



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

March 1, 2021

Ms. Margaret M. Doane
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: SAFETY EVALUATION FOR TOPICAL REPORT NEDC-33911P,
"BWRX-300 CONTAINMENT PERFORMANCE"

Dear Ms. Doane

During the 682nd meeting of the Advisory Committee on Reactor Safeguards, February 3-5, 2021, we completed our review of licensing Topical Report (TR) NEDC-33911P, Revision 0, "BWRX-300 Containment Performance," its Supplement 1, and the associated safety evaluation (SE). We met with the staff and representatives from GE-Hitachi Nuclear Energy Americas, LLC (GEH), the Applicant. We also had the benefit of the referenced documents. Our Accident Analyses - Thermal-Hydraulic Subcommittee also reviewed this topic on January 13, 2021.

CONCLUSION AND RECOMMENDATION

1. The proposed design requirements, acceptance criteria, and regulatory basis for containment performance functions documented in NEDC-33911P, subject to the limitations and conditions imposed in the staff SE, are appropriate to evaluate the BWRX-300 containment performance.
2. The SE report should be issued.

BACKGROUND

BWRX-300 is an evolutionary light water reactor based primarily on the certified Economic Simplified Boiling Water Reactor (ESBWR) design and benefits from the operating experience of the BWR fleet. Rated at 300 MWe, it is a natural-circulation small modular reactor. It is being developed by GEH. The Applicant has employed risk-informed design principles with the goals of reducing overall plant size and complexity, while diminishing the highest risk contributors that were identified during the ESBWR certification.

Licensing TR NEDC-33911P provides the design requirements, analytical methods, acceptance criteria, and regulatory bases for the containment performance design functions. Specifically, the TR addresses in detail the design requirements for the containment, the passive containment cooling system (PCCS), the containment isolation valves (CIVs), and the acceptance criteria for BWRX-300 containment performance.

In addition, the TR describes the general methodology for evaluating containment performance by identifying items, such as the transients to consider and the break locations, but it does not provide sufficient detail on the computer codes to obtain regulatory approval at this time. Those details, along with Phenomena Identification and Ranking Table (PIRT) results, benchmark data, and analyses to demonstrate conservatism in the application, are expected within a separate TR, NEDC-33922P, "BWRX-300 Containment Evaluation Method," which is currently under staff review. After this TR is reviewed and approved, the NRC staff will be in a position to evaluate the compliance of the BWRX-300 final design with the requirements documented in NEDC-33911P.

It is expected that NEDC-33922P will specify the use of code scaling, applicability and uncertainty (CSAU) methodology and a plant-specific PIRT to identify the sources of uncertainty. The application is expected to differ from the typical CSAU statistical application of uncertainties by evaluating bounding parameters (both for internal code correlations and for input data) to generate a single conservative result. We were informed that this analysis methodology will also require a best-estimate calculation with nominal parameters to quantify the impact of uncertainties.

DISCUSSION

The BWRX-300 design is not complete, but many details are in an advanced stage of conceptual design. The TR does not provide an evaluation of the containment performance; instead it defines the containment functions and regulatory requirements by specifying the ASME code sections that apply to each component type. Section 4 of the TR provides a clear set of acceptance criteria to evaluate the containment performance calculations that will be provided as part of a final submittal. The documentation in the TR is thorough and complete.

The TR presents a comprehensive review of all applicable regulatory requirements and guidance, including Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, General Design Criteria (GDC), Regulatory Guides, and the Standard Review Plan (SRP). The staff regulatory evaluation, as presented in Section 5 of the SE report, is thorough. However, compliance with GDC 55, "Reactor Coolant Pressure Boundary Penetrating Containment," requires special treatment.

GDC 55 specifies that reactor coolant pressure boundary containment penetrations must have either two CIVs (one inside and one outside containment) or be evaluated under "some other defined basis." Most of the conceptual CIV configurations documented in the TR satisfy this requirement. However, for the Isolation Condenser System (ICS) piping, the TR preliminary design does not include CIVs outside containment. The design is similar to that of the certified ESBWR. In addition, SRP Section 6.2.4 allows for a special evaluation if only one of the two CIVs is implemented in the design. Even though it applies to a different CIV configuration, SRP Section 6.2.4 states that "a single isolation valve is acceptable" if the following three conditions are satisfied:

1. system reliability can be shown to be greater,
2. the system is closed outside containment, and
3. a single active failure can be accommodated with only one isolation valve in the line.

