REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**287-8272**
SRP Section:	**09.01.02 – New and Spent Fuel Storage**
Application Section:	**9.1.2**
Date of RAI Issue:	**11/02/2015**

Question No. 09.01.02-47

The 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 4, 5, 63, and 10CFR 52.80(a) provide the regulatory requirements for the design of the new and spent fuel storage facilities. Standard Review Plan (SRP) Sections 9.1.2 and 3.8.4, Appendix D describes specific SRP acceptance criteria for the review of the fuel racks that are acceptable to meet the relevant requirements of the Commission's regulations identified above. In DCD Tier 1 Subsections 2.7.4.1.1 and 2.7.4.2.1, the new and the spent fuel racks respectively, are stated as “non-safety related, but seismic Category I for integrity of the spent fuel assemblies”. SRP Section 3.8.4, Appendix D states that “The Regulatory Guide 1.29, “Seismic Design Classification” classifies spent fuel pool racks as seismic Category I structures. Spent fuel pool racks should be treated as safety-related components for determining Quality Assurance requirements (10 CFR Part 50, Appendix B) and periodic condition monitoring requirements (10 CFR 50.65 “Maintenance Rule”)”. In accordance with SRP 3.8.4 Appendix D, and Appendix A to 10 CFR Part 50, General Design Criteria 1, 2, 4, 5, 61, 63, the applicant is requested to provide justification for treating the racks as non-safety related components and provide the basis for determining the Quality Assurance requirements (10 CFR Part 50, Appendix B) and periodic condition monitoring requirements (10 CFR 50.65 “Maintenance Rule”)” for the racks.

The applicant is requested to identify any proposed changes to and provide a mark-up of Subsections in the DCD Tier 1 and 2 and the report APR1400-H-N-NR-14012-P, Rev.0, as appropriate.

Response – (Rev. 1)

The new and spent fuel storage racks are treated as safety-related components by designing the racks in accordance with the requirements of the RG 1.13, SRP 3.8.4 Appendix D and SRP 9.1.2 for the compliance with the Appendix A to 10 CFR Part 50, General Design Criteria 1, 2, 4, 5, 61 and 63, as described in DCD, Tier 2, Section 9.1.2. In addition, as indicated in DCD Tier 2, Table 3.2-1 (28 of 36), the quality assurance of the 10 CFR 50 Appendix B are applied to new and spent fuel storage rack like as safety-related components.

The racks are designed as a seismic category I structure and located in the auxiliary building designed as a safety-related concrete structure, in order to maintain the fuel in a safe and subcritical array during all anticipated operating and accident condition.

For spent fuel racks, the neutron absorbing material (METAMIC) is monitored periodically by the surveillance program over the lifetime of the racks as described in DCD Tier 2, Subsection 9.1.2.4. And, a COL item will be added for the applicant to have a periodic inspection program of spent fuel storage rack integrity.

Impact on DCD

DCD Tier 1 Subsection 2.7.4.1.1 and 2.7.4.2.1 will be revised as indicated in the attached markup.

DCD Tier 2 Subsection 9.1.2.2.2, 9.1.6 and Table 1.8-2 will be revised as indicated in the attached markup.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

2.7.4 New and Spent Fuel Handling System

2.7.4.1 New Fuel Storage

2.7.4.1.1 Design Description

treated as safety-related components in accordance with the quality assurance of the 10 CFR 50 Appendix B. In addition, the racks are designed as

The new fuel storage racks are non safety-related, but seismic Category I for integrity of the new fuel assemblies. The new fuel storage racks provide on-site dry storage for nuclear fuel assemblies. The new fuel storage racks are located in the new fuel storage pit in the fuel handling area of the auxiliary building.

The new fuel storage racks are designed and constructed to accommodate design basis load and load combinations including impact due to postulated fuel handling accidents in a sub-critical configuration.

1. The functional arrangement of the new fuel storage racks is as described in the Design Description of Subsection 2.7.4.1.1.

