

9.0 Auxiliary Systems

9.1.2.2 Fuel Racks

9.1.2.2.1 Regulatory Criteria

In the GE-Hitachi Nuclear Energy (GEH), U.S. Advanced Boiling Water Reactor (ABWR) Design Control Document (DCD), Revision 6, the applicant proposed changes to the accident load combinations and the fuel rack support description, along with changes to two combined license (COL) license information items.

In a letter dated July 20, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12125A385), the U.S. Nuclear Regulatory Commission (NRC) staff identified 28 items for GEH's consideration as part of its application to renew the ABWR Design Certification (DC). In Item No. 18 Part B of the letter, the applicant was requested to provide structural, dynamic, and impact analysis of new and spent fuel racks (ABWR DCD Tier 2, Section 9.1.6.2, "Dynamic and Impact Analysis of New Fuel Storage Racks," and Section 9.1.6.7, "Spent Fuel Racks Structural Evaluation").

The originally certified ABWR DCD identifies that the fuel racks in the spent fuel pool (SFP) are seismic Category I structures. The staff evaluation documented in Section 9.1.2, "Spent Fuel Storage," of NUREG-1503, "Final Safety Evaluation Report Related to Certification of the Advanced Boiling Water Reactor Design," dated July 13, 1994 (ADAMS Accession No. ML080670592), approved the fuel storage racks in the SFP as described in the DCD.

In response to the staff's July 20, 2012 letter, GEH submitted proposed changes to the accident load combinations and fuel racks support description, along with a revised COL license information item in DCD Tier 2, Section 9.1.6.7, in a letter dated August 11, 2015 (ADAMS Accession No. ML15223B139). These changes have the effect of deferring the structural, dynamic, and impact analysis of the spent fuel racks to the COL applicant. In addition, the applicant deleted the COL license information item related to the dynamic and impact analysis of the new fuel storage racks described in DCD Tier 2, Revision 5, Section 9.1.6.2, "Dynamic and Impact Analyses of New Fuel Storage Racks," as part of the removal of the new fuel storage vault evaluated by the staff in Section 9.1.1, "New Fuel Storage," of this supplemental safety evaluation report (SER).

Because the changes do not fit within the definition of a "modification" and because the pertinent spent fuel rack analyses will be performed by the COL applicant in accordance with the regulations in effect during the COL application review, these proposed changes are "amendments," as defined in Chapter 1 of this supplement. Therefore, in accordance with Title 10 *Code of Federal Regulations* (10 CFR) 52.59(c), these design analysis changes are "amendments," and will correspondingly be evaluated using the regulations in effect at renewal.

The relevant requirements of the NRC's regulations for this area of review, and the associated acceptance criteria, are described in Section 9.1.2, "Spent Fuel Storage," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," LWR Edition, Revision 4, and Appendix D to Standard Review Plan (SRP) Section 3.8.4, "Other Seismic Category I Structures of SRP," Revision 4. The applicable requirement for this review is:

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, "Design Bases for Protection Against Natural Phenomena," requires that structures housing the facility and the facility itself can withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, and appropriate combinations of all loads.

9.1.2.2.2 Summary of Technical Information

GEH submitted the proposed markups to ABWR DCD, Revision 5, in Enclosure 2 (ADAMS Accession No. ML15223B141) in the letter dated August 11, 2015. In Enclosure 1 (ADAMS Accession No. ML15223B140) of this letter, GEH described that structural, dynamic, and impact analyses of fuel racks are more appropriately addressed as a COL information item since these analyses are highly dependent on the specific rack design. The staff confirmed that the proposed Revision 5 DCD markups were included in the ABWR DCD, Revision 6.

9.1.2.2.3 Technical Evaluation

The staff reviewed the proposed changes in GEH ABWR DCD Tier 2, Revision 6, Section 9.1.2.1.3, "Mechanical and Structural Design," Section 9.1.2.3.2, "Structural Design and Material Compatibility Requirements," and Section 9.1.6.7, "Spent Fuel Racks Structural Evaluation," to ensure that the effects of natural phenomena such as earthquakes, tornadoes, and hurricanes on the fuel racks in the GEH ABWR design are considered, as required by GDC 2, using the guidance in SRP Section 9.1.2, Revision 4, and Appendix D to SRP Section 3.8.4, Revision 4.

