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Sent: Tuesday, May 9, 2023 12:19 PM
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Cc: Wadkins, George (GE Power); Jordan Glisan; Michelle Hayes; Ian Tseng;
George Thomas; Kamal Manoly; Jose Pires; Ata Istar; Marcos Rolon Acevedo
Subject: Pre-Application Readiness Assessment Observations Concerning the Draft
GEH BWRX-300 LTR NEDC-33926P, "Structural Design," April 27, 2022
Attachments: Closed Pre-Application GEH Structural Design LTR Readiness Assessment
meeting Observation Summary Final Rev1.docx

Jesús,

U.S. Nuclear Regulatory Commission (NRC) staff participated in a non-public pre-application "Readiness Assessment," on April 27, 2022, of the GE-Hitachi Nuclear Energy Americas, LLC (GEH) proposed Licensing Topical Report (LTR) GEH LTR NEDC-33926P, "Steel-Plate Composite (SC) Containment Vessel (SCCV) and Reactor Building Structural Design," (Structural Design), for the BWRX-300 small modular reactor (SMR) before the application was submitted.

The "Readiness Assessment," is an approved method of engagement under the NRC's LTR acceptance review process. The objective is to help the NRC staff and GEH to determine the readiness of the draft GEH LTR on BWRX-300, Structural Design, and to identify any major issues or information gaps between the draft application and the technical content required to be included in the application submitted to the NRC. Therefore, the observations from the "Readiness Assessment" engagement do not predetermine whether the application will be docketed.

The "Readiness Assessment" staff observations are summarized in the attached "PRE-APPLICATION READINESS ASSESSMENT OBSERVATIONS OF GE-HITACHI LICENSING TOPICAL REPORT NEDC-33926P, BWRX-300 STRUCTURAL DESIGN."

No regulatory decisions were made during or as part of the staff observations from this pre-application activity and engagement with GEH.

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PRE-APPLICATION READINESS ASSESSMENT OBSERVATIONS OF GE-HITACHI LICENSING TOPICAL REPORT NEDC-33926P, BWRX-300 STRUCTURAL DESIGN

Docket No. 99900003

LOCATION

This licensing topical report (LTR) Readiness Assessment engagement was held at Residence Inn Bethesda, on April 27, 2023, from 9:30 am. till 2:30 pm.

PURPOSE

GEH requested that the staff perform a pre-application Readiness Assessment engagement activity for the draft GEH LTR NEDC-33926P, “Steel-Plate Composite (SC) Containment Vessel (SCCV) and Reactor Building Structural Design,” (Structural Design), for the BWRX-300 small modular reactor (SMR) before the application is submitted for a formal NRC review.

The Readiness Assessment engagement allows the NRC staff to:

- identify information gaps between the draft application and the technical content required in the application submitted to the NRC,
- identify major technical or policy issues that may adversely impact the docketing or technical review of the application, and
- become familiar with the application, particularly in areas where GEH is proposing new concepts or novel design features.

The observations from the Readiness Assessment will inform GEH in finalizing the application and assist the NRC staff in planning resources in preparation for the formal application.

SCOPE OF THE PRE-APPLICATION ENGAGEMENT

The Readiness Assessment covered only the draft GEH BWRX-300, Structural Design, LTR.

INFORMATION AND GUIDANCE NECESSARY FOR THE PREAPPLICATION ENGAGEMENT

GEH provided the staff with copies of the draft LTR for review in the conference room as well as access to the draft LTR in a temporary electronic reading room (eRR) that was available for staff who participated in the Readiness Assessment meeting remotely. Some staff were in attendance in the conference room while other staff attended remotely. NRC opened the Readiness Assessment engagement with an introduction at 9:30 am, including a review of the Readiness Assessment pre-application rules and guidance from the NRC-NRR Office Instruction LIC-116, Revision 0, “Preapplication Readiness Assessment,” (Agencywide Documents Access and Management System (ADAMS) Accession No. [ML20104B698](#)) and as informed by the staff draft pre-application engagement White Paper, “DRAFT Pre-application Engagement to Optimize Advanced Reactors Application Reviews” (ADAMS Accession No. [ML21145A106](#)). The Canadian Nuclear Safety Commission (CNSC) was recognized as a full participant as part of a 2019 memo of cooperation (MOC), and in a September 2022, “Collaborative Information Sharing Charter” on the review of the BWRX-300.

PRE-APPLICATION ENGAGEMENT TEAM

The NRC staff Readiness Assessment engagement team included the Office of Nuclear Reactor Regulation (NRR), Division of New and Renewed Licenses (DNRL) project staff as well as NRR technical staff representing the NRR Division of Engineering and External Hazards (DEX) that includes the lead reviewers from the Structural, Civil, Geotech Engineering (ESEB) branch. As discussed previously the CNSC technical staff also fully participated in this Readiness Assessment meeting, but their observations are not included in this summary.

PRE-APPLICATION ENGAGEMENT, READINESS ASSESSMENT, GENERAL OBSERVATION

GEH in its proposed LTR will be requesting NRC approval of a proposed structural design method for the BWRX-300, Reactor Building (RB) consisting of Steel-Plate Composite (SC) structures for the Containment Vessel (SCCV), containment internal structures, and the integrated RB structure.