2. The new fuel storage racks maintain the effective multiplication factor, K_{eff}, less than or equal to criticality limits during normal operation and the postulated accident conditions.

2.7.4.1.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.4.1-1 specifies the inspections, tests, analyses, and associated acceptance criteria for the new fuel storage racks.

2.7.4.2 Spent Fuel Storage

2.7.4.2.1 Design Description

treated as safety-related components in accordance with the quality assurance of the 10 CFR 50 Appendix B. In addition, the racks are designed as

The spent fuel storage racks are non safety-related, but seismic Category I for integrity of the spent fuel assemblies. The spent fuel storage racks provide on-site storage capability for a core offload during the design life. The spent fuel storage racks are located in the spent fuel pool in the fuel handling area of the auxiliary building. All piping penetrating the spent fuel pool are located approximately 3 m (10 ft) above the top of irradiated fuel assemblies seated in the storage racks, and all piping extending down into the spent fuel pool have siphon breaker holes at or above this level.

The spent fuel storage racks are designed and constructed to accommodate design basis load and load combinations including impact due to postulated fuel handling accidents in a subcritical configuration.

1. The functional arrangement of the spent fuel storage racks is as described in the Design Description of Subsection 2.7.4.2.1.

2. The spent fuel storage racks maintain the effective multiplication factor, K_{eff}, less than or equal to criticality limits during normal operation and the postulated accident conditions.

2.7.4.2.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.4.2-1 specifies the inspections, tests, analyses, and associated acceptance criteria for the spent fuel storage racks.

to the rack modules in an accessible location. The surveillance specimens are removed in accordance with a preplanned schedule using remotely operated tools.

Spent fuel is stored in two regions of the pool. The fresh or spent fuel assemblies including damaged fuel assemblies are stored in region I (see Figure 9.1.2-2A), which has a storage capacity for one full core, one refueling batch, and five damaged fuel assemblies. The region I storage area is designed to accommodate fuel assemblies with an initial enrichment of up to 5.0 wt% U-235.

Region II (see Figure 9.1.2-2B) has a maximum storage capacity of the spent fuel assemblies generated during 20 years of plant operation. The maximum initial enrichment of 5.0 wt% U-235 and the minimum burnup of each enrichment are applied for a region II design.

The center-to-center spacing between adjacent fuel assemblies is designed to be 27.5 cm (10.83 in) for region I racks and 22.5 cm (8.86 in) for region II racks to maintain subcriticality.

The SFSR is also provided with an array of five storage spaces for damaged fuel assembly containers. These racks contain the neutron absorbing material, and the center-to-center spacing of this array is 27.5 cm (10.83 in).

No overhead crane, except the light load fuel handling machine, passes over the SFP. The fuel handling machine is designed to withstand seismic Category I loads to preclude its fall or collapse due to an SSE.

Spent fuel storage racks are free-standing, and each rack module is supported by four legs. A lead-in guide is provided to provide reasonable assurance of easy insertion of fuel assemblies.

Design of the spent fuel storage facility is in accordance with NRC RG 1.13 (Reference 11).

9.1.2.2.3 New and Spent Fuel Storage Rack Design

The fuel storage facilities are designed to meet the guidelines of ANS 57.2 (Reference 17) and ANS 57.3 (Reference 15). The structural design and stress analysis of the new and spent fuel storage racks are evaluated in accordance with the seismic Category I requirements of NRC RG 1.29 (Reference 12).

The COL applicant is to prepare a periodic inspection program of spent fuel rack integrity to ensure that the design basis material and geometric assumptions remain valid during the operating life of the plant. (COL 9.1(9)).

COL 9.1(4) The COL applicant is to provide plant procedures for preventing and mitigating inadvertent reactor cavity drain down events, maintenance procedures for the maintenance and inspection of refueling pool seal, and emergency response procedures for the proper measures during pool drain down events.

COL 9.1(5) The COL applicant is to provide plant operating procedure guidelines for preoperational load testing and checks of interlocks, blocks, hoisting cables, control circuitry, and lubrication of fuel handling equipment.