Revision 5 to the GEH ABWR DCD did not provide the structural, dynamic, and impact analyses of the fuel racks. In its August 11, 2015 letter, GEH addressed these analyses through a COL information item and provided additional details regarding the structural, dynamic, and impact analyses of the fuel racks for the SFP. The applicant did not address the new fuel racks because the applicant proposes to remove these racks and store new fuel in the SFP; this change is evaluated in Section 9.1.1, "New Fuel Storage," of this supplemental SER. Therefore, only the structural, dynamic, and impact analyses of fuel racks in the SFP were evaluated as part of this ABWR supplemental SER section.

In GEH ABWR DCD Tier 2, Revision 6, Section 9.1.2.1.3, GEH replaced the list of load combinations previously specified with a reference to the load combinations in Appendix D to SRP Section 3.8.4. These revisions are acceptable to the staff because GEH followed the guidance of Appendix D to Section 3.8.4 of SRP Revision 4. GEH also deleted language regarding the use of linear elastic design methods in the structural evaluation of the fuel racks. This deletion is also acceptable because (a) the structural, dynamic, and impact analyses of fuel racks is a COL license information item, (b) design methods can be determined by the COL applicant, and (c) the localized nonlinear plastic regime may occur due to postulated loading

cases as proposed by a future COL applicant. In addition, GEH changed “the dynamic method” to “an acceptable dynamic analysis method,” which is acceptable because the COL applicant will identify the dynamic analysis method, and the acceptability of the method will be determined during the COL application review. GEH deleted the statement “Compressive stability will be calculated according to the American Iron and Steel Institute (AISI) code for light gauge structures,” which is also acceptable to the staff because light gauge structures are no longer used as part of fuel rack fabrication and the AISI code is not referenced for acceptable fuel rack design in Appendix D to Section 3.8.4 of SRP Revision 4.

In GEH ABWR DCD Tier 2, Revision 6, Section 9.1.2.3.2, GEH revised the sentence related to an older SFP rack design that utilized a sub-structure with the description of updated designs that are considered “Freestanding” as follows:

The fuel storage racks are designed to be supported vertically by the fuel floor. The support structure allows sufficient pool water flow for natural convection cooling of the stored fuel. The fuel rack modules are freestanding (i.e., not attached to the floor and can be removed).

The staff reviewed the proposed change and found it acceptable because GEH accurately described the boundary conditions of the SFP fuel racks. In addition, GEH deleted the statement “Lead-in guides at the top of the storage spaces provide guidance of the fuel during insert,” which is acceptable to the staff because it is not related to the structural design and material compatibility requirements of the fuel racks.

In GEH ABWR DCD Tier 2, Revision 6, Section 9.1.6.7, GEH added the following italicized language to a COL license information item:

The COL applicant shall provide the NRC a confirmatory structural evaluation of the spent fuel racks, as outlined in Subsection 9.1.2.1.3. *This evaluation is dependent on a vendor specific design and the as-built configuration of spent fuel storage racks.*

Structural integrity of the racks will be demonstrated for the load combinations described in SRP 3.8.4 Appendix D. The fuel storage racks meet seismic Category I requirements.

The staff reviewed the proposed changes and found them acceptable because GEH provided additional details related to the COL license information for the fuel racks structural evaluation, and GEH refers to the guidance of Appendix D to SRP Section 3.8.4.

9.1.2.2.4 Conclusion

The staff’s review concludes that the applicant’s proposed changes related to the fuel racks for GEH ABWR design comply with GDC 2 in Appendix A to 10 CFR Part 50, and the detailed structural evaluations of the fuel racks will be provided by the COL applicant in accordance with the guidance of Appendix D to SRP Section 3.8.4, which is acceptable.