



UNITED STATES  
**NUCLEAR REGULATORY COMMISSION**  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT BAW-1543, REVISION 4, SUPPLEMENT 3

"SUPPLEMENT TO THE MASTER INTEGRATED

REACTOR VESSEL SURVEILLANCE PROGRAM"

1.0 INTRODUCTION

By letter dated March 16, 1999, the Babcock and Wilcox Owners Group (B&WOG) Reactor Vessel Working Group submitted topical report BAW-1543, Revision 4, Supplement 3, "Supplement to the Master Integrated Reactor Vessel Surveillance Program," for NRC review and approval.

2.0 BACKGROUND

By letter dated October 12, 1989, the B&WOG submitted, for staff approval, report 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 seven B&W-designed 177-fuel assembly (FA) plants and nine 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% 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 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, Unit 1. 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 an attachment to this Safety Evaluation (SE).

The staff evaluated the B&WOG's basis for the integrated program concept. The criterion 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 changes to BAW-1543 would only involve the supplement to Revision 4. 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.

By letter dated March 16, 1999, the B&WOG submitted BAW-1543, Revision 4, Supplement 3, which replaces Supplement 2 in its entirety. In Supplement 3, the B&WOG deleted Rancho Seco, R.E. Ginna, and Zion from the program. In addition, the B&WOG updated the capsule status and the peak end-of-license fluences for several plants. This SE covers the staff's review of the revised withdrawal schedules provided in BAW-1543, Revision 4, Supplement 3.

### 3.0 EVALUATION

Appendix H to 10 CFR Part 50, "Reactor Vessel Material Surveillance Program Requirements," include 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 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 withdrawal schedule for each of the B&W and Westinghouse plant-specific reactor vessel surveillance programs, as provided in BAW-1543, Revision 4, Supplement 3, and determined that the withdrawal schedules were prepared in accordance with ASTM E 185-82 for each of the subject units except for Turkey Point, Units 3 and 4, which were prepared in accordance with ASTM 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 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 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.

By letter dated February 8, 1985, the staff issued a SE to Florida Power & Light Company approving an integrated surveillance program for Turkey Point, Units 3 and 4. The SE indicated that the only capsules at Turkey Point, Units 3 and 4, to be tested in accordance with ASTM E 185 requirements are those that contain weld metal specimens.

#### 4.0 CONCLUSION

Based on the staff's review of the B&WOG MIRVP, the staff found that the revised withdrawal schedules, as indicated in Report BAW-1543, Revision 4, Supplement 3, 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 E 185-82 Standard for all plants participating in the B&WOG MIRVP except for Turkey Point, Units 3 and 4. As discussed above, Turkey Point, Units 3 and 4, satisfy the ASTM E 185-66 standard, which was current at the time the reactor vessels were purchased; therefore, their surveillance capsule withdrawal schedules satisfy the requirements of Appendix H to 10 CFR Part 50. Also, the staff previously approved an integrated surveillance program for Turkey Point, Units 3 and 4.

The staff concludes that the proposed withdrawal schedules found in BAW-1543, Revision 4, Supplement 3, 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 MIRVP.

#### 5.0 REFERENCES

1. BAW-1543, Revision 4, Supplement 3, "The B&W Owners Group Reactor Vessel Working Group Supplement to the Master Integrated Reactor Vessel Surveillance Program," March 1999.
2. BAW-1543, Revision 4, Supplement 2, "The B&W Owners Group Reactor Vessel Working Group Supplement to the Master Integrated Reactor Vessel Surveillance Program," June 1996.
3. BAW-1543, Revision 4, Supplement 1, "The B&W Owners Group Materials Committee Supplement 1 Master Integrated Reactor Vessel Surveillance Program," February 1993.
4. BAW-1543, Revision 4, "The B&W Owners Group Materials Committee Master Integrated Reactor Vessel Surveillance Program," February 1993.
5. Code of Federal Regulations, Title 10, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements," December 1995.
6. American Society for Testing and Materials, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," ASTM E 185-66.
7. American Society for Testing and Materials, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," ASTM E 185-70.
8. American Society for Testing and Materials, "Standard Recommended Practice for Surveillance Tests for Nuclear Reactor Vessels," ASTM E 185-82.

9. NUREG-1511, "Reactor Pressure Vessel Status Report," December 1994.

Attachment: Summary of Surveillance Capsules

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Date: October 26, 1999

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 STANDBY 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	9.0E18	TESTED STANDBY NOT TESTED
CRYSTAL RIVER 3	B,C,D,F A,E		TESTED STANDBY
ANO 1	E,B,A,C D,F		TESTED STANDBY
DAVIS-BESSE 1	F,B,A,D C E		TESTED STANDBY STANDBY

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 STANDBY 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	9.0E18	TESTED STANDBY NOT TESTED
CRYSTAL RIVER 3	B,C,D,F A,E		TESTED STANDBY
ANO 1	E,B,A,C D,F		TESTED STANDBY
DAVIS-BESSE 1	F,B,A,D C E		TESTED STANDBY STANDBY