your energy partner
OPPD
Omaha Public Power District
444 South 16th Street Mall
Omaha, NE 68102-2247

LIC-12-0074
May 30, 2012

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

References:
1. Docket No. 50-285
2. Letter from Omaha Public Power District (J. B. Herman) to NRC (Document Control Desk), *Request for Change in Reactor Vessel Surveillance Capsule Removal Schedule*, dated February 6, 2012, (ML12040A317), (LIC-12-0005)
3. Letter from NRC (L. E. Wilkins) to OPPD (D. J. Bannister), *Fort Calhoun Station, Unit No. 1 – Request for Additional Information Regarding Proposed Change in Reactor Vessel Surveillance Capsule Removal Schedule (TAC No. ME8219)*, dated May 3, 2012, (ML121080125), (NRC-12-0045)

SUBJECT: OPPD Response to NRC RAI Regarding Request for Change in Reactor Vessel Surveillance Capsule Removal Schedule

As requested in Reference 3, attached is the Omaha Public Power District's (OPPD) response to the Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI) concerning OPPD's Reference 2 submittal.

If you should have any questions regarding this submittal, please contact Mr. Bill R. Hansher at (402) 533-6894.

Sincerely,

J. R. Goodell
Division Manager-Nuclear Performance Improvement & Support

JRG/KCH/mle

Attachment: OPPD Response to NRC RAI

E. E. Collins, Jr., NRC Regional Administrator, Region IV
L. E. Wilkins, NRC Project Manager
J. C. Kirkland, NRC Senior Resident Inspector

OPPD Response to NRC RAI

NRC Question:

American Society for Testing and Ma terials (ASTM) E185-82 recommends that for an RV with a five-capsule withdrawal schedule, such as the FCS RV, the fourth capsule should be withdrawn at approximately 15 effective full power years (EFPY) or at a time w hen the accum ulated neutron fluence of the capsule corresponds to the approxim ate end-of-life (EOL) fluence at the RV inner wall, whichever comes first. The lic ensee's proposed schedule for F CS for Capsule W-275S, the fourth capsule for FCS in ter ms of fluence, calls for the capsule to be withdrawn in 2028 when it has received a fluence of 3.0 x 10 ^{19} n/cm^2. The licensee also stated that the projected 60-year (48 EFPY) peak RV fluence is 3.5 x 10^{19} neutrons-per-square centim eter (n/cm^2). Therefore, the proposed withdrawal fluence of Capsule W -275S is approximately 86 per cent of the EOL RV inner wall fluence.

Please provide a tec hnical justification for withdraw ing Capsule W-275S at a fluence that is signific antly less than the peak projected RV inner wall fluence at EOL.

OPPD Response:

Fort Calhoun Station (FCS) is in an extended outage and is currently projected to return to service in the fall of 2012. In consideration of this, and to address the Staff's questions, FCS propos es to revi se the surveillanc e capsule withdr awal schedule proposed in Table 2 of Reference 5 as follows (**bold font** indicates revised values or new text):

Table 2: Fort Calhoun Station Requested Withdrawal Schedule for Remaining Capsules

Capsule	Location	Lead Factor	Approximate Removal Year	Removal (EFPY)	Fluence (n/cm^2)
W-45	45°	1.51	**2023**	**37.8**	**4.41 x 10^{19}**(a)
W-275S	275°	**1.52**$^{(d)}$	**2027**	**41.7**	**2.42 x 10^{19}**(b,c)
W-85	85°	1.17	Standby	---	---
W-95	95°	1.17	**2033**	**46.9**	**3.39 x 10^{19}**
W-225S	225°	1.12	Standby	---	---
W-265S	265°	0.97	Standby	---	---

(a) Approximately the projected 80-year (~65 EFPY) peak RPV fluence.
(b) Contains corresponding RPV weld material.
(c) Not a change required for the CRVSP but added to list at request of OPPD.
(d) Lead factor (based on flux) is from Beginning of Cycle 15 until removal.

Capsule W-275S is not intended to represent the fourth or fifth capsule of ASTM E185-82 but is included in the surveillance program as an integral part of the FCS Integrated Surveillance Program (Reference 1, Attachment D and Reference 3). In the proposed revised schedule, the purpose of this supplemental capsule is to obtain additional limiting weld surveillance results that are FCS-specific, rather than the representative results provided by the original FCS capsules. The proposed schedule delays the removal of Capsule W-275S until a new target fluence of 2.42×10^{19} n/cm^2 is attained, so that the capsule will provide optimized data that will best support the FCS Reactor Vessel Integrity (RVI) initiatives (e.g., Regulatory Guide 1.99, Revision 2, Position 2.1 analysis). This deferral is also consistent with the general goal of the Coordinated Reactor Vessel Surveillance Program (CRVSP) for the industry to obtain higher fluence data.

In the proposed schedule, the fourth and fifth capsules per ASTM E 185-82 are Capsule W-45 and Capsule W-95, respectively. Capsule W-45 is scheduled for withdrawal, per the revised proposed schedule, at 37.8 EFPY/~4.41×10^{19} n/cm^2, which will meet the ASTM E 185-82 recommendation of the fourth capsule to be withdrawn and tested. However, consistent with the goals and objectives of the CRVSP, the fourth capsule will be tested at a fluence greater than the extended EOL fluence at the inner wall of the vessel. The fifth capsule (W-95) is scheduled to be withdrawn and available for testing at 46.9 EFPY (current projected EOL), which will meet the ASTM E 185-82 recommendation of the fifth capsule to be withdrawn and available for testing, since this capsule will be withdrawn at a time when it has approximately attained not less than once nor greater than twice the peak end of extended life fluence at the vessel inner wall.

