



**HITACHI**

**GE Hitachi Nuclear Energy**

**Jerald G. Head**

Senior Vice President, Regulatory Affairs

3901 Castle Hayne Road  
P.O. Box 780 M/C A-18  
Wilmington, NC 28402  
USA

T 910 819 5692

M 910 362-5692

[Jerald.head@ge.com](mailto:Jerald.head@ge.com)

MFN 16-091

Docket No. 05200045

December 7, 2016

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

**SUBJECT: Reply to Notice of Violation, NRC Inspection Report 05200045/2016-201**

**REFERENCE:**

1. NRC, T. W. Jackson, to GE Hitachi Nuclear Energy, J. G. Head, "The GE Hitachi Nuclear Energy Advanced Boiling Water Reactor Aircraft Impact Assessment Inspection, Nuclear Regulatory Commission Inspection Report No. 05200045/2016-201," November 15, 2016
2. GE Hitachi Nuclear Energy, J. G. Head, to USNRC, "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)," November 23, 2016

The purpose of this letter is to respond to the NRC Notice of Violation (Reference 1), dated November 15, 2016. The violation was identified during the associated NRC inspection of the ABWR aircraft impact assessment conducted September 12-16, 2016, at the GE Hitachi (GEH) Wilmington, North Carolina, facility. Our reply to the Notice of Violation is provided as Enclosure 1. Reference 2 submitted information regarding revisions to the ABWR renewal licensing basis related to the aircraft impact assessment.

The NRC inspection report comments, suggestions, and observations are helpful to GEH in efforts for continuing improvements in programs, quality products, and processes, and to ensure compliance with NRC regulations, particularly as these are applied to the application for renewal of the ABWR design certification.

If you have any questions regarding the information provided, please contact me or Patricia Campbell (202-637-4239).

Sincerely,

A handwritten signature in black ink that reads "Jerald Head". The signature is written in a cursive, flowing style.

Jerald G. Head  
Senior Vice President, Regulatory Affairs

Commitments:

No commitments have been made in this letter.

Enclosure:

1. Reply to NRC Notice of Violation, Docket Number 05200045, Inspection Report 05200045/2016-201

cc: Terry W. Jackson, Chief  
Quality Assurance Vendor Inspection Branch-1  
Division of Construction Inspection  
and Operational Programs  
Office of New Reactors

A. Muniz, NRC  
DBR-0023935/003N9919

**Enclosure 1**

**MFN 16-091**

**REPLY TO NRC NOTICE OF VIOLATION  
DOCKET NUMBER 05200045  
INSPECTION REPORT 05200045/2016-201**

**REPLY TO NRC NOTICE OF VIOLATION  
DOCKET NUMBER 05200045  
INSPECTION REPORT 05200045/2016-201**

**NOTICE OF VIOLATION:**

During a U.S. Nuclear Regulatory Commission (NRC) inspection of the GE Hitachi Nuclear Energy (GEH) advanced boiling water reactor (ABWR) aircraft impact assessment (AIA) conducted in Wilmington, NC, on September 12-16, 2016; one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

A. Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.150, "Aircraft impact assessment," Paragraph (a)(1) requires that each applicant listed in 10 CFR 50.150(a)(3) shall perform a design-specific assessment of the effects on the facility of the impact of a large, commercial aircraft. Using realistic analyses, the applicant shall identify and incorporate into the design those design features and functional capabilities to show that, with reduced use of operator actions:

- (i) the reactor core remains cooled, or the containment remains intact; and
- (ii) spent fuel cooling or spent fuel pool integrity is maintained.

GEH chose to meet 10 CFR 50.150 by showing that the reactor core remains cooled and spent fuel pool integrity is maintained. But contrary to 10 CFR 50.150, as of September 16, 2016, GEH failed to identify and incorporate into the design control document (DCD) those design features and functional capabilities credited in the AIA to show the reactor core remains cool and spent fuel pool integrity is maintained. Specifically, the following design features and functional capabilities that were credited to stop damage footprints in the AIA were not identified and/or accurately incorporated in the DCD:

- Section 3H.6, "Summary of Key Structural Design Features," stated that walls will be strengthened to limit physical damage as described in NEDE-33875P. However, NEDE-33875P failed to identify the wall, wall location, elevation, and an exterior wall designation used to limit physical damage in the assessment;
- Location of a water tight door and 3-hour, 5-pounds per square inch differential (psid) fire barrier on Elevation 3F; and
- Fixed locations of buildings needed to prevent damage from an aircraft impact.

