRC) staff for review. On February 1, 2005, an NRC draft safety evaluation (SE) regarding our approval of BAW-1543(NP), Revision 4, Supplement 5, was provided for your review and comments. By letter dated February 21, 2005, you commented on the draft SE. The staff's disposition of your comments on the draft SE are discussed in the attachment to the final SE enclosed with this letter.

The staff has found that BAW-1543(NP), Revision 4, Supplement 5, is acceptable for referencing in licensing applications to the extent specified and under the limitations delineated in the Topical Report (TR) and in the enclosed SE. The SE defines the basis for the acceptance of the TR.

Our acceptance applies only to material provided in the subject TR. We do not intend to repeat our review of the acceptable material described in the TR. When the TR appears as a reference in license applications, our review will ensure that the material presented applies to the specific plant involved. License amendment requests that deviate from this TR will be subject to a plant-specific review in accordance with applicable review standards.

In accordance with the guidance provided on the NRC website, we request that B&WOG publish accepted proprietary and non-proprietary versions of this TR within three months of receipt of this letter. The accepted versions shall incorporate this letter and the enclosed SE after the title page. Also, they must contain historical review information including NRC requests for additional information and your responses. The accepted versions shall include a "-A" (designating accepted) following the TR identification symbol.

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, B&WOG and/or licensees referencing it will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

Sincerely,

/RA/

Herbert N. Berkow, Director
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Safety Evaluation

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, B&WOG and/or licensees referencing it will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

Sincerely,

/RA/

Herbert N. Berkow, Director
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

MASTER INTEGRATED REACTOR VESSEL SURVEILLANCE PROGRAM

TOPICAL REPORT BAW-1543, REVISION 4, SUPPLEMENT 5

1.0 INTRODUCTION

By letter dated December 19, 2003, the Babcock and Wilcox (B&W) Owners Group (B&WOG) Reactor Vessel Working Group submitted, for NRC approval, topical report (TR) BAW-1543(NP), Revision 4, Supplement 5, "Supplement to the Master Integrated Reactor Vessel Surveillance Program." The revisions contained in this supplement were necessary due to a commitment not being met in Supplement 4, because capsules OC1-D and OC3-F could not be removed from Crystal River Unit 3.

2.0 BACKGROUND

By letter dated April 10, 2001, the B&WOG submitted, for staff approval, report BAW-1543, Revision 4, Supplement 4, "Supplement to the Master Integrated Reactor Vessel Surveillance Program." BAW-1543, Revision 4, reported the essential features of the master integrated reactor vessel surveillance program (MIRVSP) for all operating B&W 177-fuel assembly (FA) plants and those participating Westinghouse plants having B&W-fabricated reactor vessels. These reactor vessels include seven B&W-designed 177- FA plants and six 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 13 reactors are of the same basic design concept: pressurized water reactor, operating at about 550 EF and 2250 pounds per square inch (psi) nominal inlet temperature and pressure, and with low enrichment fuel (approximately 2 percent to 4 percent enrichment).

The irradiation schedules for the B&WOG MIRVSP include the plant-specific capsules for the B&W- and Westinghouse-designed vessels, and the supplementary weld metal surveillance capsules and higher fluence supplementary weld metal surveillance capsules. All the irradiations, with the exception of Capsule W1 and the Westinghouse plant-specific capsules, are performed in the B&W host reactors, Crystal River Unit 3 and Davis-Besse. Capsule W1, an irradiation capsule of the Westinghouse-design, was irradiated in Surry Unit 2 and was subsequently tested. 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 attached.

The staff evaluated the B&WOG's basis for the integrated program concept. The criteria as provided by Appendix H to Title 10 to the *Code of Federal Regulations*, Part 50, “Reactor Vessel Material Surveillance Program Requirements,” were met; therefore, the staff determined the MIRVSP 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 American Society for Testing and Materials (ASTM) Standard E 185-73, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels." 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. In Supplement 4, the B&WOG incorporated the disposal plan for stored capsules, updated the status for various capsules, and incorporated current fluence levels. The B&WOG submitted Supplement 5 because the last supplement included a commitment regarding Capsules OC1-D and OC3-F; however, that commitment could not be met because these capsules could not be removed from Crystal River Unit 3.

