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Proprietary and Security Notice

This letter forwards **proprietary information** and **Security-Related Information** to be withheld in accordance with 10 CFR 2.390. Upon the removal of Enclosures 2 and 5, the balance of this letter may be considered non-Security-Related and non-proprietary.

MFN 16-027, Revision 2

Docket number: 52-045

November 23, 2016

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Subject: **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 2)**

Reference:

1. Letter from R.E. Kingston, GEH to USNRC, Subject: ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 5, Tier 1 and Tier 2, December 7, 2010.
2. Letter from J. G. Head, GEH to USNRC, Subject: ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 6, Tier 1 and Tier 2, February 19, 2016
3. MFN 16-027, GE-Hitachi Nuclear Energy Advanced Boiling Water Reactor Design Certification Rule Renewal Application – ABWR DCD Changes for Aircraft Impact Assessment (AIA) - Key Design Features, September 2, 2016
4. MFN 16-027, 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 1), September 14, 2016

In Reference 1, GE Hitachi Nuclear Energy ("GEH") requested renewal of the ABWR standard plant design certification (10 CFR Part 52, Appendix A) and requested approval of an accompanying amendment to the ABWR Design Control Document ("DCD") Revision 5, Tier 1 and Tier 2. In Reference 2, GEH transmitted to the NRC ABWR DCD Revision 6, Tier 1 and Tier 2 for use in GEH's ABWR Design Certification Renewal Application. Reference 3 was submitted with DCD markups and a technical report. NEDE-33875P, Revision 0. Reference 4 submitted updates to the DCD markups and a Revision 1 of the technical report. This submittal provides additional updates to the DCD (as shown on the enclosed markups), a public limited version of

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the licensing basis technical report (NEDO-33875, Revision 0), and an update for the licensing basis technical report (NEDE-33875P, Revision 2).

These additional AIA changes to the licensing basis documents are to revise or add certain information, as identified during the NRC AIA inspection conducted September 12–16, 2016.

Enclosure 1 provides a table listing the DCD Tier 2 figure updates. Enclosure 2 provides the markups showing the revisions to these DCD Tier 2 figures, and these are withheld as security-related information.

Refer to Enclosure 3 for DCD Tier 2 revised markups for Section 1.6, 3H, 9.4.5.5.3, and 19G.6 (on some pages, revisions are shown on "clean" pages that have previous markups incorporated so that the new changes are clearly indicated). A limited public version of Enclosure 5 is provided in Enclosure 4.

Enclosure 5 contains the revision to the proprietary and security-related technical report, NEDE-33875P, with revision bars and a change list describing the updates. The technical report in Enclosure 5 is considered proprietary and security-related in its entirety, is so marked, and an affidavit is included as Appendix D of the report setting forth the basis and considerations for this determination. GEH requests that the NRC withhold from public disclosure Enclosure 5 in the entirety in accordance with the provisions of 10 CFR 2.390.

The DCD markups will be incorporated into DCD Revision 7. To the extent that any of the marked-up pages refer to either Revision 6 or Revision 7, these markups show the changes from Revision 6 to Revision 7, and are interim changes showing how these revisions will be incorporated into DCD Revision 7. Notes are included on certain figures to indicate a change from Revision 6 of the figure that has already been incorporated in an interim version of the figure and which will be in Revision 7, when issued.

If you have any questions concerning this letter, please contact me.

Sincerely,

for Patricia L. Campbell

Jerald G. Head
Senior Vice President, Regulatory Affairs

Commitments: No additional commitments are made in the responses.
Enclosures:

- Enclosure 1 – Table of ABWR DCD Tier 2 Figures
- Enclosure 2 – Revised ABWR DCD Revision 6 Chapter 21 Figure Markups (Security-Related)
- Enclosure 3 – Revised ABWR DCD Revision 6 Markups
- Enclosure 4 – Technical Report NEDO-33875, Revision 0
- Enclosure 5 – Technical Report NEDE-33875P, Revision 2 (Proprietary and Security-Related)

cc: Adrian Muniz, NRC
DBR – 0018986

Enclosure 1

MFN 16-027, Revision 2

Table of ABWR DCD Tier 2 Figures

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The information contained in this document is furnished solely for the purpose(s) stated in the transmittal letter. The only undertakings of GEH with respect to information in this document are contained in the contracts between GEH and its customers or participating utilities, and nothing contained in this document shall be construed as changing that contract. The use of this information by anyone for any purpose other than that for which it is intended is not authorized; and with respect to any unauthorized use, GEH makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

