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January 28, 2016

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 16-008
NLOS/WDC: R0
Docket No.: 50-423
License No.: NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
REQUEST FOR ADDITIONAL INFORMATION REGARDING PROPOSED REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE

By letter dated July 2, 2015, Dominion Nuclear Connecticut, Inc. (DNC) requested Nuclear Regulatory Commission (NRC) review and approval of a revision to the surveillance capsule removal schedule for Millstone Power Station Unit 3 (MPS3). The proposed reactor vessel surveillance capsule removal schedule was developed to obtain high fluence surveillance data to populate the embrittlement trend curve as described in MRP-326, "Materials Reliability Program: Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines," while continuing to meet the requirements of 10 CFR 50, Appendix H, and ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," dated July 1, 1982.

In an email dated January 11, 2016, the NRC transmitted a request for additional information (RAI) to DNC related to the proposed revision to the reactor vessel surveillance capsule withdrawal schedule. The attachment to this letter provides DNC's response to the NRC's RAI.

If you should have any questions regarding this submittal, please contact Wanda Craft at (804) 273-4687.

Sincerely,

Mark D. Sartain
Vice President – Nuclear Engineering

A008
NRR

Attachment:

Response to the Request for Additional Information Regarding Proposed Revision to the Millstone Power Station Unit 3 Reactor Vessel Surveillance Program

Commitments contained in this letter: None

cc: U.S. Nuclear Regulatory Commission
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Millstone Power Station

ATTACHMENT

RESPONSE TO THE REQUEST FOR ADDITIONAL INFORMATION REGARDING PROPOSED REVISION TO THE MILLSTONE POWER STATION UNIT 3 REACTOR VESSEL SURVEILLANCE PROGRAM

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3

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BACKGROUND

10 CFR Part 50, Appendix H requires licensees to maintain reactor vessel material surveillance programs. The purpose of these programs is to monitor changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region that result from the exposure of these materials to neutron irradiation and the thermal environment. The surveillance capsules are withdrawn periodically and tested in accordance with the approved schedule and the requirements of Appendix H to 10 CFR Part 50.

ISSUE

Appendix H to 10 CFR Part 50 includes the requirement of dosimetry monitoring as part of the reactor vessel material surveillance program. In addition, for the period of extended operation for license renewal, NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Aging Management Program, XIM31 Reactor Vessel Surveillance, states that programs without in-vessel capsules use alternative dosimetry to monitor neutron fluence during the period of extended operation, as part of the aging management program for reactor vessel neutron embrittlement. The submittal states, "Concurrent reinsertion of Capsule Y will maintain continuous reactor vessel fluence monitoring as required by 10 CFR 50 Appendix H." Capsule Y was withdrawn after 13.8 effective full power years in October 2005 and placed into storage.

Question 1

Describe the analyses planned for Capsule Y, including a description of how the dosimetry analysis will account for the exposure and decay from the spent fuel pool storage when the withdrawal and testing of Capsule Y is performed.

DNC Response

At this time, no analysis is planned for Capsule Y through the end of the current license period.

Neutron fluence exposure experienced by the capsule in the spent fuel pool is not significant. The most recent MPS3 fluence analysis (Capsule W documented in WCAP-16629, Revision 0, September 2006) determined the capsule fluence after 13.8 EFPY (effective full power years) is approximately 3 x 10E19 neutrons/cm^2. Upon reinsertion of Capsule Y into the reactor, the remaining plant life should be approximately twice the 13.8 EFPY, so additional fluence for the capsule in the vessel at end of life will be approximately 6 x 10E19 neutrons/cm^2. A 1992 Electric Power Research Institute (EPRI) study (EPRI TR-100784, "Borated Stainless Steel Application in Spent Fuel Storage Racks," Section 4) determined the maximum anticipated fluence over a 40 year service life in a spent fuel pool is approximately 1 x 10E12 neutrons/cm^2. The fluence of the capsule while in the spent fuel pool is many orders of magnitude less than the fluence of the capsule while in the reactor vessel and does not need to be accounted for if and when the testing of Capsule Y is performed.

The decay of the Capsule Y dosimetry while stored in the spent fuel pool will be accounted for in the dosimetry analysis as follows:

The short half-life neutron fluence monitors are ^{54}Fe (n, p) ^{54}Mn with a half-life of 312.11 days and ^{58}Ni (n, p) ^{58}Co with a half-life of 70.82 days. During the approximate 10-year standby storage time period in the spent fuel pool, the fluence monitors would decay to 3.22x10E-4 and 3.05x10E-16 of the activity at withdrawal of the capsule at end of Cycle 10, respectively. These activities are effectively close to background activity. Due to previous burnup during cycles 1 – 10, when Capsule Y is reinserted into the reactor, the short half-life neutron fluence monitors are effectively fresh neutron fluence monitors with reduced parent nuclide atoms (N0). This reduced number of atoms for parent nuclides can be determined using Westinghouse FCALC code[1] since the power history of MPS3 Cycles 1 – 10 is reasonably known (accurate to monthly thermal power history). Similarly, since the monthly power history is known, the longer half-life monitor activity can be determined accurately by solving the buildup and decay equations.

Please refer to WCAP-16083-NP-A (ADAMS Accession No. ML061600256) Sections 4.0 and 4.1 for a discussion of exposure related to short half-life neutron fluence monitors and long half-life neutron fluence monitors. These sections discuss the effects of the compositions of the foil set on the results of the dosimetry evaluation. Section 4.1 demonstrates that with only the long half-life fission monitor measurements, the least squares results still have an acceptable uncertainty (e.g., Case #7 on page 4-2).

[1] FCALC performs radioactive decay corrections for dosimetry sensor sets included in light water reactor surveillance capsule programs.