



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

October 31, 2019

The Honorable Kristine L. Svinicki  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT:    ADVANCED BOILING WATER REACTOR DESIGN CERTIFICATION  
              RENEWAL**

Dear Chairman Svinicki:

During the 667<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), October 2-4, 2019, we completed our review of the design certification renewal application for the advanced boiling water reactor (ABWR) and the associated final safety evaluation report. Our review considered actions by GE-Hitachi (GEH), the first vendor in the U.S. to apply for a design certification renewal. Our ABWR Subcommittee reviewed this matter during a meeting on August 23, 2019. During our review, we had the benefit of discussions with representatives of the staff and GEH. We also had the benefit of the referenced documents.

This report fulfills the requirement of Title 10 of the *Code of Federal Regulations* (10 CFR) 52.57(c) that the ACRS report on those portions of the application which concern safety.

### **CONCLUSION AND RECOMMENDATION**

Staff supplemental safety evaluations (SEs) approved GEH proposed design changes to update and amend specific design attributes that meet the criteria for a Design Certification Renewal in accordance with 10 CFR 52.59, extending it for an additional 15 years, following implementation of the design certification final rule.

1. There is reasonable assurance that the ABWR, under the renewed design certification, can be constructed and operated without undue risk to the health and safety of the public.
2. We concur with the conclusions of the staffs' supplemental renewal SEs to NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design," with no open items. The SEs should be issued, and the GEH application for the Design Certification Renewal of the ABWR should be approved.

### **BACKGROUND**

Previously, on July 13, 1994, the U.S. Nuclear Regulatory Commission (NRC) issued the final design approval, along with NUREG-1503, "Final Safety Evaluation Report Related to the

Certification of the Advanced Boiling Water Reactor Design.” On May 12, 1997, the NRC issued the final design certification rule for the ABWR design.

On December 7, 2010, GEH requested the NRC to renew the ABWR design certification. The ABWR design certification rule, effective June 11, 1997, would otherwise expire at the end of a period of 15 years, or June 11, 2012. GEH applied for a design certification renewal on December 7, 2010. On July 20, 2012, staff identified proposed changes including Fukushima Near Term Task Force Recommendations. GEH provided the ABWR design control document (DCD), Revision 6, in response to staff requested changes. On June 28, 2019, the staff completed the SEs with no open items.

## **DISCUSSION**

The regulatory basis for renewal of a design certification includes three change categories: modifications, renewal backfits, and amendments. Modifications to the certified design are those changes in accordance with 10 CFR 52.57(a) (e.g., clarifications, changes to correct known errors, typographical errors, or defects that are necessary to meet 10 CFR 52.59(a)). Modifications must comply with the regulations applicable and in effect at the time the certification was originally issued. Renewal backfits are those changes that are necessary to comply with additional requirements imposed by the NRC through application of the criteria in 10 CFR 52.59(b). Amendments are those changes proposed by the design certification renewal applicant in accordance with 10 CFR 52.59(c). Amendments must comply with regulations applicable and in effect at the time of renewal. The GEH Design Certification renewal application contains modifications and amendments but no backfits.

The key significant renewal design changes involved the following areas: amendment to the emergency core cooling system (ECCS) suction strainers; peak cladding temperature (PCT) modification; Fukushima design enhancements; aircraft impact assessment; and containment overpressure protection system (COPS) modification.

- In accordance with guidance of Regulatory Guide 1.82, Revision 4, “Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident,” the staff confirmed that the ECCS suction strainer design complied with 10 CFR 50.46(b)(5), providing adequate Net Positive Suction Head margins. The staff also confirmed that GEH addressed the chemical, in-vessel, and ex-vessel downstream effects.
- Following incorporation of the effects of the ECCS evaluation model changes, and correction of errors since the original ABWR design certification, the estimated PCT increased by a small amount (42°C or 75°F). PCT is now 663 °C (1225 °F), which remains in compliance with criteria in 10 CFR 50.46(3)(i).
- To allow combined license applicants to meet anticipated requirements of the Mitigation of Beyond-Design-Basis Events Rule, GEH made design amendments, such as additional non-safety-related water and electrical connections.
- GEH performed a detailed aircraft impact assessment. The staff found that GEH adequately described the key design features and functional capabilities identified and credited to meet 10 CFR 50.150(b), including how the key design features meet the acceptance criteria in 10 CFR 50.150(a)(1).
- GEH modified the COPS design to include a dedicated containment vent path to prevent containment over pressure. The staff concluded that this modification did not alter the safety findings made in NUREG-1503.