In addition, GEH failed to use realistic analyses in certain aspects of its AIA. Specifically, GEH did not provide enough information to demonstrate that the spent fuel pool (SFP) liner has adequate resolution of the localized plastic deformation to ensure that the structural integrity of SFP is maintained.

These examples have been identified as Violation 05200045/2016-201-01.

**REPLY TO NOTICE OF VIOLATION:**

GEH does not contest the violation. The following information is provided to address the violation.

**Reason for the Violation:**

GEH agrees that certain walls were modified since the original design certification (ABWR DCD Revision 4) as key design features and these strengthening measures were not adequately described in NEDE-33875P, "ABWR US Certified Design, Aircraft Impact Assessment, Licensing Basis Information and Design Details for Key Design Features" (Revision 0). Also, the location of a water tight door was incorrect on the latest markups of the DCD at the time of the inspection. These key design features were included in the information used to perform the AIA and are appropriately shown in the assessment report and structural analysis report, which are referenced in NEDE-33875P. The reason that these modifications were not part of the licensing basis information is that, although a change package had been prepared to revise certain DCD drawings, the DCD markups were in an interim status while other information was being updated to address AIA, including the assessment report and structural analysis report. The normal steps in the process would have resulted in a submittal to the NRC with the interim changes. However, a decision was made to hold these interim changes until other changes related to the AIA were ready to be submitted to the NRC. Because these interim changes were on hold, the interim changes were inadvertently missed in the change package that was submitted to the NRC just prior to the AIA inspection. Specifically, the responsible engineer did not include the approved pending changes in the change package and, also, developed the change package markups using DCD Revision 6 files rather than the DCD files updated for these approved changes pending incorporation into the DCD master files. In addition, the revised DCD general arrangement drawings did not provide details of the modifications (e.g., wall thickness needed for meeting NEI 07-13 criteria), nor did 3H.6 provide that level of detail (although the details were included in the records files and in the earlier revision of the assessment report and the structural report). When GEH created the licensing basis technical report (NEDE-33875P), it was not initially recognized that these details should be included.

Although the locations of certain structures are key design features for the AIA, the specific distances of the structures in relation to each other were not included in the DCD for each of the structures. The standard plant site plan is discussed in DCD Section 3A.2, which provides certain building dimensions and separation distances, but does not include distances between all structures credited in the AIA. DCD Figure 1.2-1, "Site Plan," shows the standard layout of the structures in relationship to each other, but does not specifically list the distances between them. GEH originally considered that distances used in the AIA would be safeguards information. However, in discussions with the NRC, GEH agreed that such information is sensitive security information (in some cases) rather than safeguards. GEH also agrees that the distances used in the AIA should be in the DCD licensing basis to ensure that the distances are adequately maintained in detailed design activities.

Regarding the spent fuel pool liner analysis, the structural analysis report included information regarding the mesh used for the spent fuel pool liner analysis. However, the structural analysis report did not describe details explaining the process for developing the mesh refinement and evaluating its contribution to the uncertainty in the analyses, which would be more consistent with industry practice. This was due to an oversight when the analysts were determining the scope of information that should be included in the structural analysis report, with a contributing factor being the reliance on the expertise of the analysts in developing the models and analysis

methods and not documenting each step or element of the analysis process. In addition, during pre-inspection preparations, GEH raised a question with the contractor regarding mesh refinement and accepted an explanation that the mesh information was adequately captured in supplier basis documents from the analysts without requiring that the information be included in the analysis report.

**Corrective Steps Taken and Results Achieved:**

Following the GEH Corrective Action Program, condition reports were initiated to address issues identified during the inspection. The condition reports address the items identified in the violation examples as well as other items. As a result, the assessment report and the structural analysis report were revised and ABWR licensing basis documents were updated, as described below.

