16 TECHNICAL SPECIFICATIONS

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16 TECHNICAL SPECIFICATIONS

Appendix A, "Design Certification Rule for the U.S. Advanced Boiling Water Reactor," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," constitutes the standard design certification (DC) for the U.S. Advanced Boiling Water Reactor (ABWR) design. To document the U.S. Nuclear Regulatory Commission (NRC) staff's review supporting initial certification of the ABWR, the staff issued a final safety evaluation report (FSER) in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design," in July 1994 and NUREG-1503, Supplement 1, in May 1997.

The staff is documenting its review of the GE-Hitachi Nuclear Energy (GEH or the applicant) application for renewal of the ABWR DC in Supplement 2 to NUREG-1503. Chapter 1 of this supplemental FSER describes the staff's review process for the ABWR DC renewal. This supplemental FSER chapter documents the NRC staff's review specifically related to Chapter 16, "Technical Specifications," of the GEH Design Control Document (DCD), Revision 7. Except as modified by this supplement to the FSER, the findings made in NUREG-1503 and its Supplement 1 remain in full effect.

16.1 Regulatory Criteria

In the ABWR DCD Revision 7, the applicant proposed design changes to improve the diversity and defense-in-depth of safety systems to enhance the ABWR coping capabilities during a beyond-design-basis event. The ABWR DC renewal applicant is not required to address the mitigation of beyond-design-basis events (MBDBE) rule (10 CFR 50.155, "Mitigation of beyond-design-basis events") that was published in the *Federal Register* on August 9, 2019 (84 FR 39684) and became effective September 9, 2019. Prior to the effective date of the MBDBE rule, the applicant provided design enhancements in its ABWR DC renewal application that would allow a potential combined license (COL) applicant the means for meeting 10 CFR 50.155 requirements.

This evaluation documents the staff's review of the applicant's design enhancements and the proposed technical specifications (TS) changes to demonstrate that the ABWR design meets the requirements of 10 CFR 52.47, "Contents of applications; technical information," which states that proposed TS are to be prepared in accordance with the requirements of 10 CFR 50.36, "Technical specifications," which details the specific items (such as safety limits, limiting safety system settings, limiting conditions for operation, etc.) that must be included in the TS.

In a letter dated July 20, 2012 (Agencywide Document and Access Management System (ADAMS) Accession No. ML12125A385), the NRC staff identified 28 items for GEH's consideration as part of its application to renew the ABWR DC. The applicant was requested in Item No. 26 of the July 20, 2012, staff letter to address ABWR DCD design changes related to aspects of the NRC Fukushima Near Term Task Force (NTTF) Recommendation 4.2 regarding mitigation strategies for beyond-design-basis external events based on the approach described in SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated February 17, 2012 (ADAMS Accession No. ML12039A111). Subsequently, during the MBDBE

rulemaking that created 10 CFR 50.155, the Commission decided not to impose mitigation strategies requirements on DCs.[1]

In a letter dated January 23, 2017 (ADAMS Accession No. ML17025A386), GEH revised its previous responses to Item No. 26 of the July 20, 2012, staff letter, because the MBDBE proposed rule indicated that mitigation strategies requirements would not be imposed on DCs. The applicant narrowed the scope of its changes in response to Item No. 26 to remove references to NTTF Recommendation 4.2, pending final rulemaking for the MBDBE rule. As such, GEH retained related design changes that had been proposed to address NTTF Recommendation 4.2 as well as the update to the ABWR renewal TS but requested that the NRC review these changes as operational enhancements that provide additional defense in depth. GEH stated that these proposed ABWR design enhancements could provide a potential COL applicant the means for meeting the MBDBE rule requirements of 10 CFR 50.155. The final MBDBE rule requirements did not require a change to the GEH position or proposed design changes as presented in the January 23, 2017, GEH letter.

These changes do not fall within the definition of a "modification." Therefore, in accordance with 10 CFR 52.59(c), these design changes are "amendments," as this term is defined in Chapter 1 of this supplement and will correspondingly be evaluated using the applicable regulations in effect at renewal. Although the design related changes made by GEH are not required to meet the regulations, the staff evaluated the changes to assure that the TS remain consistent with the following regulatory requirements:

- 10 CFR 52.47(a)(11), as relevant here, requires the applicant (GEH) to provide proposed TS prepared in accordance with the requirements of 10 CFR 50.36.

