

March 15, 2004

Mr. L. M. Stinson
Vice President - Farley Project
Southern Nuclear Operating
Company, Inc.
Post Office Box 1295
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SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 RE: SPECIMEN
CAPSULE WITHDRAWAL SCHEDULE REVISIONS (TAC NOS. MC2270 AND
MC2271)

Dear Mr. Stinson:

By letter dated February 23, 2004, as supplemented by letter dated March 5, 2004, Southern Nuclear Operating Company, Inc., (SNC, the licensee), requested approval of the proposed changes to the Reactor Vessel Surveillance Program withdrawal schedules for Farley Nuclear Plant, Units 1 and 2. The proposed changes were submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, Section III.B.3, which requires that: (1) withdrawal schedules be submitted, as specified in 10 CFR 50.4, and (2) the proposed schedule must be approved by the Nuclear Regulatory Commission (NRC) prior to implementation.

The NRC staff has reviewed the changes proposed by SNC and finds that the changes to the reactor pressure vessel surveillance capsule withdrawal schedule are consistent with the recommendations specified in American Society for Testing and Materials Standard Practice E185-82, as referenced by the requirements of 10 CFR Part 50, Appendix H. Therefore, the proposed changes are acceptable and are approved. The NRC staff's evaluation is Enclosed.

Sincerely,

/RA by C. Gratton for/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-348 and 50-364

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE REACTOR VESSEL MATERIALS SURVEILLANCE PROGRAM

SOUTHERN NUCLEAR OPERATING COMPANY, INC., ET AL.

JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-348 AND 50-364

1.0 INTRODUCTION

By letter dated February 23, 2004 (Reference 1), as supplemented by letter dated March 5, 2004 (Reference 2), Southern Nuclear Operating Company, Inc., (SNC, the licensee), requested approval of the proposed changes to the Reactor Vessel Surveillance Program withdrawal schedules for Farley Nuclear Plant (FNP), Units 1 and 2. The proposed changes were submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix H, Section III.B.3, which requires that: (1) withdrawal schedules be submitted, as specified in 10 CFR 50.4, and (2) the proposed schedule must be approved by the Nuclear Regulatory Commission (NRC) prior to implementation.

2.0 REGULATORY EVALUATION

Nuclear power plant licensees are required by Appendix H to 10 CFR Part 50 to implement reactor pressure vessel (RPV) surveillance programs to "monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region... which result from the exposure of these materials to neutron irradiation and the thermal environment." Section III.B.1 of Appendix H states that the design of the surveillance program and the withdrawal schedule must meet the requirements of the edition of the American Society for Testing and Materials (ASTM) E185, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," that is current on the issue date of the American Society of Mechanical Engineers (ASME) Code to which the RPV was purchased. The rule permits the use of later editions of ASTM E185, but including only those editions through 1982 (i.e., ASTM E185-82).

As discussed in Section 1.0 of this Safety Evaluation (SE), 10 CFR Part 50, Appendix H, Section III.B.3, requires prior NRC approval of all withdrawal schedule changes. As discussed in NRC Administrative Letter 97-04, "NRC Staff Approval for Changes to 10 CFR Part 50, Appendix H, Reactor Vessel Surveillance Specimen Withdrawal Schedules," dated September 30, 1997, changes to RPV surveillance capsule withdrawal schedules that do not conform to ASTM E185 require approval by the license amendment process, whereas changes that do conform to the ASTM standard require only staff verification of such conformance. SNC's submittal states that the specimen capsules will be analyzed in accordance with ASTM E185-82. As such, a license amendment is not required. Therefore, the NRC staff's review provides verification of conformance to the ASTM standard.

3.0 TECHNICAL EVALUATION

3.1 Evaluation Criteria of ASTM Standard Practice E185-82

Table 1 of ASTM Standard Practice E185-82 requires that either a minimum of three, four, or five surveillance capsules be removed from the vessels, as based on the limiting amount of reference temperature for nil transition (RT_{NDT}) shift (limiting ΔRT_{NDT}) that is projected to occur at the clad-vessel interface location of the RPV at the end-of-licensed plant life (EOL).