In total, 39 design items were reviewed and approved by the staff in supplemental SEs to NUREG-1503 or closed by letter. In addition to reviewing DCD, Revision 6, and responses to requests for additional information, the staff performed audits to resolve outstanding technical issues.

## SUMMARY

The staff made safety determinations on the specific modifications and amendments proposed by GEH as part of its design certification renewal application; they were found to meet applicable regulatory requirements. We agree with the staff's determinations. There is reasonable assurance that the ABWR, under the renewed design certification, can be constructed and operated without undue risk to the health and safety of the public.

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

Sincerely,

**/RA/**

Peter C. Riccardella  
Chairman

## REFERENCES

1. U.S. Nuclear Regulatory Commission, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Main Report," July 1994 (ML080670592).
2. W. T. Russell (NRC), letter providing final design approval (FDA) for the ABWR design to GE, July 13, 1994, fiche: 80268: 037-043.
3. U.S. Nuclear Regulatory Commission, ["10 CFR Part 52, Appendix A, 'Design Certification Rule for the U.S. Advanced Boiling-Water Reactor'"](#), May 12, 1997.
4. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 02 SER Section 2.3 Meteorology," June 20, 2018 (ML18026A750).
5. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 01 SER Section 2.5 Geological, Seismological, and Geotechnical Engineering," June 12, 2017 (ML17060A378).
6. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 04 SER Section 2.6.2 Water Level (Flood) Design Site Parameters," December 11, 2017 (ML17080A134).
7. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 03 SER Section 2.6.8 Requirements for Determination of ABWR Site Acceptability," April 11, 2017 (ML17065A316).

8. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 27 Enhancements related to Fukushima Recommendation 7.1 Spent Fuel Pool Instruments SER Section 3.2.3 Safety Classifications," June 19, 2019 (ML19113A173).
9. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 02 SER Section 3.3 Wind and Tornado Loadings," June 20, 2018 (ML18026A667).
10. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 02 SER Section 3.5.1.4 Missiles Generated by Natural Phenomena," June 20, 2018 (ML18026A776).
11. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 23 SER Section 3.7.3 Seismic Subsystem Analysis," July 26, 2018 (ML18029A130).
12. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 18a SER Section 4.2 Fuel System Design," June 20, 2019 (ML19156A153).
13. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 12 SER Section 5.2.5 Reactor Coolant Pressure Boundary Leakage Detection," May 7, 2018 (ML18052A137).
14. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 5.4.7 Residual Heat Removal System," June 19, 2019 (ML19148A516).
15. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 5.4.7.1.1 Alternating Current Independent Water Addition," June 20, 2019 (ML19148A592).
16. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 10 SER Section 5.4.8 Reactor Water Cleanup System," January 15, 2019 (ML18346A609).
17. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 30 SER Section 6.2.1.3 Short-Term Pressure Response," February 8, 2019 (ML18052A925).
18. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 34 SER Section 6.2.1.6 Suppression Pool Dynamic Loads," February 8, 2019 (ML18170A118).
19. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 09 SER Section 6.2.1.9 Containment Debris Protection for ECCS Strainers," June 26, 2019 (ML19162A078).

20. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items SER Section 6.3 Emergency Core Cooling Systems," June 25, 2019 (ML19155A207).
21. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 7.4.1.4.4 Shutdown Panel," June 19, 2019 (ML19148A780).
22. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 7.5.2.1 Post Accident Monitoring System," June 19, 2019 (ML19114A365).
23. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 22 SER Section 7.7.1.2.1 Control Rod Ganged Withdrawal Sequence Restrictions," May 21, 2019 (ML19091A120).
24. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 33 SER Section 8.2.5 NRC Bulletin 2012-01: Design Vulnerability in Electric Power System," February 7, 2019 (ML18324A747).
25. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 8.3.4.4 Isolation Between Class 1E Buses and Loads Designated as Non-Class 1E," June 19, 2019 (ML19149A317).
26. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 13 SER Section 9.1.1 New Fuel Storage," July 23, 2018 (ML18096A046).
27. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 19 & 20 SER Section 9.1.2.1 New and Spent Fuel Storage," June 12, 2019 (ML19156A182).
28. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 18b SER Section 9.1.2.2 Fuel Racks," June 27, 2019 (ML19171A293).
29. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 27 Enhancements related to Fukushima Recommendation 7.1 Spent Fuel Pool Instruments SER Section 9.1.3 Fuel Pool Cooling and Cleanup System," June 19, 2019 (ML19114A353).
30. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 13 SER Section 9.1.4 Light Load Handling System (Related to Refueling)," July 23, 2018 (ML18096A120).
31. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 13 SER Section 9.1.5 Overhead Heavy Load Handling Systems," July 23, 2018 (ML18096A059).

32. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 11 SER Section 9.5.1 Fire Protection System," March 18, 2018 (ML17354A814).
33. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 8 SER Solid Waste Management System," June 12, 2017 (ML17061A175).
34. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 06 SER Section 12.2 Radiation Sources," February 1, 2018 (ML17065A197).
35. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 07 SER Radiation Protection Design Features Source Term Tables (Tables 12.2-3b and 12.2-3c)," April 11, 2017 (ML17066A260).
36. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 28 Enhancements Related to Fukushima Recommendation 9.3 SER Section 13.3 Emergency Planning," June 21, 2018 (ML18057A480).
37. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 17 SER Section 13.5 Plant Procedures," July 2, 2018 (ML18046A992).
38. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 35 SER Section 14.3.2.3.6 Structural Task Group Review," December 6, 2017 (ML17095A247).
39. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26 Fukushima Related Design Enhancements SER Section 16 Technical Specifications," June 19, 2019 (ML19148A463).
40. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 39 SER Section 19.1 Probabilistic Risk Assessment," December 4, 2018 (ML18312A162).
41. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 32 SER Section 19.2.3.3.4 ABWR Containment Vent Design," June 12, 2017 (ML17062A449).
42. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 29 SER Sect 19G-5 Aircraft Impact Evaluation," November 15, 2018 (ML18275A351).
43. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with No Open Items Related to the ABWR DC Renewal Issue 26, 27 & 28 SER Section 22 Requirements Resulting from Near Term Task Force Recommendations," June 19, 2019 (ML19141A374).

44. U. S. Nuclear Regulatory Commission, Staff Letter, "GE-Hitachi Nuclear Energy – United States Advanced Boiling-Water Reactor Design Certification Renewal Application," July 20, 2012 (ML12125A385).
45. U. S. Nuclear Regulatory Commission, Staff Letter, "GE-Hitachi Nuclear Energy—U.S. Advanced Boiling-Water Reactor Design Certification Renewal Application, Closure of Design Items 14, 15, 16, 21, 24, and 25," February 2, 2018 (ML17097A470).
46. GE Hitachi Nuclear Energy, "ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 5, Tier 1 and Tier 2," December 7, 2010 (ML110040175 (Package)).
47. GE Hitachi Nuclear Energy, "GE-Hitachi Nuclear Energy Advanced Boiling Water Reactor Design Certification Rule Renewal Application – ABWR DCD Changes for Aircraft Impact Assessment (AIA) - Key Design Features (Revision 3)," February 28, 2017 (ML17059C517).
48. GE Hitachi Nuclear Energy, "Supplemental Information for GEH's Response to Item # 26 – Fukushima Recommendation 4.2 Mitigation Strategies – of NRC Suggested U.S. Advanced Boiling Water Reactor Design Changes," January 23, 2017 (ML17025A386).
49. GE Hitachi Nuclear Energy, "GEH Proposed Resolution of Item # 28 - Fukushima Recommendation 9.3, Emergency Preparedness - of NRC Suggested U.S. Advanced Boiling Water Reactor Design Changes," July 7, 2015 (ML15188A270).
50. GE Hitachi Nuclear Energy, "Peak Cladding Temperature/10 CFR §50.46 for the GE Hitachi Nuclear Energy Advanced Boiling Water Reactor (ABWR) Design Certification Renewal Application, Supplemental Information," January 21, 2019 (ML19021A015).
51. GE Hitachi Nuclear Energy, "NRC Review of GE Hitachi Nuclear Energy – United States Advanced Boiling Water Reactor (ABWR) Design Certification Renewal Application – Submittal Date for ABWR DCD Revision 6," March 17, 2014 (ML14078A070).
52. GE Hitachi Nuclear Energy, "Response to NRC Letter: GE Hitachi Nuclear Energy – United States Advanced Boiling-Water Reactor Design Certification Renewal Application (July 20, 2012)," September 17, 2012 (ML12261A311).
53. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," March 2012 (ML111330285)

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SUBJECT: ADVANCED BOILING WATER REACTOR DESIGN CERTIFICATION  
RENEWAL

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