

## KHNPDCDRAIsPEm Resource

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**Sent:** Wednesday, July 15, 2015 3:23 PM  
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**Subject:** APR1400 Design Certification Application RAI 79-7990 (09.01.02 - New and Spent Fuel Storage)  
**Attachments:** APR1400 DC RAI 79 SPSB 7990.pdf; image001.jpg

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, 60 days to respond to the RAI question. We may adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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**Hearing Identifier:** KHNP\_APR1400\_DCD\_RAI\_Public  
**Email Number:** 88

**Mail Envelope Properties** (541bdd86a08d4d458180567d0e3fa8e6)

**Subject:** APR1400 Design Certification Application RAI 79-7990 (09.01.02 - New and Spent Fuel Storage)  
**Sent Date:** 7/15/2015 3:23:10 PM  
**Received Date:** 7/15/2015 3:23:11 PM  
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Files	Size	Date & Time
MESSAGE	638	7/15/2015 3:23:11 PM
APR1400 DC RAI 79 SPSB 7990.pdf		101292
image001.jpg	5040	

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**Priority:** Standard  
**Return Notification:** No  
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**Sensitivity:** Normal  
**Expiration Date:**  
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# REQUEST FOR ADDITIONAL INFORMATION 79-7990

Issue Date: 07/15/2015

Application Title: APR1400 Design Certification Review – 52-046

Operating Company: Korea Hydro & Nuclear Power Co. Ltd.

Docket No. 52-046

Review Section: 09.01.02 - New and Spent Fuel Storage

Application Section:

## QUESTIONS

09.01.02-1

RAI 9.1.2-1

GDC 2 requires that nuclear power plant SSCs important to safety be designed to withstand the effects of natural phenomena. The design of these SSCs also must reflect appropriate combinations of the effects of accidents and natural phenomena. NUREG-0800, SRP Section 9.1.2.III.2.C states that nonsafety-related SSCs not designed to seismic Category I standards located in the vicinity of the new and spent fuel storage facilities are reviewed for whether their failure would cause an increase in  $K_{eff}$  to more than the maximum allowable.

The staff determined that the applicant's DCD Tier 2, Section 9.1.2, does not discuss this design criterion for the new fuel storage pit (NFSP) or the spent fuel pool (SFP).

The applicant is requested to include in the DCD a discussion on how the APR1400 design prevents the failure of nearby non-seismic category I components from increasing the  $K_{eff}$  in the NFSP and the SFP.

09.01.02-2

RAI 9.1.2-2

GDC 61 requires that new and spent fuel storage facilities provide assurance of adequate cooling of stored fuel, appropriate confinement of radioactive materials, and adequate radiation shielding for personnel.

NUREG-0800, SRP 9.1.2.III.2.B states that the new and spent fuel storage racks are designed so that a fuel assembly can be inserted only in specified locations. The pool design also should prevent placement of fuel assemblies in the adjacent regions external to the racks.

The applicant's description of the new storage racks and the spent fuel racks in DCD Tier 2, Section 9.1.2, does not discuss these features (such as interlocks, spacing, sizing, and associated operating procedures) that deny a fuel assembly from being placed outside a storage rack.

The applicant is requested to discuss in the DCD the design features that prevent the storage of fuel assemblies outside of the designated storage racks.

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### 09.01.02-3

#### RAI 9.1.2-3

GDC 63, as applicable for the dry storage of new fuel, requires either criticality accident monitors pursuant to 10 CFR 70.24 or an acceptable method of preventing an increase in  $K_{\text{eff}}$  beyond safe limits pursuant to 10 CFR 50.68. NUREG 0800, SRP Section 9.1.2 states that flood prevention in the new fuel storage pit (NFSP) is required to prevent submerging the new fuel in an unintentional moderator which may lead to an unintentional criticality.

NUREG-0800, SRP Section 9.1.2.III.2.L states that the drain system should be sized to handle the maximum flow from the rupture of the largest water pipe in the area.

In DCD Tier 2, Section 9.1.2, the applicant states that a drainage system is provided to prevent accumulation of water or other moderating media in the NFSP; however, the applicant's description of the drain system does not address the sizing criteria for the system or the seismic design of the piping.

The applicant is requested to include in the DCD the design description that demonstrate that the NFSP drain system is capable of handling the maximum flow from the rupture of the largest water pipe in the area, and therefore preventing conditions that may lead to an unintentional criticality.

### 09.01.02-4

#### RAI 9.1.2-4: ITAAC

NUREG-0800, SRP Section 14.3 states that the type of information and the level of detail in Tier 1 are based on a graded approach commensurate with the safety significance of the structures, systems, and components (SSCs) for the design. The top-level information selected should include the principal performance characteristics and safety functions of the SSCs and should be verified appropriately by ITAAC. Design-specific and unique features of the facility should be considered carefully for inclusion in Tier 1.

The staff reviewed DCD Tier 1, Section 2.7.4.1, "New Fuel Storage," which contains the specific ITAACs for the NFSP. Table 2.7.4.1-1, "New Fuel Storage ITAAC," specifies the inspections, tests, analyses, and associated acceptance criteria for the new fuel storage racks. The staff evaluated the proposed ITAAC and identified that the system design description does not include discussion of the flood prevention features (drain sizing and back-flow prevention), and Table 2.7.4.1-1 does not verify the proper installation of the back flow prevention features. The staff also identified that DCD Tier 2 Section 9.1.2.2.1 identified that the minimum edge-to-edge spacing between fuel assemblies in adjacent rows is maintained to keep the fuel assemblies in a subcritical configuration. However, in DCD Tier 1 Section 2.7.4.1 the system design description does not discuss the minimum separation requirement and Table 2.7.4.1-1 does not include a test to verify this on the final installed new fuel racks. DCD Tier 2 Section 9.1.2 also describes the racks as seismic category I components, bolted to the pit floor to prevent tipping; this description is also missing from DCD Tier 1, as well as the test to confirm this.