Current design codes do not address the use of SC structural systems as a containment pressure boundary. Therefore, GEH is proposing specific design rules for the SCCV based on alternatives to the ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Rules for Construction of Nuclear Facility Components, Division 2, Code for Concrete Containments, Subsection CC, Concrete Containments, Articles CC-1000 through CC-8000, for materials, design, fabrication, construction, examination, testing, marking, stamping and preparation of reports for the BWRX-300 SCCV, including Division 2 Appendices to the extent they apply to an SC containment without reinforcing steel or tendons. In addition, GEH is proposing in its LTR specific structural design, rules for the integrated RB and the containment internal structures not part of the SCCV pressure boundary based on current codes and standards with some alternatives to cover design elements that are beyond the scope of current standards. The proposed enhanced design rules for the RB and the containment internal structures design using SC structures as outlined in the LTR would be supplemented by a test program that is being performed under the National Reactor Innovation Center (NRIC) Advanced Construction Technology (ACT) project in the United States. This program is known as the BWRX-300 Steel Bricks™ NRIC Demonstration Program.

The primary purpose of the proposed LTR is to provide the approach and technical bases for meeting applicable regulatory requirements with the proposed alternatives to codes and standards supplemented by design rules that are specific to the BWRX-300 SC structures for the design of the integrated RB and the pressure retaining BWRX-300 SCCV using the proposed SC technology, including the NRIC testing program ongoing that will demonstrate and validate the design and safety margins of the SC structural design proposed for the BWRX-300.

During the course of the meeting both NRC and the CNSC asked several clarification questions and provided some observations to the GEH staff that resulted in additional clarity and understanding of the proposed LTR. The NRC and CNSC staff did not identify information gaps or major technical or policy issues and GEH did not present new concepts or novel design features that had not been previously discussed during past public meeting engagements.

The following are some specific observations and feedback that GEH could consider prior to submitting the LTR for acceptance review.

PRE-APPLICATION ENGAGEMENT, READINESS ASSESSMENT, OBSERVATIONS

Observation 1:

Section 2.4 included discussion of a joint NRC and CNSC review of the LTR where it could be perceived that NRC and CNSC would provide a joint or collaborative safety evaluation of the proposed LTR. The staff wanted to make it clear to GEH that the NRC staff would make a safety finding based on the NRC requirements and regulations and that it should be clear in the LTR the

specific safety findings based on specific NRC regulations that GEH is seeking in this Pre-Application LTR for future licensing of the BWRX-300 in the United States. The draft LTR cited regulations from both the NRC and CNSC and staff noted that a clear demarcation of requirements from United States and Canada should be clear and unambiguous. There could be a future joint report from the NRC and CNSC on this topic as has been done for previous topics, but no decisions have been made.

Observation 2:

Under Section 7 of the draft LTR, GEH provided a summary of the Phase 1 NRIC testing that has been done to demonstrate and validate the BWRX-300 SC structural design for the integrated RB structures and the pressure retaining SCCV. The staff was not clear on whether that section would be part of the LTR review or if this Section was just provided for information and reference. It should be clear in the LTR that this Section was provided only as background information and reference but not for specific staff review. As a follow up to this issue was a question as to the quality assurance program that the NRIC testing is being done under and has that been reviewed and would it meet the standards described in 10 CFR 50 Appendix B. For a construction permit (CP), the applicant is required by the provisions of § 50.34 to include in its preliminary safety analysis report (PSAR) a description of the quality assurance program to be applied to the design, fabrication, construction, and testing of the structures, systems, and components of the facility.

Observation 3:

Section 1.1 "Purpose," third bullet requests USNRC design-specific authorization for the use of alternatives to specific codes and standards, namely, ASME Section III, Division 2, 2021 edition and ANSI/AISC N690-18, any edition of which are not incorporated by reference nor mandated in NRC regulations (e.g., 10 CFR 50.55a). There appears to be a regulatory inconsistency in the request since regulatory authority for proposed alternatives does not exist in 10 CFR 50.55a for codes and standards that are not incorporated by reference and mandated in the regulations. This feedback was also provided on the Whitepaper. This request, as written, falls under the jurisdiction of the respective Standards Development Organization (SDO), lacks clarity of what the third bullet covers that is not covered by the first two bullets of the section, and is inconsistent with NRC regulations. The NRC staff reviews a proposed approach to make its regulatory finding whether the approach has sufficient technical bases to provide an acceptable way to meet the applicable regulatory requirements for the intended application, and not as proposed alternative to codes and standards that are not required in the regulations.

Observation 4:

There are several draft LTR Sections (e.g., 1.1, 1.2, 2.1.1.3 SOCs for design, etc.) that appear to indicate that ASME Section III, Division 2, 2021 edition and/or ANSI/AISC N690-18, are incorporated by reference and mandated in NRC regulations, and are therefore regulatory requirements. As noted in Observation 3, this understanding is not consistent with 10 CFR 50.55a regulation.

Observation 5:

Section 2.1 states that USNRC requirements and guidance are evaluated to determine compliance or to justify the BWRX-300 specific approaches to compliance, including exemptions from regulatory requirements or exceptions to regulatory guidance where applicable. The staff observed that exemptions from regulatory requirements, if sought, should be requested pursuant to 10 CFR 50.12 "Specific exemptions."

Observation 6:

Chapter 7 does not appear to provide a discussion on any scaling effects of the applicability of the results of NRIC scaled testing being used in part as technical basis for the design of full-scale Diaphragm Plate Steel-Plate Composite (DPSC) structures for BWRX-300.

Conclusion:

As a result of the NRC staff observations, GEH may consider enhancing the LTR as described above or clarify specifically in its letter of submission to the NRC the specific areas requested for review and approval as well as the specific NRC requirements and regulations that will be met by the proposed design requirements for the BWRX-300 RB and SCCV SC structures.