COL 9.1(9) The COL applicant is to prepare a periodic inspection program of spent fuel rack integrity to ensure that the design basis material and geometric assumptions remain valid during the operating life of the plant.

9.1.7 References

1. 10 CFR Part 50, Appendix A, General Design Criterion 62, “Prevention of Criticality in Fuel Storage and Handing,” U.S. Nuclear Regulatory Commission.

2. 10 CFR 50.68, “Criticality Accident Requirements,” U.S. Nuclear Regulatory Commission, November 1998.

3. DSS-ISG-2010-01, “Staff Guidance Regarding the Nuclear Criticality Safety Analysis for Spent Fuel Pools,” U.S. Nuclear Regulatory Commission, October 2011.

4. NUREG/CR-6698, “Guide for Validation of Nuclear Criticality Safety Calculational Methodology,” U.S. Nuclear Regulatory Commission, January 2001.

5. ORNL/TM-2005/39, “Scale: A Comprehensive Modeling and Simulation Suite for Nuclear Safety Analysis and Design,” Version 6.1, ORNL, June 2011.

6. M. B. Chadwick et al., “ENDF/B-VII.0 Next Generation Evaluated Nuclear Data Library for Nuclear Science and Technology,” Special Issue on Evaluated Nuclear Data File ENDF/B-VII.0 Nuclear Data Sheets, 107(12), 2931-3059, December 2006.

7. NEA/NSC/DOC(95), “International Handbook of Evaluated Criticality Safety Benchmark Experiments,” OECD NEA Nuclear Science Committee, September 2008.

8. NUREG/CR-6361, “Criticality Benchmark Guide for LWR Fuel in Transportation and Storage Packages,” U.S. Nuclear Regulatory Commission, September 2008.

Table 1.8-2 (12 of 29)

Item No.	Description
COL 9.1(4)	The COL applicant is to provide plant procedures for preventing and mitigating inadvertent reactor cavity drain down events, maintenance procedures for the maintenance and inspection of refueling pool seal, and emergency response procedures for the proper measures during pool drain down events.
COL 9.1(5)	The COL applicant is to provide plant operating procedure guidelines for preoperational load testing and checkouts of interlocks, blocks, hoisting cables, control circuity and lubrication of fuel handling equipment.
COL 9.2(1)	The COL applicant is to develop procedures for system filling, venting, and operational procedures to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 in the ESWS.
COL 9.2(2)	The COL applicant is to develop layout of the site-specific portion of the system to minimize the potential for water hammer in the ESWS.
COL 9.2(3)	The COL applicant is to (1) to determine required pump design head, using pressure drop from the certified design portion of the plant and adding site-specific head requirements, (2) determine pump shutoff head to establish system design pressure, which is not to exceed APR1400 system design pressure, and (3) evaluate potential for vortex formation at the pump suction based on the most limiting applicable conditions in the ESWS.
COL 9.2(4)	The COL applicant is to determine the design details of the backwashing line, vent line, and their discharge locations in the ESWS.
COL 9.2(5)	The COL applicant is to provide the evaluation of the ESW pump at the high and low water levels of the UHS. In the event of approaching low UHS water level, the COL applicant is to develop a recovery procedure.
COL 9.2(6)	The COL applicant is to provide measures to prevent long-term corrosion and organic fouling that may degrade system performance in the ESWS.
COL 9.2(7)	The COL applicant is to evaluate the need and design and install freeze protection in the ESWS if required.
COL 9.2(8)	The COL applicant is to conduct periodic inspection, monitoring, maintenance, performance, and functional testing of the ESWS and UHS piping and components, including the heat transfer capability of the CCW heat exchangers based on GL 89-13 and GL 89-13 Supplement 1.

COL 9.1(9) The COL applicant is to prepare a periodic inspection program of spent fuel rack integrity to ensure that the design basis material and geometric assumptions remain valid during the operating life of the plant.