ABWR DCD Tier 2 Figures

NOTE: All Figures Contain Security-Related Information

Figure	Changes Associated with this Submittal
Figure 1.2-10	• Added EDG protective awnings at HVAC intake openings per approved design change • Enhanced R/B door between Rm No 613 and Rm No 614 as water tight (WT) at R6/RB • Updated R/B door at corridor Rm No 614 from water tight (WT) door to standard door at R5/RA • Strengthened wall at R6/RA-RB • Elevator wall thickness at R1/RD corrected at elevation 23500mm
Figure 1.2-12	• Deleted duct space adjacent to elevator R2/RF at elevation 31700mm
Figure 1.2-14	• Corrected elevation of C/B roof at MSL to correspond with Figure 3H.2-28, Control Building Section
Figure 1.2-22	• Corrected elevation of C/B roof at MSL to correspond with Figure 3H.2-28, Control Building Section
Figure 9A.4-2	• Revised fire area F4201 to F1200 for duct space adjacent to elevator R2/RF at elevation -1700mm
Figure 9A.4-4	• Updated F4201 as 3 hr rated floor at duct space adjacent to elevator R2/RF at elevation 12300mm
Figure 9A.4-6	• Added EDG protective awnings at HVAC intake openings per approved design change • Enhanced R/B door between Rm No 613 and Rm No 614 as water tight (WT) at R6/RB • Updated R/B door at corridor Rm No 614 from water tight (WT) door to standard door at R5/RA • Strengthened wall at R6/RA-RB as 3 hr rated fire and 5 psid barrier [Blue] • Elevator wall thickness at R1/RD corrected at elevation 23500mm
Figure 9A.4-7	• Updated F6100 as 3 hr rated floor at Rm No 659 at elevation 27200mm
Figure 9A.4-8	• Deleted duct space adjacent to elevator R2/RF at elevation 31700mm

Figure	Changes Associated with this Submittal
Figure 12.3-7	• Added EDG protective awnings at HVAC intake openings per approved design change • Enhanced R/B door between Rm No 613 and Rm No 614 as water tight (WT) at R6/RB • Updated R/B door at corridor Rm No 614 from water tight (WT) door to standard door at R5/RA • Strengthened wall at R6/RA-RB
Figure 12.3-9	• Deleted duct space adjacent to elevator R2/RF at elevation 31700mm
Figure 12.3-18	• Added EDG protective awnings at HVAC intake openings per approved design change • Enhanced R/B door between Rm No 613 and Rm No 614 as water tight (WT) at R6/RB • Updated R/B door at corridor Rm No 614 from water tight (WT) door to standard door at R5/RA • Strengthened wall at R6/RA-RB
Figure 12.3-20	• Deleted duct space adjacent to elevator R2/RF at elevation 31700mm
Figure 12.3-60	• Added EDG protective awnings at HVAC intake openings per approved design change • Enhanced R/B door between Rm No 613 and Rm No 614 as water tight (WT) at R6/RB • Updated R/B door at corridor Rm No 614 from water tight (WT) door to standard door at R5/RA • Strengthened wall at R6/RA-RB
Figure 12.3-62	• Deleted duct space adjacent to elevator R2/RF at elevation 31700mm

Enclosure 3

MFN 16-027, Revision 2

Revised ABWR DCD Revision 6 Markups

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Table 1.6-1 Referenced Reports (Continued)

Report No.	Title	Tier 2 Section No.
NEDC-30851P-A	W. P. Sullivan, "Technical Specification Improvement Analyses for BWR Reactor Protection System", March 1988.	19D.6
NEDE-31096-A	"GE Licensing Topical Report ATWS Response to NRC ATWS Rule 10CFR 50.62", February 1987.	19B.2
NEDE-31152-P	"GE Bundle Designs", December 1988.	4.2
NEDO-31331	Gerry Burnette, "BWR Owner's Group Emergency Procedure Guidelines", March 1987.	18A
NEDC-31336	Julie Leong, "General Electric Instrument Setpoint Methodology", October 1986.	7.3
NEDC-31393	"ABWR Containment Horizontal Vent Confirmatory Test, Part I", March 1987.	3B
NEDO-31439	C. VonDamm, "The Nuclear Measurement Analysis & Control Wide Range Neutron Monitoring System (NUMAC-WRNMS)", May 1987	20.3
NEDC-31858P	Louis Lee, "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control System", 1991	15.6
NEDE-31906-P	A. Chung, "Laguna Verde Unit I Reactor Internals Vibration Measurement", January 1991.	7.4
NEDO-31960	Glen Watford, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology", June 1991.	4.4
NEDC-32267P	"ABWR Project Application Engineering Organization and Procedures Manual", December 1993.	17.1
NEDO-32686-A	"Utility Resolution Guide for ECCS Suction Strainer Blockage", October 1998.	6C

