KHNPDCDRAIsPEm Resource

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Sent: Tuesday, August 04, 2015 11:47 AM
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Cc: Ciocco, Jeff; Lee, Samuel; Curran, Gordon; Dias, Antonio; Wunder, George
Subject: APR1400 Design Certification Application RAI 124-8071 (9.1.5 Overhead Heavy Load Handling Systems)
Attachments: image001.jpg; APR1400 DC RAI 124 SPSB 8071.pdf

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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REQUEST FOR ADDITIONAL INFORMATION 124-8071

Issue Date: 08/04/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 09.01.05 - Overhead Heavy Load Handling Systems
Application Section: 9.1.5

QUESTIONS

09.01.05-1

Standard review plan (SRP) 9.1.5 of NUREG-0800 specifies that acceptance for meeting the relevant aspects of GDC 1 is based in part on NUREG-0554 for overhead handling systems and ANSI N14.6 or ASME B30.9 for lifting devices. The guidance provided in SRP Section 9.1.5.III.4.C.ii specifies that lifting devices for use with single-failure-proof handling system should satisfy the criteria of ANSI N14.6. In addition, the review criteria in paragraph III.3 of SRP Section 9.1.5 states that the guidelines apply to heavy load handling in all areas of the facility housing safety-related structures, systems, and components. Item III.3.E also states that "[s]pecial lifting devices should satisfy the criteria of ANSI N14.6 or, if special lifting devices are not used, slings should be selected to satisfy the criteria of ASME B30.9."

Guidelines in SRP Section 9.1.5.III.4.C.ii specifies that special lifting device and slings used in single failure proof handling systems have either dual, independent load paths or a single load path with twice the design safety factor specified. In addition, slings for use with single-failure-proof handling systems should be constructed of metallic material (chain or wire rope).

The APR1400 DCD commits to use of lifting devices that conform to ASME B30.9 for the single failure proof polar crane and ANSI N14.6 for the Integrated Head Assembly lifting device.

The staff cannot determine whether additional lifting devices are utilized for heavy load handling in critical or safety-related areas of the plant and what codes are applied to their design. For example, the reactor internals lift rig is a structure used to remove either the upper guide structure assembly or the core support barrel assembly from the reactor vessel, but the DCD does not specify what ASME or ANSI codes apply.

The applicant is requested to specify all use of special lifting devices in all critical areas of the facility housing safety-related structures, systems, and components and verify they are designed to the appropriate ANSI and ASME code. In addition, the applicant is requested to verify use of metallic material (chain or wire rope).

09.01.05-2

GDC 4 applies to heavy load handling for protection against the effects of internally-generated missiles (i.e., dropped loads). A dropped heavy load in a critical area could cause a release of radioactive materials, a criticality accident, or inability to cool fuel within the reactor vessel or spent fuel pool or could prevent safe shutdown of the reactor. To accomplish this, SRP 9.1.5 and NUREG-0612 requests the applicant to describe a method for satisfying one of the following criteria: A) Mechanical stops or electrical interlocks to prevent movement of heavy loads over irradiated fuel or in the proximity of equipment essential for safe shutdown (i.e., a

single load drop should not disable redundant trains of a system necessary for safe shutdown), B) The effects of drops of heavy loads should be analyzed and shown to satisfy the evaluation criteria of Section 5.1 of NUREG-0612 or, C) The likelihood of failure is extremely low due to a single failure-proof handling system.

When using interlocks to restrict movement of hoist over spent fuel, NUREG-0612 (Section 5.1.2) provides guidance on specific aspects for the applicant to address. These include:

(a) Mechanical stops or electrical interlocks should be provided that prevent movement of the overhead crane load block over or within 15 feet horizontal (4.5 meters) of the spent fuel pool. These mechanical stops or electrical interlocks should not be bypassed when the pool contains "hot" spent fuel, and should not be bypassed without approval from the shift supervisor (or other designated plant management personnel). The mechanical stops and electrical interlocks should be verified to be in place and operational prior to placing "hot" spent fuel in the pool.

(b) The mechanical stops or electrical interlocks mentioned in NUREG-0612, Section 5.1.2(2)(a), should also not be bypassed unless an analysis has demonstrated that damage due to postulated load drops would not result in criticality or cause leakage that could uncover the fuel.

(c) To preclude rolling if dropped, the cask should not be carried at a height higher than necessary and in no case more than six (6) inches (15 cm) above the operating floor level of the refueling building or other components and structures along the path of travel.