- 10 CFR 50.36, states that TS impose limits, operating conditions, and other requirements upon reactor facility operation for the public health and safety. The TS are derived from the analyses and evaluations in the safety analysis report. In general, the TS must contain: (1) safety limits and limiting safety system settings; (2) limiting conditions for operation (3) surveillance requirements; (4) design features; and (5) administrative controls.

- 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," describes acceptance criteria for ECCS for light-water nuclear power reactors.

- 10 CFR Part 50," Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 33, "Reactor Coolant Makeup," requires a system to supply reactor coolant makeup for protection against small breaks in the reactor coolant pressure boundary.

- 10 CFR Part 50, Appendix A, GDC 19, "Control Room," states, in pertinent part, that equipment at appropriate locations outside the control room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary

[1] In the MBDBE proposed rule regulatory analysis (ADAMS Accession No. ML15266A133), the Commission proposed to not make the MBDBE proposed rule applicable to existing DCs, which included the ABWR, because "[t]he issues that may be resolved in a DC and accorded issue finality may not include operational matters, such as the elements of the [MBDBE] proposed rule."

instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown.

16.2 Summary of Technical Information

Item No. 26 from the staff letter dated July 20, 2012, requested that the applicant address the design related aspects of Fukushima NTTF Recommendation 4.2 regarding mitigation strategies for beyond-design-basis external events as outlined in Attachment 2 of Commission Order EA-12-049 (ADAMS Accession No. ML12054A735), "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," issued on March 12, 2012 (ADAMS Accession No. ML12054A735).

The staff discussed NRC actions involving a pending final rulemaking for the MBDBE rule during a public teleconference held December 1, 2016. As described in the version of the draft final MBDBE rule that was publicly available at that time, no requirements would be applicable to applicants for a standard DC (or a renewal, as in the case of the ABWR application). It was also expected, at that time, that the final rule would be effective before the ABWR DC renewal would be completed. The final MBDBE rule was made effective on September 9, 2019.

On that basis, in a letter dated December 6, 2016, GEH informed the NRC of its plans to submit a revised response for addressing Item No. 26 by the end of January 2017. In its January 23, 2017, letter the applicant provided the updated GEH response for Item No. 26, maintaining some enhanced design features related to mitigating strategies that may be used by a potential COL applicant to satisfy MBDBE rule requirements including the proposed updates to the ABWR TS.

The proposed TS changes include the addition of Alternating Current (AC) Independent Water Addition (ACIWA) mode to Residual Heat Removal (RHR) Loop B (currently available for RHR Loop C), affecting TS 3.5.1, "ECCS-Operating," and TS 3.6.2.4, "RHR Containment Spray;" and additional controls and indications on the ABWR remote shutdown panel. These additional controls and indications improve the diversity and defense in depth during beyond-design-basis events. These changes to the Remote Shutdown Panel include the following:

1. addition of wide range reactor pressure vessel (RPV) water level indication (Division I & II) (cold calibration)

2. addition of N2 supply header pressure indication (Division I & II)

3. addition of condensate storage tank (CST) water level indication (Division I)

4. addition of containment (dry well) wide range pressure indication (Division I)

5. addition of wide range suppression pool water level indication (Division I & II)

16.3 Technical Evaluation

Changes to TS 3.5.1, ECCS-Operating (Add ACIWA mode to RHR Loop B (currently available for RHR Loop C):

GEH in its submittal dated January 23, 2017, states the following regarding changes to TS 3.5.1:

Diverse alternatives to reactor core isolation cooling (RCIC) are provided by the combustion turbine generator (CTG) and the ACIWA mode of RHR. If RCIC is inoperable, water can be injected into the RPV either by powering other ECCS subsystems from the CTG or by the fire protection system (FPS) using one of the loops of the ACIWA mode of RHR (RHR C loop or RHR B loop which is added with ABWR DCD, Revision 7).