Standard Practice E185-82 establishes the following criteria for determining the minimum number of capsules that are to be removed in accordance with a withdrawal schedule and the number of capsules that are to be tested:

- For plants with projected RT_{NDT} shifts (i.e., ΔRT_{NDT}) less than 100 °F (56 °C), three capsules are required to be removed from the RPV and the first two capsules are required to be tested (for dosimetry, tensile-ductility, Charpy-V impact toughness, and alloying chemistry).
- For plants with projected ΔRT_{NDT} between 100 °F (56 °C) and 200 °F (111 °C), four surveillance capsules are to be removed from the RPV and the first three capsules are required to be tested.
- For plants with projected ΔRT_{NDT} above 200 °F (111 °C), five surveillance capsules are required to be removed from the RPV and the first four capsules are required to be tested.
- Standard Practice E185-82 permits the last scheduled surveillance capsules in three, four, or five capsule withdrawal schedules to be removed without the implementation of testing. However, licensees who opt to pull their final required capsules without the implementation of testing are required by the Standard Practice to hold the capsules in storage.

Table 1 of ASTM Standard Practice E185-82 also provides specific criteria for removal of surveillance capsules. The criteria are that the surveillance capsules be removed after a certain amount of power operation has elapsed or at various times when the RPV shell is projected to achieve certain levels of neutron fluence. The intent of the Standard Practice is to achieve a set of testing data over a range of neutron fluences for the RPV that bounds the current life of the plant. Of key importance are the removal criteria for the second to last and final capsules required for capsule withdrawal. For the second-to-last required capsule in a withdrawal schedule, the ASTM standard requires that the capsules be pulled at either 13 effective full power years (EFPYs) or at the time when the capsule is equivalent to the limiting fluence projected for the clad-based metal interface of the RPV at EOL, whichever time comes first. For the final capsule that is required for removal, ASTM E185-82 requires that the capsule be removed at a time when the neutron fluence projected for the capsule is between the limiting fluence value projected for the RPV at the EOL and two times that value.

For the current operating terms, the RPVs have limiting ΔRT_{NDT} values between 100 °F and 200 °F (i.e., ΔRT_{NDT} of ~135 °F for FNP, Unit 1 and ΔRT_{NDT} of ~198 °F for FNP, Unit 2). The licensee is therefore required, as a minimum, to remove four capsules from each reactor during

the current operating period. The licensee has already met this requirement for each unit's reactor vessel surveillance program.

3.2 Changes Proposed to the Withdrawal Schedule for FNP, Unit 1

The licensee's March 5, 2004, letter provides the updated RPV surveillance capsule withdrawal schedules for FNP, Unit 1. The letter indicates that Capsules Y, U, X, and W were removed at 1.15 EFPY, 3.08 EFPY, 6.11 EFPY, and 12.43 EFPY, and that the neutron fluences reported for capsules Y, U, X, and W at the time of withdrawal are 6.12×10^{18} n/cm², 1.73×10^{19} n/cm², 3.06×10^{19} n/cm², and 4.75×10^{19} n/cm², respectively. The letter also reported updated lead factors for surveillance Capsules Y, U, X, and W. The NRC staff compared updated withdrawal data for FNP, Unit 1 surveillance Capsules Y, U, X, and W with the criteria of ASTM E185-82 for a required four capsule withdrawal schedule and confirmed that the withdrawals were consistent with the criteria in E185-82.

The limiting neutron fluence projected for the FNP, Unit 1 RPV is approximately 4.34×10^{19} n/cm² at EOL. In the March 5, 2004, letter the licensee also reported withdrawal schedule data for a supplemental Unit 1 surveillance capsule (Capsule V), which was removed from the RPV in April 2003. The letter indicates that this capsule was pulled at 20.16 EFPY with an achieved neutron fluence of 7.14×10^{19} n/cm² and lead factor of 3.04. Although the licensee's removal of Capsule V is a supplemental withdrawal (i.e., not required for the current operating period for FNP, Unit 1), the NRC staff compared the withdrawal data for Capsule V to the criteria for the final required capsule in a withdrawal schedule and determined that the removal of the capsule was consistent with the criterion in ASTM E185-82 for the final required capsule.