(d) Mechanical stops or electrical interlocks should be provided to preclude crane travel from areas where a postulated load drop could damage equipment from redundant or alternate safe shutdown paths.

(e) Analyses should conform to the guidelines of NUREG-0612, Appendix A.

As indicated in DCD Tier 1, Section 2.7.4.5.1, the fuel handling area overhead crane contains 2 hoists with interlocks to prohibit movement over specific areas. The fuel handling hoist is interlocked to prevent moving new fuel over the spent fuel storage racks. The cask handling hoist is interlocked and equipped with mechanical stops to prevent moving a cask over the spent fuel storage racks and the new fuel storage racks. Therefore, the APR1400 includes mechanical stops or electrical interlocks for the Fuel Handling Area Overhead Crane to prevent movement of heavy loads over irradiated fuel.

The DCD also indicates that a shipping cask is prevented from traveling over the new fuel storage racks and the spent fuel storage racks by mechanical stops and electrical interlocks and the defined load path prevents the shipping cask from traveling within 4 m (13 ft) of the edge of the SFP, which is 2 feet closer than the recommended value in NUREG-0612.

The staff finds that the DCD does not address the potential for bypass of interlocks and how they are controlled.

The applicant is requested to address the following issues for the non-single failure proof fuel handling area overhead crane:

1) Justify not meeting the NUREG-0612 allowable travel to edge of SFP and define any restriction on the lift height for handling cask

2) Verify whether interlocks can be bypassed and explain any controls in-place to prevent bypass for the cask handling hoist and fuel handling hoist

3) Describe any lift height restrictions when moving heavy loads (i.e., cask)

4) Describe features provided to preclude crane travel in areas where a postulated load drop could damage safety related equipment

09.01.05-3

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.
DCD Tier 2, Section 9.1.5.2.1 states "[a]ll loads that are handled over the new fuel storage racks, spent fuel storage racks, SFP, and fuel transfer system fuel carrier are limited in weight and lift height so that, if they fall, the resultant impact will not exceed the design impact energy of the fuel storage racks and SFP."

The staff finds it not clear what loads this statement is referring to, since the fuel handling area overhead crane has travel restrictions to avoid carrying loads over these components. The staff is also unable to locate any load drop analysis to verify the resultant impact will not exceed the design impact energy, as indicated in this statement.

DCD Tier 2, Section 9.1.5.3 states "[t]he effects of a heavy load drop are analyzed. The results provide reasonable assurance that it does not damage stored fuel and preclude the operation of equipment required to achieve safe shutdown." As noted above, Section 9.1.5.2.1 indicates the design of the fuel handling area overhead crane limits the impact energy of postulated dropped loads on the new fuel storage racks, spent fuel storage racks, fuel transfer system fuel carrier, and SFP.

The staff finds it not clear what analyses have been performed and referred to in DCD, Tier 2 Sections 9.1.5.2.1 and 9.1.3.

The applicant is requested to:

1. Specify what loads will be handled over the safe shutdown equipment, new fuel storage racks, spent fuel storage racks, spent fuel pool, and fuel transfer system fuel carrier by the fuel handling hoist and cask handling hoist of the non-single failure proof Fuel Building Area Overhead Crane

2. Provide description of analyses completed for heavy load handling system.

3. Clarify what load drop analyses were completed and which cranes were evaluated for impact energy of postulated dropped loads and what assumptions were included

09.01.05-4

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

DCD Tier 2, Section 9.1.5 classifies the main hoist of the Polar crane as single failure proof. The staff finds it not clear whether the polar crane auxiliary hoist is also single failure proof.

In addition, DCD Tier 2, Section 9.1.5.2.2.1 states that containment polar crane auxiliary hoist has 60-ton load block and Table 9.1.5-1 indicates capacity to be 81.6 metric tons.

The applicant is requested to provide classification of the containment polar crane auxiliary hoist, clarify its capacity, and describe features provided to control travel restrictions.

09.01.05-5

In accordance with SRP 9.1.5, the NRC reviews overhead heavy load handling systems (OHLHS) consisting of all components and equipment for moving all heavy loads (i.e., loads weighing more than one fuel assembly and its handling device) at the plant site for compliance with the requirements of General Design Criteria (GDCs) 1, 2, 4, and 5.