The three considerations for the license renewal period specified in References 3 and 4 are met by the revised proposed surveillance capsule removal schedule for FCS. The availability of standby capsules and the ability to expose the fifth capsule for the full length of the 60 calendar year service lifetime provides this capability. In addition to meeting the general considerations for the license renewal period, the FCS reactor vessel integrated surveillance program will also include the use of the W-275S capsule and the integrated surveillance program.

The proposed FCS capsule withdrawal schedule represents a significant enhancement over the current schedule. Under the existing schedule, a high-fluence capsule (W-95) would not be withdrawn until 46.9 EFPY (end of extended license, 2033). Under the proposed schedule, Capsule W-45 will be withdrawn and tested at a significantly higher fluence (~4.41×10^{19} n/cm^2) more than ten years before the end of extended license, providing meaningful surveillance data for managing loss of fracture toughness due to neutron embrittlement of the reactor vessel beltline shell and welds.

NRC Question:

The proposed schedule calls for Capsule W-275S to be withdrawn at 47.2 EFPY, corresponding to the year 2028. Table 2 of the submittal provides no lead factor for this capsule (implying capsule fluence is identical to the peak RV inner wall fluence). The submittal also indicates that Capsule W-275S was inserted at 13.6 EFPY. Therefore, the capsule will have been irradiated for 33.6 EFPY at withdrawal. The average fluence per EFPY of the peak RV inner wall location should be (3.5 x 10^{19} n/cm^2/48 EFPY) = 7.29 x 10^{17} n/cm^2/EFPY. Based on no lead factor, it would appear the fluence received by the capsule would be 33.6 EFPY x 7.29 x 10^{17} n/cm^2/EFPY = 2.45 x 10^{19} n/cm^2, which is significantly less than the proposed withdrawal fluence of 3.0 x 10^{19} n/cm^2.

[*Further, this calculation uses the average fluence per EFPY. With a switch to a*][1] *low-leakage core, fluence/EFPY would have been higher earlier in plant life. Also, since the projected EOL EFPY is 48 in 2033, the EFPY value of 47.2 for 2028 appears high unless the FCS RV will receive greater than 48 EFPY in 60 calendar years.*

Please provide the details of the fluence projection for capsule W-275S.

OPPD Response:

In 1992, FCS implemented extreme low radial leakage fuel management in Cycle 14. Supplemental Capsule W-275S was installed at the end of Cycle 14 in 1993. Thus, this capsule has seen only the same fuel management since it was installed. There is no integrated lead factor comparable to the other original capsules which began irradiation in 1973, thus none was reported in Reference 5 for consistency reasons. The absence of a reported lead factor was not intended to imply a lead factor of 1.0. Based on fast neutron flux, the corresponding lead factor for W-275S is 1.52. The nominal Capsule W-275S fast neutron flux is 2.74 x 10^{10} n/cm^2 (Reference 1, Attachment C analysis), thus the projected fluence at 47.2 EFPY (33.6 capsule EFPY) is 2.905 x 10^{19} n/cm^2. Based on further evaluation FCS proposes to pull Capsule W-275S in approximately 2027, which will correspond to approximately 41.7 EFPY and a fast neutron fluence of 2.42 x 10^{10} n/cm^2.

[1] The bracketed words were missing in the NRC RAI (Reference 6) and have been inserted so that the question is consistent with the NRC email (ML121000242) that OPPD received prior to the arrival of Reference 6.

References:

1. Letter from OPPD (W. G. Gates) to NRC (Document Control Desk), "Application for Amendment of Operating License," dated August 3, 2000, (ML003738600), (LIC-00-0064) (Attachment C: WCAP-15443, "Fast Neutron Fluence Evaluations for the Fort Calhoun Unit 1 Reactor Pressure Vessel," July 2000; Attachment D: CEN-636, Revision 02, "Evaluation of Reactor Vessel Surveillance Data Pertinent to the Fort Calhoun Reactor Vessel Beltline Materials," July 19, 2000)
2. Letter from NRC (A. B. Wang) to OPPD (S. K. Gambhir), "Fort Calhoun Station, Unit No. 1 - Issuance Of Amendment [199] - Deletion Of Section 3.D, "License Term" (TAC No. MA9690)," dated June 6, 2011, (ML011580518), (NRC-01-058)
3. Letter from OPPD (R. L. Phelps) to NRC (Document Control Desk), "Reactor Vessel Surveillance Capsule Removal Schedule Change Request," dated November 8, 2001, (ML020070044), (LIC-01-0107) (Contains WCAP-15741, Rev. 00, "Reactor Vessel Surveillance Program Withdrawal Schedule Modifications," September 2001)
4. Letter from NRC (S. Dembek) to OPPD (R. T. Ridenoure), "Fort Calhoun Station, Unit No. 1 – Reactor Vessel Surveillance Capsule Removal Schedule Change (TAC No. MB3422)," dated May 2, 2002, (ML021070609), (NRC-02-067)
5. Letter from OPPD (J. B. Herman) to NRC (Document Control Desk), "Request for Change in Reactor Vessel Surveillance Capsule Removal Schedule," dated February 6, 2012, (ML12040A317), (LIC-12-0005) (Contains MRP-326, "Materials Reliability Program: Coordinated PWR Reactor Vessel Surveillance Program (CRVSP) Guidelines," December 2011)
6. Letter from NRC (L. E. Wilkins) to OPPD (D. J. Bannister), "Fort Calhoun Station, Unit No. 1 - Request For Additional Information Regarding Proposed Change In Reactor Vessel Surveillance Capsule Removal Schedule (TAC No. ME8219)," dated May 3, 2012, (ML121080125), (NRC-12-0045)
7. NUREG-1782, "Safety Evaluation Report Related to the License Renewal of Fort Calhoun Station, Unit 1," dated October 2003, (ML033020438)