3.0 EVALUATION

Appendix H to 10 CFR Part 50 includes criteria 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 Standard E 185-73. Appendix H states that "[t]he 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 [American Society of Mechanical Engineers] Code [Boiler and Pressure Vessel 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 Standard E 185-82, "Standard Practice for Conducting Surveillance Tests for Light Water Cooled Nuclear Power Reactor Vessels" and ASTM Standard E 185-66, "Recommended Practice for Surveillance Tests on Structural Materials in Nuclear Reactors" 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 withdrawal schedule for each of the B&W and Westinghouse plant-specific reactor vessel surveillance programs, as provided in BAW-1543(NP), Revision 4, Supplement 5, and determined that the withdrawal schedules were prepared in accordance with ASTM Standard E 185-82 for each of the subject units except for Turkey Point Units 3 and 4. Additional details of the staff's assessment are provided below. It should be noted that this evaluation will focus on the staff's review of the B&WOG's revised withdrawal schedules, as provided in BAW-1543(NP), Revision 4, Supplement 5. As stated previously, capsules OC1-D and OC3-F could not be removed; therefore, credit for these two capsules could no longer be taken for Oconee Unit 1 and Oconee Unit 3, respectively. The staff independently reviewed the

surveillance capsule withdrawal schedules for Oconee Unit 1 and Oconee Unit 3, to ensure that the subject units' surveillance capsule program would still comply with the requirements of ASTM Standard E 185-82.

The staff found that the capsule withdrawal schedule for Oconee Unit 1 adequately met the requirements of ASTM Standard E 185-82, in that four capsules have been withdrawn and tested, and the last capsule that was tested, OC1-C, had a fluence of 1 to 2 times the end-of-life fluence. Therefore, the staff determined that the inability to withdraw capsule OC1-D had no impact on the ability of the Oconee Unit 1 surveillance capsule program to meet the Appendix H requirements.

The staff found that the capsule withdrawal schedule for Oconee Unit 3 adequately met the requirements of ASTM Standard E 185-82, in that three capsules have been tested and an additional capsule, capsule CR3-LG2, which contains the limiting beltline material for Oconee Unit 3 (heat number 72442), was tested and had a fluence of 1 to 2 times the end-of-life fluence for Oconee Unit 3. Therefore, the staff determined that the inability to withdraw capsule OC3-F had no impact on the ability of the Oconee Unit 3 surveillance capsule program to meet the Appendix H requirements.

The staff noted that the Nuclear Management Company (NMC) added a supplemental capsule, to be removed and tested, to the Point Beach Unit 2 surveillance program. Also, the B&WOG updated the status of capsules Y and X of Surry Unit 2 and Turkey Point Unit 3, respectively, to indicate that they had been tested. The staff found that these revisions were enhancements or updates to the program and are, therefore, acceptable to the staff.

On May 26, 2004, the staff requested that the B&WOG remove or address the relevance of the statement, "The owners of plants that have been granted license renewal have made no commitments to test or use information from the capsules that continue to be irradiated under the MIRVSP," because future applicants may wish to take credit for information obtained from the MIRVSP, as opposed to using plant-specific information in order to meet the requirements of 10 CFR Part 50, Appendix H. By letter dated July 7, 2004, the B&WOG indicated that the statement will be removed upon issuance of the approved version of BAW-1543, Revision 4, Supplement 5. The staff found this acceptable.

The staff determined that the withdrawal schedules for Oconee Unit 2, Three Mile Island Unit 1 (TMI-1), Crystal River Unit 3, Arkansas Nuclear One Unit 1, Davis-Besse, Point Beach Unit 2, Surry Unit 1, and Turkey Point Unit 4, as provided in Tables VI and VII of BAW-1543(NP), Revision 4, Supplement 5, did not change from Supplement 4 and, therefore, still comply with the requirements of ASTM Standard E 185-82, as stated in the staff's safety evaluation dated July 31, 2001. However, the staff noted that the information in Table VIII, of the subject TR, did not accurately list the capsules to be withdrawn and tested for Oconee Units 1, 2 and 3, and TMI-1. The B&WOG listed capsules for these subject plants that were no longer going to be withdrawn and tested, i.e., Capsule OC1-D for Oconee Unit 1, Capsule OC2-F for Oconee Unit 2, Capsule OC3-F for Oconee Unit 3, and Capsules F and D for TMI-1.

