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

October 21, 2011

Mr. William Jefferson, Jr.
Vice President
Carolina Power & Light Company
Shearon Harris Nuclear Plant
P.O. Box 165, Mail Zone 1
New Hill, NC 27562-0165

SUBJECT: SHEARON HARRIS NUCLEAR PLANT – SAFETY EVALUATION FOR REVISION TO REACTOR VESSEL SURVEILLANCE CAPSULE WITHDRAWAL SCHEDULE (TAC NO. ME6998)

By letter dated August 16, 2011 (Agencywide Documents Access and Management System Accession No. ML11235A730), Carolina Power & Light Company (the licensee) submitted for staff review a request for revising the withdrawal schedule (WS) for the reactor pressure vessel surveillance capsules for Shearon Harris Nuclear Power Plant (Harris), Unit No. 1. The purpose of the licensee's submittal was to better align the WS with the projection of neutron fluence at the end-of-life extended, while satisfying the requirements of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. Section III(B)(3) of Appendix H to 10 CFR Part 50 requires that proposed withdrawal schedules must be submitted and approved by the staff prior to implementation.

The Nuclear Regulatory Commission (NRC) staff has reviewed the submittal and has concluded that the proposed changes are consistent with the intent and requirements of the applicable regulations and guidance found in Appendix H to Part 50; as well as American Society for Testing and Materials Standard E185-82, and the NRC technical report, NUREG-1801, Revision 2. The NRC staff evaluation of this proposal is enclosed.

If you have any questions regarding this letter, please feel free to contact me at (301) 415-2020.

Sincerely,

Brenda Mozafari

Brenda Mozafari, Senior Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure: Safety Evaluation

cc: Distribution via Listserv

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SAFETY EVALUATION RELATED TO

THE REVISION OF THE REACTOR VESSEL SURVEILLANCE

CAPSULE WITHDRAWAL SCHEDULE FOR

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1

TAC NO. ME6998

DOCKET NO. 50-400

1.0 INTRODUCTION

By letter dated August 16, 2011,[1] Carolina Power & Light Company (the licensee) submitted for staff review a request for revising the withdrawal schedule (WS) for the reactor pressure vessel (RPV) surveillance capsules for Shearon Harris Nuclear Power Plant (Harris), Unit No. 1. The purpose of the licensee's submittal was to better align the WS with the projection of neutron fluence at the end-of-life (EOL) extended, while satisfying the requirements of Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50. Section III(B)(3) of Appendix H to 10 CFR Part 50 requires that proposed withdrawal schedules must be submitted and approved by the staff prior to implementation

2.0 REGULATORY REQUIREMENTS

The surveillance program for Harris was established in accordance with Appendix H to 10 CFR Part 50 that requires licensees to monitor changes in the toughness properties of ferritic materials in the RPV beltline region of light-water nuclear power reactors. Appendix H states that the design of the surveillance program and the WS must meet the requirements of the edition of the American Society for Testing and Materials (ASTM) Standard E185-82, "Standard Practice for Conducting Surveillance Test for Light-Water Cooled Nuclear Power Reactor Vessels," that was current on the issue date of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code to which the RPV was purchased; however, the licensee may choose to use later editions through 1982 of the ASTM specification. The current surveillance program at Harris has been developed in accordance with ASTM E185-82, as allowed by 10 CFR Part 50, Appendix H.

[1] Request from licensee, August 16, 2011, Agencywide Documents and Access Management System (ADAMS) Accession No. ML11235A730.

In December 2008, Harris was granted an extended license for operation.[2] NUREG-1801, Revision 2, "Generic Aging Lessons Learned Report,"[3] (GALL Report) provides additional guidance for the surveillance program during the extended period of operation, approximately an additional 20 years. This guidance is critical as the requirements found in ASTM E185-82 were designed based on 40-year operating periods.

3.0 TECHNICAL EVALUATION

The basis for the Harris surveillance program is ASTM E185-82 compliant with the requirements of Appendix H to 10 CFR Part 50. Table 1 of ASTM E185-82 requires that either a minimum of three, four, or five surveillance capsules be removed from each of the vessels, as based on the limiting amount of RT_{NDT} shift (ΔRT_{NDT}) that is projected to occur at the clad-vessel interface location of the RPV at the EOL. ASTM E185-82 establishes the following criteria for determining the minimum number of capsules that are to be removed in accordance with a WS and the number of capsules that are to be tested:

- For plants with projected ΔRT_{NDT} less than 100 degrees Fahrenheit (°F) (56 degrees Celsius (°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.

