February 2, 2005

Mr. Rick A. Muench
President and Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION - REVISION TO REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM WITHDRAWAL SCHEDULE (TAC NO. MC5407)

Dear Mr. Muench:

By letter dated December 16, 2004 (ET 04-0007), the Wolf Creek Nuclear Operating Corporation requested approval of a revision to the withdrawal schedule for Capsules W and Z in the Reactor Vessel Material Surveillance Program for the Wolf Creek Generating Station. The capsules will be withdrawn in the Spring 2005 refueling outage in accordance with American Society for Testing and Materials (ASTM) E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels." In accordance with Section III.B.3 of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50, the proposed withdrawal schedule was submitted for approval.

As discussed in the enclosed Safety Evaluation, the NRC staff concludes that the proposed revision to the Reactor Vessel Material Surveillance Program withdrawal schedule is in accordance with the ASTM E 185-82 edition, and, therefore, meets Section III.B.1 of Appendix H of 10 CFR Part 50. Based on this, the NRC staff concludes that the proposed revision to the withdrawal schedule for Capsules W and Z is acceptable.

Sincerely,

/RA/
Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure: Safety Evaluation

cc w/encl: See next page

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As discussed in the enclosed Safety Evaluation, the NRC staff concludes that the proposed revision to the Reactor Vessel Material Surveillance Program withdrawal schedule is in accordance with the ASTM E 185-82 edition, and, therefore, meets Section III.B.1 of Appendix H of 10 CFR Part 50. Based on this, the NRC staff concludes that the proposed revision to the withdrawal schedule for Capsules W and Z is acceptable.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISION TO REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM

WITHDRAWAL SCHEDULE

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

1.0 INTRODUCTION

By letter dated December 16, 2004 (ET 04-0007), the Wolf Creek Nuclear Operating Corporation (the licensee) requested approval of a revision to the withdrawal schedule for Capsules W and Z in the Reactor Vessel Material Surveillance Program for the Wolf Creek Generating Station (WCGS). The licensee stated that the capsules will be withdrawn in the Spring 2005 refueling outage in accordance with American Society for Testing and Materials (ASTM) E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels." In accordance with Section III.B.3 of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50, the licensee submitted its proposed withdrawal schedule for approval.

The licensee also provided information in an e-mail dated January 7, 2004, to clarify the information in its application.

As background for its proposed schedule, the licensee stated the following about the withdrawal schedule of the reactor vessel material surveillance (RVMS) capsules at WCGS:

- As shown in Table 5.3-11, "Reactor Vessel Material Surveillance Program - Withdrawal Schedule," of the Updated Safety Analysis Report (USAR), there are six capsules labeled U, V, W, X, Y, and Z, which are located six different vessel locations. As of now only Capsules W and Z have not been removed.

- Capsules U, Y, V, and X were withdrawn at 1.07, 4.79, 9.78, and 13.83 effective full power years (EFPYs), respectively, and the results of the evaluation of the capsules were documented in Westinghouse WCAP topical reports that were submitted by letters dated November 4, 1987; November 5, 1992; September 25, 1998; and April 8, 2003, respectively.

- The last capsule withdrawn, Capsule X, was withdrawn during the 12^{th} refueling outage (April 2002) and the results submitted by letter dated April 8, 2003. The licensee stated that Capsule X reached the peak vessel surface fluence approximately equivalently to 54 EFPYs after an actual exposure of 13.83 EFPYs because the lead factor for the capsule is 4.3. The exposure of Capsule X at 13.83 EFPYs is 3.49×10^{19} n/cm^2 with a

projected neutron fluence of 3.51 x 10^{19} n/cm^2 at the clad-base metal interface at the end-of-life (EOL) of the current operating license at 54 EFPYs.