The Applicant has not yet finalized the above calculations but provided an excellent evaluation of the ICS performance without outboard CIVs in the response to electronic request for additional information eRAI 9758. Our review of NEDC-33911P suggests that the proposed approach to satisfy the above criteria is likely to be successful.

The staff has imposed Limitation and Condition 2 that requires an evaluation of the safety consequences of ICS pipe breaks outside containment to be submitted as part of future licensing activities. The staff will use this design-specific data to make a regulatory decision whether the final design meets SRP Section 6.2.4 criteria and, thus, satisfies GDC 55.

We note that GDC 55 allows evaluation based on "other design basis" of CIV configurations that do not explicitly adhere to the ones listed. SRP Section 6.2.4 provides some examples of acceptable "other design basis," but application of the guidance is not sufficiently clear. An update of SRP Section 6.2.4 with additional clarification on this topic is warranted.

Limitation and Condition 1 in the SE report requires that the NRC staff review and approve a detailed description of the computational methodology and modeling assumptions. This requirement should be satisfied by the ongoing staff review of NEDC-33922P.

The staff could not review the PCCS design because it is not yet complete. If the final PCCS design includes containment penetrations, the staff should review the PCCS design against GDC 57, "Closed System Isolation Valves," which requires isolation valves on piping that penetrates containment.

SUMMARY

The proposed design requirements, acceptance criteria, and regulatory basis for containment performance functions documented in NEDC-33911P, subject to the limitations and conditions imposed in the staff SE, are appropriate to evaluate the BWRX-300 containment performance. The SE report should be issued.

We are not requesting a formal response from the staff to this letter report.

Sincerely,

Matthew W. Sunseri
Chairman

REFERENCES

1. U.S. Nuclear Regulatory Commission, "Safety Evaluation for GE-Hitachi Nuclear Energy Americas, LLC, Topical Report NEDC-33911P/NP, Revision 0, Supplement 1, 'BWRX-300 Containment Performance'," January 8, 2021 (ADAMS Accession Nos. ML21008A371 (Publicly Available) and ML21008A370 (Non-Publicly Available)).
2. GE-Hitachi Nuclear Energy Americas, LLC, NEDC-33911P/NP, Revision 0, "BWRX-300 Containment Performance," March 31, 2020 (ADAMS Accession Nos. ML20091S367 (Publicly Available) and ML20091S363 (Non-Publicly Available)).
3. GE-Hitachi Nuclear Energy Americas, LLC, NEDC-33911P/NP, Revision 0, Supplement 1, "BWRX-300 Containment Performance," September 4, 2020 (ADAMS Accession Nos. ML20248H573 (Publicly Available) and ML20248H572 (Non-Publicly Available)).
4. GE-Hitachi Nuclear Energy Americas, LLC, NEDC-33922P/NP, Revision 0, "BWRX-300 Containment Evaluation Methods," September 25, 2020 (ADAMS Accession Nos. ML20269A472 (Publicly Available) and ML20269A471 (Non-Publicly Available)).
5. GE-Hitachi Nuclear Energy Americas, LLC, "Response to Request for Additional Information eRAI-9745, Licensing Topical Report NEDC-33911P/NP, Revision 0," June 22, 2020 (ADAMS Accession Nos. ML20178A708 (Publicly Available) and ML20178A707 (Non-Publicly Available)).
6. GE-Hitachi Nuclear Energy Americas, LLC, "Response to Request for Additional Information eRAI-9746, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L388).
7. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9760, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L389).
8. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9764, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L390).
9. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9765, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L391).

10. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9766, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L393 (Publicly Available) and ML20206L392 (Non-Publicly Available)).
11. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9767, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 24, 2020 (ADAMS Accession Nos. ML20206L394).
12. GE-Hitachi Nuclear Energy Americas, LLC., "Response to Request for Additional Information eRAI-9758, Licensing Topical Report NEDC-33911P/NP, Revision 0," July 31, 2020 (ADAMS Accession Nos. ML20213C745 (Publicly Available) and ML20213C744 (Non-Publicly Available)).
13. U.S. Nuclear Regulatory Commission, Title 10 of the Code of Federal Regulations (10 CFR), Volume 2, "Energy," Appendix E to Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," January 1, 2020.
14. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 6.2.4, "Containment Isolation System," Revision 3, March 27, 2007, (ADAMS Accession Nos. ML070380197 (Publicly Available)).

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