The applicant is requested to update DCD Tier 1 Section 2.7.4.1 and DCD Tier 1 Table 2.7.4.1-1 to include:

- a. a discussion on the flood prevention features and an ITAAC to confirm the proper installation of back-flow protection check valve,
- b. the minimum edge-to-edge spacing between fuel assemblies in adjacent rows and an ITAAC to confirm installed racks have sufficient spacing to prevent criticality,
- c. a discussion on the seismic design of the storage racks and an ITAAC to confirm installed racks are adequately design
- d. a discussion on the anti-tipping feature of the racks (bolted to the floor) and an ITAAC to confirm installed racks are adequately installed.

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### 09.01.02-5

#### RAI 9.1.2-5

GDC 61 requires that the fuel storage system be designed for adequate safety under anticipated operating and accident conditions. The fuel storage system must be designed with (1) the capability for appropriate periodic inspection and testing of components important to safety, (2) suitable shielding for radiation protection, (3) appropriate containment, confinement, and filtering capability, (4) residual heat removal that reflects the safety importance of decay heat and other residual heat removal, and (5) the capability to prevent a significant reduction in fuel storage coolant inventory under accident conditions.

DCD Tier 2, Section 9.1.2.2.2 indicates that the SFP is separated from the adjacent fuel-handling areas by a single swing gate, designed to allow the draining of the fuel transfer canal and the cask loading pit (CLP) without impacting SFP water level. Since the APR1400 design only has one gate in each location (unlike previous designs that relied on double gates) it is unclear to the staff how the applicant prevents a single operator error from opening the gates while the adjacent fuel-handling areas are drained, particularly when the fuel transfer equipment is undergoing maintenance.

The applicant is requested to discuss how the SFP design prevents and or mitigates the consequences of accidental opening of a gate.

### 09.01.02-6

#### RAI 9.1.2-6

GDC 61 requires that the fuel storage system be designed for adequate safety under anticipated operating and accident conditions. The fuel storage system must be designed with (1) the capability for appropriate periodic inspection and testing of components important to safety, (2) suitable shielding for radiation protection, (3) appropriate containment, confinement, and filtering capability, (4) residual heat removal that reflects the safety importance of decay heat and other residual heat removal, and (5) the capability to prevent a significant reduction in fuel storage coolant inventory under accident conditions.

NUREG-0800, SRP 9.1.2.III.2.I states that the thermal-hydraulic analysis of the flow through the spent fuel racks must be adequate for decay heat removal from the spent fuel assemblies during all anticipated operating and accident conditions. Furthermore, the analysis should show adequate natural circulation of the coolant during all anticipated operating conditions, including full core-offloads during refueling, to prevent nucleate boiling for all fuel assemblies.

DCD Tier 2, Section 9.1.2.3.2 states that the thermal-hydraulic analysis demonstrates that the flow through the spent fuel rack is adequate for decay heat removal from the spent fuel assemblies during anticipated operating conditions. However, the applicant has not provided this report for evaluation.

The applicant is requested to provide the report for staff evaluation.

### 09.01.02-7

#### RAI 9.1.2-7: ITAAC

## REQUEST FOR ADDITIONAL INFORMATION 79-7990

NUREG-0800, SRP Section 14.3 states that the type of information and the level of detail in Tier 1 are based on a graded approach commensurate with the safety significance of the structures, systems, and components (SSCs) for the design. The top-level information selected should include the principal performance characteristics and safety functions of the SSCs and should be verified appropriately by ITAAC. Design-specific and unique features of the facility should be considered carefully for inclusion in Tier 1.

The staff reviewed DCD Tier 1 Section 2.7.4.2, "Spent Fuel Storage," which contains the specific ITAACs for the NFSP. Table 2.7.4.2-1, "Spent Fuel Storage ITAAC," specifies the inspections, tests, analyses, and associated acceptance criteria for the new fuel storage racks. The staff evaluated the proposed ITAAC and identified that the system design description does not contain sufficient relevant design information discussed in DCD Tier 2 Section 9.1.2.

The applicant is requested to update DCD Tier 1 Section 2.7.4.2 in order to include:

- a. a discussion on the elevation of the bottom of the gates, weirs and doors and how they relate to the top of the stored fuel, (no opening below the top of the stored fuel)
- b. discussion on pool dimensions (minimum depth and volume)
- c. a discussion on the pool liner seismic design
- d. a discussion on the design criteria for all the SFP gates (leak tightness and seismic design)

The applicant is also requested to update FSAR Tier 1 Table 2.7.4.2-1 in order to include ITAAC to:

- e. confirm there are no opening, gate, drain, or connection below the top of the stored fuel
- f. confirm as-built pool dimensions
- g. confirm proper installation of siphon breakers
- h. confirm SFP liner was properly installed as Seismic Category I and leak tight
- i. confirm SFP gates were properly installed as Seismic Category I, leak tight, and capable of holding water pressure