2.0 REGULATORY EVALUATION

Appendix H to 10 CFR Part 50 provides the following requirements on the withdrawal schedule for RVSM capsules:

- Section III.B.3 states that "A proposed withdrawal schedule must be submitted with a technical justification specified in [10 CFR] 50.4. The proposed schedule must be approved prior to implementation." 10 CFR 50.4 requires that the application be sent by mail or electronic submission.

- Section II.B.1 states "The ... withdrawal 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 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. For each capsule withdrawal, the test procedures and reporting requirements must meet the requirements of ASTM E 185-1982 to the extent practicable for the configuration of the specimens in the capsule."

As stated in the licensee's application, ASTM E 185-82 specifies the following criteria for determining the minimum of three, four, or five surveillance capsules to be removed from the reactor vessels (RVs) based on the limiting amount of reference temperature for nil-ductility transition shit (ΔRT_{NDT}):

- For plants with projected ΔRT_{NDT} less than 100 ^oF, three capsules are required to be removed from the RV and the first two capsules are required to be tested.

- For plants with projected ΔRT_{NDT} between 100 ^oF and 200 ^oF, four capsules are required to be removed from the RV and the first three capsules are required to be tested.

- For plants with projected ΔRT_{NDT} greater than 200 ^oF, five capsules are required to be removed from the RV and the first four capsules are required to be tested.

- The ASTM E 185-82 allows the last scheduled capsules in three, four, or five capsule withdrawal schedules (discussed above) to be removed without testing of the capsules; however, these capsules, which are withdrawn without testing, are required to be held in storage.

- The criteria in ASTM E 185-82 for removal of capsules are that the capsules be removed after a certain number of EFPYs or at times when the RV shell is projected to achieve certain levels of neutron fluence. The intent is to achieve a set of testing data over a range of RV neutron fluences that bounds the current life of the plant. For removal of the second-to-last capsule, the capsule would be pulled at 15 EFPYs, or at a time when the capsule is equivalent to the limiting neutron fluence projected for the clad-based metal interface of the RV at EOL, which ever comes first. For the final capsule, the capsule would be pulled when the neutron fluence projected for the capsule is between the limiting neutron fluence value projected for the RV at EOL, and two times that value.

3.0 TECHNICAL EVALUATION

The licensee proposed the following changes to USAR Table 5.3-11:

- Change the lead factor for the six capsules and the footnote (a) for the lead factor.
- Change the withdrawal time for Capsules U, V, and Y from a refueling outage to a specified EFPY, and add the footnote (b) to the proposed EFPYs.
- Change the withdrawal time for Capsule X from "Standby" to a specified EFPY, and add the footnote (b) to the proposed EFPY.
- Change the withdrawal time for Capsules W and Z from "Standby" to "14th refueling (Storage)" with no footnote.

3.1 Change Lead Factor

The licensee has (1) proposed to change the lead factors for each of the six capsules and (2) stated that the lead factors are being revised based on the capsule results reported in WCAP-16028, Revision 0, "Analysis of Capsule X from Wolf creek Nuclear Operating Corporation, Wolf Creek Reactor vessel Radiation Surveillance Program," dated March 2003. This report was submitted to NRC in the licensee's letter dated April 8, 2003. Therefore, the proposed lead factors are based on the Capsule X dosimetry analysis and the licensee has also proposed to add footnote (a), which states "Updated in Capsule X dosimetry analysis," to the column entitled "Lead Factor."

In its e-mail, the licensee stated that the lead factors for the withdrawn Capsules U, Y, V, and X were calculated as the ratio of the neutron fluence received by the specimens in a specific surveillance capsule to the neutron fluence at the reactor pressure vessel inside surface at the peak fluence location. The measured fluence levels for these capsules and the calculated maximum pressure vessel fluences are presented in Tables 7-1 and 6-2, respectively, of WCAP-16028, Revision 0. The measured fluence for Capsule U at the withdrawn EFPY of 1.07 is 3.16E+18 n/cm^2 and the calculated peak fluence at the clad/base metal interface is 7.44E+17 n/cm^2. Therefore, the licensee stated that the lead factor for Capsule U is calculated to be 4.25 (i.e., 3.16E+18 n/cm^2/7.44E+17 n/cm^2).