REVISE: NEDO-33875, ABWR US Certified Design Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features, Rev. 0, November 2016 19G

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NEDE-33875P, "ABWR US Certified Design Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features," Rev.~~1~~ 2, ~~September~~ November 2016 19G

Clean Copy with 3H.6 Changes submitted under MFN 16-027 and MFN 16-027 Rev 1

3H.6 Summary of Key Structural Design Features

An assessment of the effects on the ABWR for the beyond design basis impact of a large, commercial aircraft has been performed in accordance with 10 CFR 50.150(a). A summary of the assessment can be found in Appendix 19G. Information that supports detailed design used in the AIA assessment is provided in NEDE-33875P "Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features" (Reference 19G-3). NEDE-33875P captures the strengthening measures configured as part of the design enhancements for Aircraft Impact Assessment.

This appendix describes the key structural design features of the ABWR that were identified in that assessment.

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(1) Structural configuration of Spent Fuel Pool (SFP) within Reactor Building precludes direct strike on SFP. The spent fuel pool is a reinforced concrete structure with a 6.4mm (minimum) thick ASTM A-240 Type 304L stainless steel liner (see DCD Section 9.1.2.1.3). The SFP walls ~~will be~~ strengthened as described in NEDE-33875P (Reference 19G-3) to ensure the integrity of the SFP is maintained.

(6a) Protective awnings for the HVAC exhaust openings on 2F (Figure 1.2-9) are sized to provide structural capacity equivalent to the corresponding exterior wall to prevent unabated wreckage through these openings.

(2) Structural configuration of primary containment (RCCV) within Reactor building precludes direct strike on containment and structural design of RCCV ensures that RCCV is not perforated.

(3) Shield blocks over drywell head are configured to fully resist secondary impacts from concrete debris, aircraft wreckage, and falling crane components to protect integrity of drywell head. The reactor cavity shield blocks are shown in Figure 3H.1-23.

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(4) Interior partition walls ~~will be~~ thickened and strengthened as shown~~described~~ in NEDE-33875P (Reference 19G-3) to limit physical damage to interior partition walls.

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(5) Reinforced Concrete Sliding Barriers with structural capacity equivalent to the surrounding wall ~~will be~~ provided for the 6 large openings on 1F (Figure 1.2-8) to limit physical damage to exterior wall.

~~(6) Protective awnings with structural capacity equivalent to that provided in Table 3-2 of NEI 07-13 (Reference 19G-1) for exterior walls will be provided for the 3 EDG HVAC exhausts and intake openings on 2F and 3F (Figure 1.2-9 and Figure 1.2-10).~~

(6b) Protective awnings for the HVAC intake openings on 3F (Figure 1.2-10) are sized to provide structural capacity equivalent to that provided in Table 3-2 of NEI 07-13 for exterior walls. (Reference 19G-1)

(7) Deleted.

(8) Control Building Annex exterior walls are made of reinforced concrete and are at least 450mm thick.

9) The Service Building exterior wall running in the North-South direction immediately adjacent to the Control Building is a reinforced concrete wall of 900mm minimum thickness.

10) Turbine Building reinforced concrete exterior wall adjacent to the Control Building (south wall) from column line T6 to T9 up to elevation ~~23500~~mm is at least 900mm thick.

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11) R/B exterior walls on the East, West, and South sides are strengthened with enhanced reinforcement as described in NEDE-33875P (Reference 19G-3).

Generator HVAC System is designed to provide filtered outdoor cooling air to ensure the continued operation of safety-related diesels under accident conditions. The power supplies to the outdoor cooling air supply systems for the safety-related diesel generator allow uninterrupted operation in the event of loss of normal offsite power.