In the license renewal application for FNP, Units 1 and 2 (Reference 3), SNC reported that the limiting neutron fluence for the RPV clad-base metal interface of the FNP, Unit 1 RPV will be 6.41×10^{19} n/cm² at the end of the extended period of operation (i.e., at 54 EFPY). The NRC staff has verified that the neutron fluence for the removal of Capsule V would meet the criterion in ASTM E185-82 for the final required withdrawal capsule even when the applicability of the criterion of the ASTM standard is extrapolated out to 54 EFPY. Thus, the surveillance test data from Capsule V is both relevant to the fracture toughness assessments (i.e., pressurized thermal shock, upper shelf energy, and pressure-temperature limits assessments) for FNP, Unit 1 for both the current operating period (i.e., through 32 EFPY) and the period of extended operation (i.e., through 54 EFPY).

In its March 5, 2004, letter the licensee indicated that it would remove a sixth, supplemental surveillance capsule, Capsule Z, at approximately 24 EFPY. Based on a lead factor of 3.04 for Capsule Z, the licensee projects that the fluence for Capsule Z at the time of removal will be 8.44×10^{19} n/cm² and states that this projected fluence is not less than once or greater than twice the peak fluence that is projected for the RPV if 80 years of operation were licensed. Using a lead factor of 3.04 and a neutron fluence of 2.50×10^{19} n/cm² at 21.55 EFPY, the NRC staff projected that the neutron fluence for this capsule at 24 EFPY would be 8.5×10^{19} n/cm². This value is consistent with the licensee's projected fluence for Capsule Z at 24 EFPY. The NRC staff has verified that the time of removal and projected fluence for Capsule Z will meet the criterion in ASTM E185-82 for the final capsule in the withdrawal schedule if the criterion is applied to the current operating period as well as if the criterion is extrapolated to the extended period of operation for the unit. Therefore, if Capsule Z is removed at 24 EFPY and tested, as

projected by SNC, the capsule should provide relevant surveillance data for both the current operating period and the extended operating period of FNP, Unit 1.

However, at this time, the NRC staff will not assess the applicability of Capsule V to an additional period of extended operation because SNC has yet to apply for a license extension through 80 years of licensed life.

3.3 Changes Proposed to the Withdrawal Schedule for FNP, Unit 2

The licensee's March 5, 2004, letter provides the updated RPV surveillance capsule withdrawal schedule for FNP, Unit 2. The letter indicates that Capsules U, W, X, and Z were removed at 1.10 EFPY, 3.97 EFPY, 6.41 EFPY, and 13.24 EFPY, respectively, and that the neutron fluences reported for capsules U, W, X, and Z at the time of withdrawal were 6.44×10^{18} n/cm², 1.85×10^{19} n/cm², 3.19×10^{19} n/cm², and 5.28×10^{19} n/cm², respectively. SNC also reported updated lead factors for surveillance Capsules U, W, X, and Z. The NRC staff compared the updated withdrawal data for FNP, Unit 1 surveillance Capsules U, W, X, and Z with the criteria of ASTM E185-82 for a required four capsule withdrawal schedule and confirmed that the withdrawals remain consistent with the criteria in E185-82.

The limiting neutron fluence projected for the FNP, Unit 2 RPV is approximately 4.39×10^{19} n/cm² at EOL. The licensee indicated in its March 5, 2004, letter that two additional capsules will be removed from the RPV in the future. The fifth capsule, Capsule Y, a supplemental capsule, will be removed from the reactor vessel at approximately 19 EFPY. SNC projected that the neutron fluence for Capsule Y at the time of removal will be 7.24×10^{19} n/cm² and that the lead factor for the capsule is 3.03. The licensee stated that this projected fluence for Capsule Y is not less than once or greater than twice the peak fluence that is projected for the RPV if 60 years of operation were licensed. The licensee also indicated that a sixth, supplemental capsule, Capsule V, will be removed from the reactor vessel at approximately 22 EFPY. The licensee projected that the neutron fluence for Capsule V at the time of removal will be 9.45×10^{19} n/cm² and that the lead factor for the capsule is 3.47. SNC stated that this projected fluence for Capsule V is not less than once or greater than twice the peak fluence that is projected for the RPV if 80 years of operation were licensed.