Capsule X is the last capsule that has been withdrawn from the RV and evaluated. Based on the proposed lead factors for the six capsules being based on the last capsule withdrawn from the WCGS RV and evaluated, and the proposed footnote (a) states this, the NRC staff concludes that the proposed lead factor values and the proposed footnote are acceptable.

3.2 Change Withdrawal Time for Capsules U, V, X, and Y

The licensee has proposed to (1) change the withdrawal times specified for Capsules U, V, X, and Y from a reference to the refueling outage the capsules were withdrawn (i.e., Capsules U, V, and Y), or the capsule being standby (i.e., Capsule X), to the EFPYs at the time of withdrawal and (2) add the footnote that states the capsule was withdrawn and analyzed.

The licensee stated that these four capsules have been withdrawn from the RV, and the proposed EFPYs are the actual EFPYs calculated for the capsules at withdrawal and the proposed footnote states the actual status of the four capsules. Based on this, the NRC staff

concludes that the proposed changes for capsules U, V, X, and Y are acceptable.

3.3 Change Withdrawal Time for Capsules W and Z

The licensee has proposed to change the withdrawal schedule for the two capsules from "Standby" to "14th refueling (Storage)."

In its e-mail, the licensee stated that the WCGS reactor vessel falls within the first category plants because the ΔRT_{NDT} for WCGS is projected to be less than 100 ºF. This is based on a chemistry factor (CF) of 39.1 ºF (calculated per Regulatory Guide 1.99, Revision 2, Position 2.1, see Table D-1 of WCAP-16028, Revision 0) and a fluence factor (FF) of 1.33 (determined from the equation $FF = f^{(0.28-0.1*\log f)}$ for a projected clad/base metal interface fluence of 3.51E+19 n/cm^2 at the operating license life extension of 54 EFPY), the licensee stated that the limiting ΔRT_{NDT} is calculated to be 52 ºF (i.e., CFxFF).

The licensee stated that the beltline neutron fluences at the clad-base metal interface for the RV are 2.23×10^{19} n/cm^2 at 35 EFPYs and 3.51×10^{19} n/cm^2 at 54 EFPYs, and that the current operating license is expected to reach approximately 35 EFPYs at the termination of the license. However, the licensee also stated that it intends to submit a license renewal application for WCGS in September 2006. This would extend the operating license for an additional 20 years beyond the current license termination date of March 2025. The licensee stated that at the end of extended license life (60-year), WCGS plant operation would be at approximately 54 EFPY.

For plants with projected ΔRT_{NDT} of 52 ºF, which is less than 100 ºF, ASTM E 185-82 specifies that three capsules are required to be removed from the RV and the first two capsules are required to be tested and permits the last scheduled capsules to be removed and held in storage without testing of the capsules. The licensee has withdrawn and tested four capsules. The licensee is proposing to withdraw the fifth and sixth capsules and place them in storage. The NRC staff concludes that this proposed withdrawal schedule for WCGS meets ASTM E 185-82.

6.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the licensee has submitted:

- lead factor values and footnotes to USAR Table 5.3-11 that are acceptable.

- its revised withdrawal schedule of the RVMS capsules at WCGS with a technical justification in accordance with 10 CFR 50.4 and Section III.B.3 of Appendix H of 10 CFR Part 50.

- a revised withdrawal schedule of the RVMS capsules for WCGS that meets ASTM E 185-82 in accordance with Section III.B.1 of Appendix H of 10 CFR Part 50.

Based on this, the NRC staff further concludes that the proposed revision of the withdrawal schedule of the RVMS capsules at WCGS meets Appendix H of 10 CFR Part 50, and is, therefore, acceptable.

Principal Contributor: Jack Donohew

Date: February 2, 2005