With the RCIC inoperable and one or two inoperable ECCS subsystem(s) inoperable (Conditions B and C,) one of the loops (RHR loop B or RHR loop C) of the ACIWA mode of RHR is verified to be functional, so that the FPS can be used to inject water into the RPV during a station blackout with the RPV sufficiently depressurized. Loop B(C) of ACIWA is verified to be functional by stroking one complete cycle of each of the two manual valves in the FPS connection to the RHR Loop B(C) injection line, by starting the FPS diesel-driven fire pump and verifying that the FPS header pressure is maintained, and by stroking one complete cycle of the RHR Loop B(C) injection valve using its handwheel.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to the ECCS systems that provide additional capabilities and diversity in the case of a beyond design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR Final Safety Evaluation Report (FSER) NUREG–1503, Chapter 16, "Technical Specifications."

Changes to TS 3.6.2.4, RHR Containment Spray (Add ACIWA mode to RHR Loop B (currently available for RHR Loop C):

The primary containment is designed with a suppression pool so that, in the event of a loss of coolant accident (LOCA), or a rapid depressurization of the RPV through the safety/relief valves, steam released from the primary system is channeled through the suppression pool water and condensed without producing significant pressurization of the primary containment (without exceeding its design pressure). The primary containment must also withstand a postulated bypass leakage pathway that allows the passage of steam from the drywell directly into the wetwell airspace, bypassing the suppression pool. In that case, some means must be provided to condense steam from the wetwell so that the pressure inside primary containment remains within the design limit. This function is provided by two redundant RHR containment spray subsystems (only RHR subsystems B and C operate in this mode). The ACIWA mode of RHR provides a backup drywell or wetwell spray capability.

With one RHR containment spray subsystem inoperable, the ACIWA mode of RHR loop B or loop C, using the FPS, can be used to inject water into the drywell or wetwell spray spargers. Loop B or loop C of ACIWA is verified to be functional by stroking one complete cycle of each of the two manual valves in the FPS connection to the RHR Loop B(C) injection line, by verifying that the FPS header pressure is maintained and by stroking one complete cycle of the RHR Loop B(C) injection valve.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to the RHR systems in the case of a beyond-design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 50.36 and the staff's evaluation in the previous ABWR FSER NUREG-1503, Chapter 16.

Changes to TS 3.3.6.2, Remote Shutdown Panel:

RPV wide range/narrow range water level (Addition of Wide Range RPV Water Level Indication Cold Calibration) (Div. I & II) (TS Table 3.3.6.2-1, functions 12, 13, & 27) Reactor vessel water level is provided to support monitoring of core cooling, to verify operation of the make-up pumps, and is needed for satisfactory operator control of the make-up pumps. The wide range water level channels cover the range from the near top of the fuel to near the top of the steam separators. The narrow range provides indication from near the bottom of the separators to above the steam lines. RPV level is a necessary parameter for achieving and maintaining the reactor in MODE 3. There is an additional set of wide range instruments that have been calibrated for cold conditions and will be used when the normal instruments are off scale. One channel of each of the RPV Water Level conditions and ranges is provided on each of the RSS panels. Both channels are required to be OPERABLE to provide redundant capability to achieve MODE 3 from both RSS panels.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to the remote shutdown panel in the case of a beyond-design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16.

Suppression Pool Water Level, Narrow and Wide Range (Addition of Wide Range) (Div. I & II) (TS Table 3.3.6.2-1, functions 18, & 26)

The suppression pool water level provides information needed to assess the status of the RCPB and to assess the status of the water supply to the ECCS. The narrow range level indicators monitor the suppression pool level from the bottom of the ECCS suction lines to five feet above the normal suppression pool level. The wide range level indicators monitor the suppression pool from the centerline of the ECCS suction piping to the wetwell spargers. One channel of both functions is provided on each of the RSS panels. Both channels are required to be OPERABLE to provide redundant capability to achieve MODE 3 from both RSS panels.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to suppression pool water level in the case of a beyond-design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16.

