NRC-016

December 7, 2015

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	
NUCLEAR INNOVATION NORTH	)	
AMERICA LLC	)	Docket Nos. 52-012 & 52-013
	)	
(South Texas Project, Units 3 and 4)	)	

NRC STAFF RESPONSES TO COMMISSION POST-HEARING QUESTIONS

Pursuant to the November 30, 2015 "Order (Transmitting Post-Hearing Questions)," the staff of the U.S. Nuclear Regulatory Commission hereby responds to the questions posed in that Order. The staff's responses are attached. An updated exhibit list is being filed separately.

Respectfully submitted,

/Signed (electronically) by/
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Dated at Rockville, Maryland,
this 7th day of December 2015

ATTACHMENT

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1. **In FSAR Tier 2, Section 5.3.1.6.5, NINA includes the following STD DEP Vendor departure for alternative dosimetry testing that is based on the equivalent departure identified in the ABWR DCD, as administratively amended by the applicant: "*A separate neutron dosimeter* is provided *so that fluence measurements may be made at the vessel ID during the first fuel cycle to verify the predicted fluence at an early date in plant operation. This measurement is made over this short period to avoid saturation of the dosimeters now available. Once the fluence-to-thermal power output is verified, no further dosimetry is considered necessary because of the linear relationship between fluence and power output. It will be possible, however, to install a new dosimeter, if required, during succeeding fuel cycles.*"**

   Does the referenced departure mean that either: (a) NINA will not be performing any further dosimetry testing of external dosimeter locations once the initial round of external dosimetry testing is completed, or (b) that NINA will not be performing any further dosimetry testing of both external and internal dosimeter specimens once the initial round of external dosimetry testing is completed?

Response to be submitted by the applicant only.

2. **FSAR Sections 5.3.1.6.1 and 5.3.4.2 discuss the reactor vessel material surveillance program capsule withdrawal schedule. At the hearing, NINA stated that its plan is to withdraw four capsules during the initial 40-year licensing period, and its withdrawal schedule is intended to be consistent with ASTM E185. Tr. at 178-79.**

   The following table shows the expected times of withdrawal for capsules under the ASTM E 185 schedule for a four-capsule program and the FSAR schedule.

	ASTM E 185 Table 1	FSAR Sec. 5.3.1.6.1
1st Capsule	No later than 3 effective full power years (EFPY)	After 6 EFPY
2nd Capsule	No later than 6 EFPY	After 20 EFPY
3rd Capsule	No later than 15 EFPY	With an exposure not to exceed peak end-of-life fluence
4th Capsule	When capsule achieves a neutron fluence not less than once or greater than twice the peak end-of-life fluence	Determined based on results of first two capsules

The FSAR schedule does not appear to match the withdrawal schedule in Table 1 of ASTM E 185-82. Please explain which schedule applies to STP and why.

Staff Response: The withdrawal schedule for the South Texas Project (STP) Units 3 and 4 Surveillance Capsule Program was not part of the combined license (COL) review because the withdrawal schedule is incorporated by reference from the U.S. Advanced Boiling Water Reactor (ABWR) design control document (DCD), Tier 2, Section 5.3.1.6.1. The following explanation is based primarily on information from the ABWR review.

The withdrawal schedule requirements in the 1982 Edition of ASTM Standard E 185 (ASTM E 185-82) are in Section 7.6.2. This section points to Table 1 of ASTM E 185-82 for the recommended number of capsules and the withdrawal schedule for three ranges of predicted transition temperature shift. Section 7.6.2 states that the withdrawal schedule is in terms of effective full-power years (EFPY) of the reactor vessel (RV) with a design life of 32 EFPY. A design life of 32 EFPY is considered equal to the 40 years of operation for which the current fleet was licensed.

Per the ABWR DCD and the STP COL final safety analysis report (FSAR), from which the following information is taken, the STP RVs will be constructed from RV steels which are expected to demonstrate small changes in material properties due to radiation. Therefore, in applying the withdrawal schedules specified in ASTM E 185-82, the withdrawal schedule based on the RV having a shift in material reference temperature of less than 100 ^{o}F applies, rather than the withdrawal schedule identified in the Commission's question. The withdrawal schedule identified in the Commission's question is based on a higher predicted transition temperature shift. The following table shows a comparison of the applicable withdrawal schedule from ASTM E 185-82 and the schedule proposed for each STP RV:

Withdrawal Sequence	**ASTM E 185-82, Table 1 (Left column – Predicted shift less than or equal to 100 ^{o}F)**	**STP (DCD 5.3.1.6.1, FSAR 5.3.4.2)**
First	6 EFPY*	6 EFPY - an expected capsule neutron fluence of 5.2×10^{16} n/cm^2 (E > 1.0 MeV)
Second	15 EFPY*	20 EFPY - an expected capsule neutron fluence of 1.7×10^{17} n/cm^2 (E > 1.0 MeV)
Third	Withdraw at a neutron fluence not less than once or greater than twice the peak end of design life vessel neutron fluence (this capsule may be held without testing following withdrawal).	Withdraw at a neutron fluence equivalent to the peak end of design life vessel neutron fluence – at a capsule neutron fluence of 5.0×10^{17} n/cm^2 (E > 1.0 MeV).
Fourth	Not required	Based on the results of the first two capsules

* Table 1 of ASTM E 185-82 provides that the capsule may need to be withdrawn earlier than the listed time depending on other factors. These other factors would not apply to STP because of the characteristics of the ABWR reactor.

As shown above, ASTM E 185-82 recommends that three capsules be installed. This recommendation is based on a 40 year (32 EFPY) design life. However, the surveillance capsule program for the ABWR (and STP) is based on a 60 year design life. The staff noted this difference during its review of the ABWR DCD (see Section 5.3.1 of the final safety evaluation report (NUREG-1503)) and requested that the design certification applicant reassess the number of surveillance capsules and revise the surveillance program as necessary to account for the additional 20 year increase in the design life of the vessel. As a result, the withdrawal schedule was revised, as shown above, to include four capsules. The revised withdrawal schedule also called for the second surveillance capsule to be withdrawn at 20 EFPY instead of 15 EFPY. Section 5.3.1.6.1 of the ABWR DCD states that this withdrawal schedule "is extrapolated from ASTM E-185." In Section 5.3.1 of the ABWR final safety evaluation report, the staff concluded that the proposed withdrawal schedule complied with 10 CFR Part 50, Appendix H, and ASTM E 185-82.

Although the withdrawal schedule was not part of the staff's review of the STP COL application, the staff notes that the ABWR withdrawal schedule ensures that the STP surveillance program will generate sufficient information to determine the conditions under which the vessel will be operated throughout both the 40 year license period and the 60 year design life of STP. The withdrawal schedule also adequately spaces the capsule withdrawals to achieve neutron fluences that support the underlying purpose of both 10 CFR Part 50, Appendix H and ASTM E 185-82 by ensuring that the data collected from subsequent capsules will be meaningfully different from that of the first or previous capsule.

3. In Pre-hearing Question 38, the Commission asked whether there is an ITAAC to verify that the as-built Engineered Safety Features Logic and Control System (ELCS) meets the 70 percent central processing unit (CPU) load restriction. NINA's response indicates that there is no specific ITAAC to verify that the 70% CPU load restriction is met for the as-built ELCS. Although NINA points to several ITAACs within the application that verify the overall system requirements are met for the ELCS, no specific maximum CPU loading testing or analysis requirements are identified in these ITAACs. The AP1000 design certification, which also uses the Common Q platform, includes a specific ITAAC to verify that the maximum CPU loading requirements are met in the as-built safety system (ITAAC Item 11.d in AP1000 FSAR, Tier 1, Table 2.5.2-8).

If COLs are issued, would it be appropriate to include the following acceptance criterion for ITAAC 3.4.8b(7) to verify that the as-built ELCS meets the 70 percent CPU load restriction?

"Response time test performed under maximum CPU loading to demonstrate that the safety system can fulfill its response time criteria."

Staff Response: It is not necessary to supplement the inspections, tests, analyses, and acceptance criteria (ITAAC) to verify that the as-built ELCS meets the 70 percent CPU load restriction because existing ITAAC verify the deterministic performance of the as-built ELCS. These include ITAAC 3.4.2, which verifies that the Safety System Logic and Control design basis performance requirements are met, and ITAAC 2.7.5.2, which verifies that the essential communication functions use deterministic communications protocols. This is documented in the STP Units 3 and 4 FSAR, Tier 2, Appendix 7DS, which consolidates information regarding key design features of the safety-related platforms, and facilitates mapping of applicable design

acceptance criteria (DAC), and ITAAC against that information. The staff notes that the purpose of ITAAC 3.4.8 is to institute a Software Management Plan, not to verify as-built performance.

Please note that the Common Q topical report requires the Common Q platform loading to be limited to 70 percent to assure deterministic performance. Since verification of the as-built response times for the ESF safety functions is being conducted under the mapped DAC and ITAAC in Appendix 7DS, there is no need for an additional ITAAC acceptance criterion to verify that the as-built ELCS meets the 70 percent CPU load restriction.

With respect to the difference between the AP1000 and STP ITAAC, applicants are free to propose ITAAC, which may differ from application to application. The staff reviewed both the AP1000 and STP ITAAC for digital instrumentation and controls and found both of them to be acceptable.