During a telephone conference call that was held on November 23, 2004, the staff discussed this issue with the B&WOG, who indicated that it would revise Table VIII of the report to accurately list the capsules that were going to replace those that were no longer going to be withdrawn and tested. The staff noted that the withdrawal schedule for Oconee Unit 1 already

met the requirements of ASTM Standard E185-82; however, the table still needed revision, because the capsules listed were not correct. The B&WOG indicated that Oconee Unit 2's limiting material is contained in Capsule A5 (which was irradiated in Davis Besse), which was tested and satisfied the fifth capsule requirement of ASTM Standard E185-82 for Oconee Unit 2. For Oconee Unit 3, the limiting material is contained in Capsule CR3-LG2, which was tested and satisfied the fifth capsule requirement of ASTM Standard E185-82, for Oconee Unit 3. The TMI-1 limiting material is contained in Capsule TMI2-LG2, which was tested and satisfied the fifth capsule requirement of ASTM Standard E185-82.

By supplemental letter dated January 5, 2005, the B&WOG revised Table VIII to the BAW-1543(NP), Revision 4, Supplement 5 report. The staff found that the revised table accurately listed the withdrawal schedules for Oconee Units 1, 2, and 3, and TMI-1. As stated above, the staff found that each of these plants met the capsule withdrawal schedule requirements of ASTM Standard E185-82, even though the original capsules were not going to be withdrawn and tested for Oconee Units 2 and 3 and TMI-1, because there are other capsules in the MIRVSP that contain the same limiting material for the subject plants that will be withdrawn and tested, and, therefore, will satisfy the requirements of ASTM Standard E185-82.

Turkey Point Units 3 and 4 surveillance capsule withdrawal schedules were prepared in accordance with ASTM Standard E 185-66. The Turkey Point Units 3 and 4 reactor vessels were purchased to the Summer 1966 Addenda to the 1965 ASME Code. ASTM Standard E 185-66 was the surveillance capsule standard in effect at the time the Turkey Point Units 3 and 4 reactor vessels were purchased. Since the Turkey Point Units 3 and 4 capsule withdrawal schedules meet the ASTM Standard E 185 edition that was current at the time the reactor vessels were purchased, the withdrawal schedules meet the requirements of Appendix H to 10 CFR Part 50.

It should also be noted that, by letter dated February 8, 1985, a safety evaluation report (SER) was submitted to Florida Power & Light Company, which indicated that the NRC approved an integrated surveillance program for Turkey Point Units 3 and 4. The SER indicated that the only capsules to be tested at Turkey Point Units 3 and 4 in accordance with ASTM Standard E 185 requirements, are those that contain weld metal specimens.

4.0 CONCLUSION

Based on the staff's review of the B&WOG MIRVSP, the staff found that the revised withdrawal schedules, as indicated in Report BAW-1543(NP), Revision 4, Supplement 5, are acceptable for the B&W-designed 177-FA plants and the Westinghouse-designed plants with B&W-fabricated reactor vessels. The proposed withdrawal schedules satisfy the ASTM Standard E 185-82 for all plants participating in the B&WOG MIRVSP except for Turkey Point Units 3 and 4. Turkey Point Units 3 and 4 satisfy the ASTM Standard E 185-66. Since this edition of the standard was current at the time the reactor vessels were purchased, the Turkey Point Units 3 and 4 surveillance capsule withdrawal schedules satisfy the requirements of Appendix H to 10 CFR Part 50. Also, it should be noted that the NRC previously approved an integrated surveillance program for Turkey Point Units 3 and 4.

The staff concluded that the proposed withdrawal schedules of BAW-1543(NP), Revision 4, Supplement 5, comply with Appendix H to 10 CFR Part 50. Therefore, the staff approves the revised withdrawal schedule for each of the plants included in the B&WOG MIRVSP.

5.0 REFERENCES

1. BAW-1543, Revision 4, Supplement 4, “Supplement to the Master Integrated Reactor Vessel Surveillance Program," April 2001.

2. NRC letter to A. Mendiola, from K. Wichman, NRC, “Safety Evaluation of BAW-1543, Master Integrated Reactor Vessel Surveillance Program, Revision 4, Supplement 4," July 31, 2001, ML012130374.

3. Code of Federal Regulations, Title 10, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."

4. American Society for Testing and Materials, "Recommended Practice for Surveillance Tests on Structural Materials in Nuclear Reactors," ASTM E 185-66.

5. American Society for Testing and Materials, "Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," ASTM E 185-70.

6. American Society for Testing and Materials, "Standard Practice for Conducting Surveillance Tests for Light Water Cooled Nuclear Power Reactor Vessels," ASTM E 185-82.