DCD Tier 1, Section 2.7.4.5.1 states, “The overhead heavy load handling system (OHLHS) is a non safety-related system that handles and moves any loads greater than a fuel assembly load.” However, DCD Tier 2 Section 9.1.5 defines a heavy load as “[h]eavy loads are loads that weigh more than the weight of one fuel assembly plus its handling device. For the APR1400, a fuel assembly weighs approximately 639 kg (1,409 lb) and its handling device weighs approximately 82 kg (181 lb). For the APR1400, a heavy load is therefore any load greater than approximately 721 kg (1,590 lb).”

The applicant is requested to verify whether the definition of heavy load includes the weight of the handling devices and update DCD accordingly.

09.01.05-6

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

DCD Tier 1, Section 2.7.4.5 specifies “[t]he fuel handling hoist of fuel handling area overhead crane is interlocked to prevent moving new fuel over the spent fuel storage racks.” The same statement can be found in DCD Tier 1, ITAAC Table 2.7.4.5, Item 7. However, DCD Tier 2,

Section 9.1.5.3 states, “[t]he fuel handling area overhead crane is restricted from moving heavy loads over the SFP by the permanent mechanical stops installed on the rails.”

The staff finds that there is a difference between “moving new fuel over spent fuel storage racks” versus “moving heavy loads over SFP”. Also inconsistent is the acceptance criteria for Item 7 in DCD Tier 1, ITAAC Table 2.7.4.5 since it incorrectly indicates that the crane can only move over the spent fuel storage racks, which is the opposite to what is expected for such crane.

The applicant is requested to revise the DCD and ITAAC to clearly define the travel restrictions applied to the fuel handling area overhead crane.

09.01.05-7

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

DCD Tier 1, Section 2.7.4.5 specifies “[t]he cask handling hoist of fuel handling area overhead crane is interlocked and equipped with mechanical stops to prevent moving a cask over the spent fuel storage racks and the new fuel storage racks.” However, DCD Tier 2, Section 9.1.5.3 states “[t]he fuel handling area overhead crane is restricted from moving heavy loads over the SFP by the permanent mechanical stops installed on the rails.”

The staff finds that there is a difference between “moving a cask over the spent fuel storage racks and the new fuel storage racks” versus “moving heavy loads over the SFP.” Also inconsistent is the design commitment for Item 8 in DCD Tier 1, ITAAC Table 2.7.4.5 since, while verifying interlocks prohibit cask travel over new fuel racks and spent fuel racks, it does not verify interlock movement restrictions over the complete spent fuel pool. Further, the staff finds that the design commitment only discusses movement of a cask over racks and does not address other heavy loads (i.e. gates, etc…) handled with the fuel handling area overhead crane.

The applicant is requested to revise the DCD and ITAAC to clearly define the travel restrictions applied to the fuel handling area overhead crane and update DCD accordingly.

09.01.05-8

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

DCD Tier 1, Section 2.7.4.5 specifies “OHLHS prevents the uncontrolled lowering of a heavy load.” Similarly, ITAAC Design Commitment for Item 5 of DCD Tier 1, Table 2.7.4.5-1 specifies “OHLHS prevents the uncontrolled lowering of a heavy load.”

The staff finds that the testing and acceptance criteria of the ITAAC are requesting NOG-1 load tests to verify lifting capacity.

The applicant is requested to justify how lift capacity testing is sufficient to assure uncontrolled lowering of a heavy load will not occur.

09.01.05-9

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

According to Section 9.1.5 of the DCD Tier 2, the design of the hoists on the fuel handling area overhead crane will conform to the requirements of ASME NOG-1, Type II crane, CMAA-70, and Section 2-1 of ASME B30.2.

DCD Tier 2, Section 9.1.5.2.1 states "[d]uring an SSE, the fuel handling area overhead crane and all its components retain control and hold all loads up to the maximum critical load for all loading conditions, and the bridge and trolley remain in place on their respective runways with their wheels prevented from leaving the tracks. The crane is not required to be functional during and after the SSE, but structural integrity is preserved."

As defined by NOG-1, a Type II crane is "a crane that is not used to handle a critical load. It shall be designed and constructed so that it will remain in place with or without a load during a seismic event; however, the crane need not support the load nor be operational during and after such an event. Single-failure-proof features are not required."

The staff finds the DCD stating that the cranes will retain control and hold its load whereas, as indicated above, NOG-1 Type II cranes are not designed to support their loads during or after an SSE.

The applicant is requested to describe any additional design features provided with this Type II crane to hold all loads up to the maximum critical load for all loading conditions during SSE. The DCD should be modified accordingly.