To determine appropriate corrective actions to address the interim changes to the DCD, GEH evaluated the current process for creating DCD markups, leading up to a complete DCD revision (e.g., GEH submitted DCD Revision 6, February 2016). The decision to hold the interim changes was an exception to the normal process, in part because the AIA involves a somewhat special process due to the sensitive nature of and limited access to the supporting information. As part of the condition report extent of condition evaluation, the DCD change packages process since the issuance of DCD Revision 6 were reviewed with no additional Reactor Building configuration issues noted. With no other issues identified, this exception appears to be an isolated case. Nevertheless, GEH evaluated the managing of interim changes, whether AIA related or not, that might occur in the future. It was determined that the decision to take exception to the normal process was made by a lead engineer without fully involving project management to track the interim changes in the schedule. With more recent increased scrutiny in managing the ABWR renewal schedule (e.g., weekly teleconferences with the ABWR team; weekly schedule updates; an improved time control system for linking work activities directly with the schedule actions; and frequent interactions with NRC Project Management on remaining actions), GEH determined that such an exception is highly unlikely to be missed in either correspondence with the NRC or in creating the “final” DCD revision that incorporates the DCD markups. In addition, information in the assessment report and the structural analysis report was compared in detail to the DCD key design features descriptions and the figures to ensure that design changes made to address the AIA are addressed in the ABWR licensing basis documents (this included changes to DCD figures for consistency between the general arrangement, fire protection, and radiation zones and area radiation monitor layouts for the affected Reactor Building elevations). The DCD and technical report NEDE-33875P have been revised to incorporate these AIA design changes and were submitted to the NRC in 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 2),” dated November 23, 2016.

To ensure that the locations and separation distances are maintained in the ABWR licensing basis, the assessment report has been revised to include greater details on how the structures are considered in the assessment, including conformance with the guidance in NEI 07-13, Revision 8, for both adjacent and intervening structures. Because of the sensitive nature of the relationship of the structures to each other, certain non-safeguards information is added to technical report NEDE-33875P, rather than including the information directly in the DCD. NEDE-33875P contains precautions regarding control of changes to AIA key design features, information that can guide designers in identifying when a proposed change might affect the AIA key design features, and the need to contact a cognizant AIA engineer if considering such a

change. A cognizant engineer (with the appropriate access to the safeguards assessment report and structural analysis report) will have the details as to how the structures are credited and analyzed to ensure that no design changes would undermine the assessment. In addition to information on the structures, the assessment report and structural analysis report were reviewed and other information regarding key design features has been added to these safeguards reports and, where this information is designated security-related rather than safeguards, it has been added to the licensing basis in technical report NEDE-33875P (e.g., figures showing credited walls).

Regarding the spent fuel pool liner analysis, the structural analysis report has been revised to include a new subsection entitled "Assessment for Mesh Sensitivity," in Section 5, "Summary and Conclusion." This section includes more detailed information that was discussed with the NRC inspectors during the inspection and explains how mesh refinement and uncertainty are addressed throughout the process, including model development, simulations of experimental test data, and review of analysis results to assess conditions where a more refined mesh might lead to different results. It also discusses the specifics regarding the spent fuel pool and liner analyses and results and conformance with NEI 07-13 criteria. The overall conclusions of the analysis, as discussed with the NRC during the inspection, do not change based on the more detailed assessment of mesh sensitivity.

#### **Corrective Steps Taken to Avoid Further Violations:**

As explained above, GEH reviewed the process and procedures of preparing of DCD markups to ensure that they are sufficiently robust and that ongoing activities are tracked in the scheduling and resource management of the ABWR renewal project. Since the time that the interim changes on AIA design features were not properly submitted to the NRC, the Project Work Plan has been enhanced to avoid further violations, including focus of Project Leadership Team reviews of DCD changes for ensuring pending changes are captured.

Through detailed reviews of the assessment report and the structural analysis report, other deficiencies in documenting assumptions, bases, and acceptance criteria were identified and corrected. To the extent that the licensing basis information was affected, it also has been revised to be consistent with the corrections in the reports. The revised licensing basis changes are included in the submittal MFN 16-027, Revision 2, as noted above.

In addition to addressing the specific issues, the corrective actions include interacting with the technical analyses suppliers to evaluate their internal processes for performing aircraft impact assessments and structural analyses and adequately documenting the results. Although these actions do not relate directly to GEH compliance with 10 CFR 50.150, they provide an opportunity for improvements in future analyses performed by the contractors.

Actions are being considered separate from the AIA-specific issues for managing ABWR licensing basis and figures (e.g., transition of the DCD content and the configuration management of figures). These actions should ensure an overall improvement in configuration management in any future ABWR projects (e.g., applications for a Combined License referencing the ABWR renewed design certification) or new plant process more generally, and would allow requirements management to be used for completing detailed design (e.g., apply the requirements management system being used for the ESBWR to the ABWR when the renewal is completed). The lessons learned and process changes from these actions can also be applied to future GEH design certification and design certification renewal applications.

These actions are for consideration in the longer term and do not relate to compliance with 10 CFR 50.150.

**Date When Full Compliance Will be Achieved:**

Full compliance with 10 CFR 50.150 for the ABWR renewal design certification has been achieved.