

December 3, 1999

Mr. Douglas J. Walters
Nuclear Energy Institute
1776 I Street, N.W., Suite 300
Washington, DC 20006-3708

SUBJECT: LICENSE RENEWAL ISSUE NO. 98-0085, "REACTOR VESSEL SURVEILLANCE PROGRAM"

Dear Mr. Walters:

Enclosed is the staff's evaluation and proposed resolution for the subject issue. The staff plans to incorporate the recommended change to the Standard Review Plan for License Renewal in a future revision. Accordingly, if there are any industry comments on the evaluation basis or the proposed resolution, we request that you document those comments within 30 days following your receipt of this letter, to ensure a timely resolution of this issue. If you have any questions regarding this matter, please contact Sam Lee at (301) 415-3109.

Sincerely,

Original Signed By

Christopher I. Grimes, Chief
License Renewal and Standardization Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Project No. 690

Enclosure: As stated

94-210

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 Office of Nuclear Reactor Regulation

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Concurrence via e-mail

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 Office of Nuclear Reactor Regulation

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OFC:	LA	PM:PDLR	SC:PDLR	(A)D:DET/RES	BC:SRXB
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Project No. 690

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**LICENSE RENEWAL ISSUE NO. 98-0085
REACTOR VESSEL SURVEILLANCE PROGRAM**

BACKGROUND

Appendix H to 10 CFR Part 50 requires a reactor vessel material surveillance program 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. Under the program, fracture toughness test data are obtained from material specimens exposed in surveillance capsules, which are withdrawn periodically from the reactor vessel. Appendix H to 10 CFR Part 50 requires the reactor vessel material surveillance program to meet the appropriate edition of the American Society for Testing and Materials (ASTM) E185 standard.

The surveillance program in ASTM E185 is based on plant operation during the current license term. Additional surveillance capsules may be needed for the period of extended operation. Section 4.1.II.A.2 of the draft Standard Review Plan for License Renewal (SRP-LR) indicates that specific acceptance criteria for the surveillance program during the period of extended operation have yet to be developed. In a telephone call on February 5, 1999, Mr. Douglas Walters of the Nuclear Energy Institute (NEI) clarified that License Renewal Issue No. 98-0085 was to address the need for acceptance criteria for the reactor vessel surveillance program.

Since the publication of the draft SRP-LR, the staff has reviewed a topical report submitted by the B&W Owners Group addressing aging management of the reactor vessel. In addition, the staff is reviewing the Calvert Cliffs and Oconee license renewal applications. Based on this review experience, the staff has developed guidance for an acceptable reactor vessel material surveillance program for license renewal.

EVALUATION

Reactor vessel material surveillance program requirements vary with the plant vintage. Appendix H of 10 CFR Part 50 requires the surveillance program and withdrawal schedule to meet the requirements of the edition of ASTM E185 that is current on the issue date of the ASME Code to which the reactor was purchased. Later editions of ASTM E185 may be used, but including only those editions through 1982. Surveillance programs earlier than ASTM E185-73 did not require standby capsules, and therefore, there may be no capsules remaining in the surveillance program after the current operating term. Surveillance programs later than ASTM E185-73 required standby capsules and that one capsule be withdrawn and tested at a neutron fluence equivalent to the design life of the reactor vessel.

The surveillance data are used by licensees to project the extent of reactor vessel embrittlement based on the staff guidance in Regulatory Guide 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials." The Regulatory Guide 1.99, Rev. 2, estimation procedures are valid within certain bounds, such as cold leg operating temperature and neutron fluence, based on the database which formed the basis for the regulatory guide. For plants operating within these specific bounds, the procedures in Regulatory Guide 1.99, Rev. 2, could be used to project the extent of reactor vessel embrittlement for the period of extended operation based on data from the existing surveillance program; and a new surveillance program for license renewal should be

unnecessary. Thus, the staff has determined that the existing surveillance program, with slight modifications, is acceptable for license renewal provided that the applicants are operating within these specific bounds. The following is an itemized list describing details of the staff guidance:

1. An applicant may project the extent of reactor vessel embrittlement for upper-shelf energy and pressure-temperature limits for 60 years in accordance with Regulatory Guide 1.99, Rev. 2, "Radiation Embrittlement of Reactor Vessel Materials." When using Regulatory Guide 1.99, Rev. 2, an applicant has a choice of the following:
 - a. Neutron Embrittlement Using Chemistry Tables

An applicant may use the tables in Regulatory Guide 1.99, Rev. 2, to project the extent of reactor vessel neutron embrittlement for the period of extended operation. This is described as Regulatory Position 1 in the Regulatory Guide.
 - b. Neutron Embrittlement Using Surveillance Data

When credible surveillance data are available, the extent of reactor vessel neutron embrittlement for the period of extended operation may be projected according to Regulatory Position 2 in Regulatory Guide 1.99, Rev. 2. The credible data could be collected during the current operating term. The applicant may have a plant-specific program or an integrated surveillance program during the period of extended operation to collect additional data.
2. For an applicant that determines embrittlement using the Regulatory Guide 1.99 tables (see item 1.a above), the applicant should use the applicable limitations in Regulatory Position 1.3 of the regulatory guide.
3. For an applicant that determines embrittlement using surveillance data (see item 1.b above), the applicant should define the applicable bounds of the data, such as cold leg operating temperature and neutron fluence. These bounds should be specific for the referenced surveillance data and would be more restrictive than the bounds for the Regulatory Guide in item 2 above. For example, the plant-specific data could be collected within a smaller temperature range than that in the regulatory guide.
4. All pulled and tested capsules, unless previously discarded, should be placed in storage. (Note: These specimens are saved for future reconstitution use, in case the surveillance program needs to be re-established.)

5. If an applicant has a surveillance program which consists of capsules with a projected fluence of less than the 60-year fluence at the end of 40 years, at least one capsule should remain in the reactor vessel and should be tested during the period of extended operation. The applicant should either delay withdrawal of their last capsule or withdraw a standby capsule during the period of extended operation to monitor the effects of long-term exposure to neutron irradiation.
6. If an applicant has a surveillance program which consists of capsules with a projected fluence exceeding the 60-year fluence at the end of 40 years, the applicant should pull these capsules when they reach the 60-year fluence and test one capsule to meet the requirements of ASTM E185 and place the remaining capsules in storage without testing. Any changes in anticipation of additional renewals, however, should be discussed with the staff.
7. Applicants without in-vessel capsules should have alternative dosimetry to monitor neutron fluence during the period of extended operation, as part of the aging management program for reactor vessel neutron embrittlement.
8. The reactor vessel monitoring program should include that, when future plant operations exceed the limitations or bounds in item 2 or 3 above (as applicable) such as operating at a lower cold leg temperature or higher fluence, the impact of plant operation changes regarding the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. For an applicant without capsules in their reactor vessel, the applicant could propose re-establishing the reactor vessel surveillance program to assess the extent of embrittlement. This program may consist of (1) capsules from item 6 above; (2) reconstitution of specimens from item 4 above; and/or (3) capsules made from any available archival materials. This program could be a plant-specific program or an integrated surveillance program.

RESOLUTION

Based on the above evaluation, the staff concludes that the existing surveillance program, with the modifications described above, is acceptable for managing the neutron embrittlement and thermal aging of the reactor vessel materials. The guidance in Section 4.1.II.A.2 of the draft SRP-LR will be revised to include this guidance.