The NRC staff independently calculated that the projected fluences for Capsules Y and V at 19 EFPY and 22 EFPY will be 7.19×10^{19} n/cm² and 9.54×10^{19} n/cm², respectively. This value is consistent with the neutron fluence values projected by the licensee for the capsules at the proposed removal times. Even though the projected withdrawals of Capsules Y and V are considered by the licensee to be supplemental withdrawals (i.e., not required for the current operating period for FNP, Unit 1), the NRC staff compared the withdrawal data for these capsules to the criterion for the final required capsule in a withdrawal schedule. Based on an extrapolation of the applicability of the criterion to these capsules, the NRC staff verified that the proposed removal of the capsules would be consistent with the criterion for the final required capsules if it were applied to the current operating term.

In the license renewal application for FNP, Units 1 and 2, SNC reported that the limiting neutron fluence for the RPV clad-base metal interface of the FNP, Unit 2 RPV would be 6.29×10^{19} n/cm² at the end of the extended period of operation (i.e., at 54 EFPY). The NRC staff also verified that the neutron fluences for the projected removals of Capsules Y and V would meet the criterion in ASTM E185-82 for the final required withdrawal capsules if the criterion of the ASTM

standard were extrapolated out to 54 EFPY. Therefore, if Capsules Y and V are removed and tested at 19 EFPY and 22 EFPY, respectively, as projected by the licensee, they should provide relevant surveillance data for both the current operating term and the extended period of operation for FNP, Unit 2.

However, at this time, the NRC staff will not assess the applicability of Capsule V to an additional period of extended operation because SNC has yet to apply for a license extension through 80 years of licensed life.

4.0 CONCLUSION

The staff has reviewed SNC's proposed withdrawal schedules and has determined that the changes to the schedules will continue to meet the RPV surveillance capsule withdrawal schedule criteria in ASTM E185-82 for the current licensed periods of FNP Units 1 and 2. The NRC staff, therefore, concludes that the RPV withdrawal schedules, as proposed in the licensee's March 5, 2004, letter are acceptable for implementation.

This SE does not provide acceptance of the proposed withdrawal schedules for the periods of extended operation for FNP, Units 1 and 2 (i.e., through 54 EFPY). However, the NRC staff has determined that the proposed withdrawal schedules for FNP, Units 1 and 2, would also conform to ASTM E185-82 if the acceptance criteria were extrapolated until the expiration of the extended periods of operation for the units. The NRC staff will evaluate the applicability of these withdrawal schedules for the extended periods of operation in the NRC staff's evaluation of the License Renewal Application for FNP, Units 1 and 2, and specifically in the NRC staff's evaluation of the *Monitoring and Trending* program attribute for the licensee's Reactor Vessel Surveillance Program, as provided in Section B.3.4 of the license renewal application.

5.0 REFERENCES

1. Letter from L. M. Stinson, Southern Nuclear Operating Company, Inc., to USNRC, "Joseph M. Farley Nuclear Plant, Reactor Material Surveillance Program Standby Specimen Capsule Withdrawal Plans," February 23, 2004.
2. Letter from L. M. Stinson, Southern Nuclear Operating Company, Inc., to USNRC, "Joseph M. Farley Nuclear Plant, Reactor Material Surveillance Program Specimen Capsule Withdrawal Schedule Revisions - Additional Information," March 5, 2004.
3. Letter from J. B. Beasley, Southern Nuclear Operating Company, Inc., to USNRC, "Joseph M. Farley Nuclear Plant, Application for License Renewal," September 12, 2003.

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Date: March 15, 2004