7. NUREG-1511, Supplement 2, "Reactor Pressure Vessel Status Report," October 2000.

Principal Contributor: M. Khanna

Date: May 16, 2005

STATUS OF WESTINGHOUSE PLANT-SPECIFIC SURVEILLANCE CAPSULES

PLANT	CAPSULE ID	TARGET FLUENCE	STATUS	NOTES
POINT BEACH 1	N	4.5E19	STANDBY	1
	P		REMOVED	3
	R,S,T,V		TESTED	
POINT BEACH 2	N	5.0E19	STANDBY	1
	P		REMOVED	3
	R,S,T,V		TESTED	
	W		SUPPL CAPSULE	2
SURRY 1	S	3.9E19	STANDBY	4
	U	3.0E19	STANDBY	4
	W		TESTED	5
	Y	4.3E19	STANDBY	4
	Z	5.2E19	STANDBY	1
	T,V,X		TESTED	
SURRY 2	V,X,Y		TESTED	
	S		TESTED	5
	T	3.8E19	STANDBY	1
	U	3.6E19	STANDBY	1
	W		TESTED	5
	Z	3.4E19	STANDBY	4
TURKEY POINT 3	S,T,V,X		TESTED	
	U,W,Y,Z		STANDBY	*
TURKEY POINT 4	S,T		TESTED	
	X		STANDBY	*
	U,V,W,Y,Z	3.85E19	STANDBY	*

NOTES:
1. TO BE WITHDRAWN AND STORED
2. TO BE WITHDRAWN AND TESTED
3. WITHDRAWN AND STORED
4. WILL REMAIN FOR LIFE EXTENSION
5. 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	NOTE
OCONEE 1	F,E,A,C		TESTED	
	B		REMOVED	1
OCONEE 2	C,A,E		TESTED	
	B,D,F		REMOVED	1
	TMI2-LG1		TESTED	
	A5		TESTED	
OCONEE 3	A,B,D		TESTED	
	C,E		REMOVED	1
	L1		TESTED	
	CR3-LG2		TESTED	
TMI 1	E, C, W1*		TESTED	
	B,D,F		REMOVED	1
	CR3-LG1		TESTED	
	TMI2-LG2		TESTED	
CRYSTAL RIVER 3	B,C,D,F		TESTED	
	A, E		REMOVED	1
ANO 1	E,B,A,C		TESTED	
	D, F		REMOVED	1
DAVIS-BESSE 1	F,B,A,D		TESTED	
	C, E		REMOVED	1

NOTE:

1. Capsule contains only base metal specimens, or 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.

* Irradiated in Surry and subsequently tested.

PAGE NO. - LINE NOs.	PROPOSED CHANGE AND REASON	STAFF'S DISPOSITION
1 - 13	Add "participating" prior to the words 'Westinghouse plants." Not all Westinghouse plants having B&W fabricated reactor vessels participated in the program.	Accepted
1 - 14	Change "nine" to "six." As of April 10, 2001, the submittal date of Supplement 4 of BAW-1 543, Revision 4, there were six Westinghouse-designed plants with B&W fabricated reactor vessels participating in the program.	Accepted
1 - 16	Change "16" to "13" for accuracy (see above comments).	Accepted
1 - 17	Add "about" prior to "550 EF" for accuracy.	Accepted
1 - 25	Change "is being" to "was" for accuracy.	Accepted
2 - 17	Change "archive specimens" to "stored capsules" for clarification.	Accepted
3 - 11	Delete "and test." OC1-D was a standby capsule with no commitment for testing.	Accepted
3 - 18	Delete "and test." OC3-F was a standby capsule with no commitment for testing.	Accepted
3 - 21	Change "the B&WOG" to "NMC" for accuracy.	Accepted - NMC defined
4 - 11, 12, 14	Change "fourth" to "fifth" for accuracy.	Accepted
7 - 5, 6	Under the fifth column entitled "Notes," omit Note 3 for consistency. None of the other capsule irradiation locations are noted	Accepted
7 - 6	Under the second column entitled "Capsule ID," omit Capsule ID "F." This capsule was unable to be removed and is still in the reactor.	Accepted
7 - 7	Under the second column entitled "Capsule ID," Omit Capsule ID "A," or substitute with "W1."	Accepted - Note 2 also removed. W1 was irradiated in Surry.
7 - 17	Omit Note 3 for consistency.	Accepted