Each division of three HVAC system divisions and components are Seismic Category I and are located in separate and independent compartments of the Reactor Building, a Seismic Category I structure that is tornado/hurricane missile ~~missile~~, and flood protected, including tornado/hurricane missile barriers on intake and exhaust structures.

For compliance with code standards and regulatory guides, see Sections 3.2 and 1.8.

For information on fire protection and smoke removal methods for the Safety-related Diesel Generator HVAC Systems, see Subsection 9.4.5.4.1.1.

9.4.5.5.1.2 Power Generation Design Bases

The system is designed to provide outdoor air to ensure the integrity of the safety-related diesel generators. The system is designed to facilitate periodic inspection of the principal system components.

9.4.5.5.2 System Description

The R/B Safety-Related Diesel Generated HVAC System for each of three diesel generator divisions consists of a filter and two supply fans and associated ductwork. They both take air from the outside through a tornado damper and a fire damper and distribute it to the diesel generator room. The exhaust air is forced out the exhaust louvers and a tornado damper.

9.4.5.5.3 Safety Evaluation

The diesel generator rooms are designed to the requirements specified in Section 3.2. The systems are connected to their corresponding division Class 1E bus, are independent, physically separated, and are operable after loss of offsite power supply.

The diesel generator compartments ventilated by the R/B safety-related Diesel Generator HVAC System are maintained at positive pressure relative to atmosphere when the diesel generators are operating. This is achieved by only using supply fans. At other times the diesel generator compartments are maintained at positive pressure relative to atmosphere by the R/B SREE HVAC System.

The intake louvers are located at 11.5m above grade and exhaust louvers are at 8.5m above grade (see general arrangement drawing, ~~Figures 1.2-11 and 1.2-12~~).

All HVAC equipment is designed to Engineered Safety Feature requirements.

Figures 1.2-9 and 1.2-10

19G.4.2 Site Arrangement and Plant Structural Design

The design and arrangement of major structures associated with the ABWR design as described in Section 1.2 and Figures 1.2-1 are key design features. Key structural design features for aircraft impact are listed in Section 3H.6. Specifically, the assessment credited the arrangement and design of the following building features to limit the location and effects of potential aircraft strikes on the R/B, RCCV and C/B in the following locations:

1) The location and design of the C/B structure as described in Section 3.8.4 and 3H.2 are key design features that protect portions of the north wall of the R/B below Elevation 22000 from the impact of a large commercial aircraft. The C/B location on site is reflected on Figure 1.2-1, Site Plan. The C/B location, fixed with respect to other major structures, is defined in NEDE-33875P (Reference 19G-3) to ensure that credit of the C/B as an intervening structure is maintained.
2) The location and design of the Turbine Building structure and layout as described in Tier 1 Section 2.15.11 and Tier 2 Figures 1.2-24 through 1.2-31 are key design features that protect the entire north wall of the C/B and portions of the north wall of the R/B from the impact of a large commercial aircraft. The Turbine Building location on site is reflected on Figure 1.2-1, Site Plan. The Turbine Building location, fixed with respect to other major structures, is defined in NEDE-33875P (Reference 19G-3) to ensure that credit of the Turbine Building as an intervening structure is maintained.
3) The location and design of the R/B structure as described in Section 3.8.4 and 3H.1 are key design features that protect portions of the primary containment and the entire south wall of the C/B from the impact of a large commercial aircraft. This includes the protection provided by exterior walls, interior walls, intervening structures and barriers on the large openings in the reactor building exterior walls. A detailed structural analysis using NEI 07-13 Rev 8 methodology was utilized to determine the design of selected internal walls as shown in Figures 1.2-10 through 1.2-12 and exterior barriers as shown in Figures 1,2-8 and 1.2-9 that in combination with the external wall, protects the critical penetrations. That analysis was also used to determine the key design features for the reactor cavity shield blocks for protecting the drywell head from secondary impacts as identified in Section 3H.1.3, 3H.1.4 and Figure 3H.1-23. The R/B location on site is reflected on Figure 1.2-1, Site Plan. The R/B location, fixed with respect to other major structures, is defined in NEDE-33875P (Reference 19G-3) to ensure that credit of the R/B as an intervening structure is maintained.
4) The location and design of the Spent Fuel Pool and its supporting structure as described in Section 9.1 and Figure 1.2-12 are key design features in protecting the spent fuel pool from the impact of a large commercial aircraft.
5) The physical separation of the Class 1E emergency diesel generators is a key design feature that prevents the loss of all electrical power to core cooling systems by protecting them from physical damage, fire damage and smoke effects.