For both the 40-year period and 60-year extended period of operation the Harris RPV has limiting ΔRT_{NDT} values below 100 °F (56 °C). Therefore, the licensee was required to remove a minimum of three capsules from Harris during the 40-year periods of operation, and must test an additional capsule for the 60-year extended period of operation to remain in compliance with ASTM E182-82, and license renewal commitments as described in the GALL Report:

> The plant-specific or integrated surveillance program shall have at least one capsule with a projected neutron fluence equal to or exceeding the 60-year peak reactor vessel wall neutron fluence prior to the end of the period of extended operation. The program withdraws one capsule at an outage in which the capsule receives a neutron fluence of between one and two times the peak reactor vessel wall neutron fluence at the end of the period of extended operation and tests the capsule in accordance with the requirements of ASTM E185-82.

Three capsules have already been withdrawn and tested from the reactor (representing a fluence received between 0.8×10^{19} and 3.4×10^{19} n/cm^2, E > 1 MeV) covering the initial

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[2] License renewal at Harris, December 2008, ADAMS Accession No. ML082340952.
[3] NUREG-1801, Rev. 2, "Generic Aging Lessons Learned Report, December 2010, ADAMS Accession No. ML011080726.

40-year license period. The licensee has proposed an alternate WS for a capsule that will satisfy the ASTM E185-82/GALL Report requirement for removing a capsule with fluence between one and two times the EOL estimated vessel fluence for the 60-year license period as recommended while providing test-data more useful in a fleet-wide context.

The Nuclear Regulatory Commission (NRC) staff notes that under the proposed WS there will be one standby surveillance capsule remaining for Harris that has the potential of being removed for storage or used for future testing.

The licensee's letter of August 16, 2011, provides the updated history of the RPV surveillance capsules for Harris. The pertinent information is summarized in Table 1 below.

Table 1. Summary of Surveillance Capsule Withdrawal at Harris.

ID	Withdrawal EFPY	Withdrawal Neutron Fluence (E > 1.0 MeV)
U	1	0.55×10^{19} n/cm^2
V	3	1.32×10^{19} n/cm^2
X	9	3.25×10^{19} n/cm^2
W	18	$6.8^{B} \times 10^{19}$ n/cm^2
Y	27.2[A]	$9.39^{B} \times 10^{19}$ n/cm^2
Z	27.2[A]	$9.39^{B} \times 10^{19}$ n/cm^2

[A] Proposed withdrawal date for either Y or Z, but not both
[B] Estimated fluence value

The licensee proposes to remove either Capsule Y or Z during their 21st refueling outage, circa 2018, when the capsule will have been exposed to a total neutron fluence of 9.39×10^{19} n/cm^2 (E > 1.0 MeV). Removing the capsule at this target fluence will provide valuable information in the higher fluence ranges, for which there is currently little experience or data. The staff reiterates the recommendation found in the GALL Report that either Capsule Y or Z be withdrawn and tested while the other is left in place and maintained in readiness should it become necessary at a future date.

The staff compared the withdrawal conditions for Harris surveillance capsules U, V, X, W, Y, and Z with the criteria of ASTM E185-82 and the GALL Report for a required four capsule WS. The staff confirmed that the withdrawals were consistent with the criteria in ASTM E185-82 and the GALL Report for the proposed WS.

Capsule W was withdrawn in the fall of 2010 when the neutron fluence on capsule W was expected to be roughly equal to the maximum neutron fluence on the clad-vessel interface at EOL, 55 effective full power years (EFPY). Capsule W is currently in storage, held ready for testing or reconstitution and reinsertion into the vessel in accordance with the Harris renewed license NPF-63, Condition 2.K.

The staff finds that the proposed change in WS adequately addresses the requirements and recommendations of Appendix H, ASTM E185-82, and the GALL Report. Within this context, the testing of a Harris capsule with a higher fluence is both acceptable and prudent. The staff has further concluded that licensee has adequately addressed all concerns, limitations, and commitments related to this request.

4.0 CONCLUSION

Based on the NRC's staff's review of the licensee's August 16, 2011, submittal the NRC staff finds that the revised surveillance capsule WS and associated actions for Harris satisfy the requirements and recommendations of ASTM E185-82 and the GALL Report as pertinent to the application. Therefore, the NRC staff concludes that the licensee's modified surveillance capsule WS for Harris is acceptable for implementation and satisfies the requirements of Appendix H to 10 CFR Part 50 for the 60-year extended license period.

Principal Contributor: Dan Widrevitz

Date: October 21, 2011

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/RA/

Brenda Mozafari, Senior Project Manager
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