Condensate Storage Tank Level (Addition of CST Water Level Indication Division I, which will be in addition to the existing Division II) (TS Table 3.3.6.2-1, functions 19)

The CST level provides information needed to assess the status of the water supply to reactor core isolation coolant (RCIC) and high-pressure core flooder (HPCF). The indication is needed in order to achieve and maintain MODE 3 when using RCIC and HPCF. Both channels are required to be OPERABLE to achieve MODE 3 from both RSS panels.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to the CST water level indication in the case of a beyond-design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16.

N2 Header Pressure (Addition of N2 Supply Header Pressure Indication) (Div. I & II) (TS Table 3.3.6.2-1, functions 24)

This function is provided to permit monitoring the status of the N2 bottle header pressure. These monitors are required to permit the operator to manage the N2 supply to the safety/relief valves (SRVs). One channel of this function is provided on each RSS panel. Both channels of the function are required to be OPERABLE to provide redundant capacity to achieve MODE 3 from both RSS panels.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to N2 supply pressure indications in the case of a beyond-design-basis event. Therefore, the staff concludes the change is consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16, "Technical Specifications."

Drywell Pressure - Wide Range (Addition of Containment Wide Range Pressure Indication) (Div. I & II) (TS Table 3.3.6.2-1, functions 25)

This function is provided to permit monitoring of the status of the drywell pressure. This will allow the operator to determine if there is a potential of operation of the containment overpressure protection system (COPS). One channel of this function is provided on each RSS panel. Both channels of the function are required to be OPERABLE to provide redundant capacity RSS panels.

The staff reviewed these TS changes and concludes that they are acceptable because the changes reflect the design enhancements to the containment drywell pressure indication in the case of a beyond-design-basis event. Therefore, the staff concludes the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36, and with the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16.

16.4 Conclusion

The staff reviewed the relevant GEH TS changes related to the ABWR design enhancements that were evaluated as ABWR DCD amendments as described in the Enclosure 1, Table 1, of the GEH letter dated January 23, 2017. As described above, these additional TS controls and indications improve the ABWR diversity and defense-in-depth during beyond-design-basis events and, therefore, enhance the safety of the plant. Therefore, the staff finds acceptable the above proposed changes made to align the TS with the ABWR DC renewal design changes. Therefore, the staff concludes that the changes are consistent with the requirements of 10 CFR 52.47(a) and 10 CFR 50.36 for all the associated TS changes; 10 CFR 50.46, for the ECCS; GDC 33 and GDC 19 for light-water nuclear power reactors; and the staff's evaluation in the previous ABWR FSER NUREG–1503, Chapter 16. Therefore, the staff finds the changes to be acceptable.

References

1. 10 CFR 50.155, “Mitigation of beyond-design-basis events.”

2. 10 CFR 50.36, “Technical specifications.”

3. 10 CFR 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.”

4. 10 CFR 52.47, “Contents of applications; technical information.”

5. 10 CFR 52.59, “Criteria for renewal.”

6. 10 CFR Part 52, Appendix A, “Design Certification Rule for the U.S. Advanced Boiling Water Reactor.”

7. 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants.”

8. 10 CFR Part 50, Appendix A, GDC 19, “Control Room.”

9. 10 CFR Part 50, Appendix A, GDC 33, “Reactor Coolant Makeup.”

10. NRC, NUREG-1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design,” July 1994 (ADAMS Accession No. ML080670592).

11. NRC, NUREG-1503, “Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design,” Supplement 1, May 1997 (ADAMS Accession No. ML080710134).

12. GEH, ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 5, Tier 1 and Tier 2, December 2010 (ADAMS Accession No. ML110040323).

13. GEH, ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 6, Tier 1 and Tier 2, February 2016 (ADAMS Accession No. ML16214A015).

14. GEH, ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 7, Tier 1 and Tier 2, December 2019 (ADAMS Accession No. ML20007E371).

15. NRC, EA 12-049, “Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” March 12, 2012 (ADAMS Accession No. ML12054A735).

16. NRC, SECY-12-0025, “Proposed Orders and Requests for Information in Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Tsunami,” February 17, 2012 (ADAMS Accession No. ML12039A111).