Clean Version of 19G.4.2 changes submitted under MFN 16-027

6) The location and design of the Service Building structure as described in Section 3H.6 and Figure 1.2-20 through 1.2-22 are key design features that protect the east wall of the C/B from the impact of a large commercial aircraft. The Service Building location on site is reflected on Figure 1.2-1, Site Plan. The Service Building location, fixed with respect to other major structures, is defined in NEDE-33875P (Reference 19G-3) to ensure that credit of the Service Building as an intervening structure is maintained.

7) The location and design of the Control Building Annex structure as described in Section 3H.6 and Figure 1.2-20 through 1.2-22 are key design features that protect the west wall of the C/B from the impact of a large commercial aircraft. The Control Building Annex location on site is reflected on Figure 1.2-1, Site Plan. The Control Building Annex location, fixed with respect to other major structures, is defined in NEDE-33875P (Reference 19G-3) to ensure that credit of the Control Building Annex as an intervening structure is maintained.

8) The seismic gap between the Reactor Building and Control Building described in DCD Section 3.8.5.1 is a key design feature in protecting the Control Building from shock effects from strikes on the Reactor Building.

9) The locations of the R/B HVAC system ducting are also key design features that prevent loss of core cooling systems by protecting HVAC SSC from physical damage, fire damage and smoke effects through physical separation.

10) During normal operating conditions, the R/B crane will be parked at the Reactor Building North wall when not in use.

~~10)~~11) Any permanent structure that penetrates the C/B roof ~~shall be~~ sized to preclude a strike from the east and west ~~direction.~~

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directions.

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ADD
_Subsequent installation of the SFP gates may be performed with less than the previously described ECC system injection capability as long as the amount of water in the reactor / reactor cavity is sufficient to provide 24 hours of cooling for the fuel remaining in the reactor.

RHR/HPCF equipment is available. If this train were to be out of service for maintenance, shutdown cooling would be lost. Administrative controls will be established by the COL applicant to ensure that RHR Train A and either RHR or HPCF for Trains B and C are not out of service for maintenance until the cavity is flooded and the SFP gates are opened. This will ensure an adequate water reservoir to provide cooling of the fuel in the vessel for at least 24 hours. ~~Following shutdown from normal power operation, an undamaged Emergency Core Cooling System (ECCS) division has the capability of maintaining core cooling. The assessment determined that at least one division of ECCS is available following the impact of commercial aircraft on the R/B.~~

The minimum system availability requirements are covered by Technical Specifications.

~~For an aircraft impact during shutdown with the reactor head removed and reactor water level at the level of the vessel flange or higher, at least one train of RHR is available to provide sufficient decay heat removal. In the event the undamaged train of RHR is out of service for maintenance, sufficient time is available to employ fire hoses connected to the spent fuel pool makeup standpipes installed to meet the requirements of 10CFR50.54(hh) to provide makeup water and cooling to the reactor vessel.~~

19G.5 Conclusions of Assessment

This assessment based upon NEI 07-13 Rev ~~7~~8, concludes that the ABWR can continue to provide adequate protection of the public health and safety in the event of an impact of a large, commercial aircraft, as defined by the NRC. The aircraft impact would not inhibit the ABWR's core cooling capability and spent fuel pool integrity ~~is maintained~~ based on best estimate calculations. There are no AIA scenarios that would result in leakage from the spent fuel pool below the required minimum water level. The pool liner is not perforated and all piping attachments are configured such that they will not allow drain down below the minimum water level described in Section 9.1.3.3. The assessment resulted in the identification of the key design features and functional capabilities described in Section 19.G.4, changes to which are required to be controlled in accordance with 10 CFR 50.150(c).

19G.6 References

19G-1

, Guidance for the Assessment of Beyond-Design-Basis Aircraft Impacts, Rev. 0, August 2011

~~19.7-1~~ NEI 07-13, Rev ~~7~~8

19G-2-

~~19.7-2~~ Regulatory Guide 1.217

19G-3
NEDE-33875P, ABWR US Certified Design Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features, Rev. 2, November 2016; NEDO-33875 (Public Version), ABWR US Certified Design Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features, Rev. 0, November 2016.