

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.: 199-8223
SRP Section: 03.08.01 – Concrete Containment
Application Section: 03.08.01
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Question No. 03.08.01-9

10 CFR Part 50.55a provides the regulatory examination requirements of the prestressed concrete containment. Standard Review Plan (SRP) 3.8.1, Section II.7, provides guidance for testing and examining the preservice, in-service, and repair/replacement requirements of the concrete containment. DCD Tier 2, Section 3.8.1.7, "Testing and Inservice Inspection Requirements," describes the testing and in-service requirements of the containment. The staff reviewed Section 3.8.1.7 and noted that additional information is needed in order to complete the safety review procedure of the testing and in-service inspection of the concrete containment. In accordance with 10 CFR Part 50.55a, and SRP 3.8.1, the applicant is requested to explain the following:

- a. DCD Tier 2, Section 3.8.1.7.1, "General Requirements," does not identify whether this containment is considered a prototype containment. DCD Tier 2, Section 3.8.1.7.1, "General Requirements," does not identify whether this containment is considered a prototype containment. It is believed that containment designed to ASME Subsection CC, incorporating new or unique design features not yet confirmed by tests are supposed to be designated as prototype containment. Thus, the applicant is requested to address whether this containment is designated as a prototype design and if not, explain why not. If it is a prototype containment, Section 3.8.1.7.1 of the DCD should be updated accordingly and explain that the additional provisions applicable to prototype containments in ASME Subsection CC, Article CC-6000 are implemented.
- b. DCD Tier 2, Section 3.8.1.7 does not identify and discuss the examination requirements of the containment, including the supplemental requirements of 10 CFR 50.55a. DCD Tier 2, Section 3.8.1.7 does not identify and discuss the examination requirements of the containment, including the supplemental requirements of 10 CFR 50.55a. Thus, the applicant is requested to include this information in the DCD.
- c. CD Tier 2, Section 3.8.1.7, does not identify and discuss the periodic leakage testing and examination of the containment in accordance with 10 CFR 50, Appendix J. CD Tier 2,

Section 3.8.1.7, does not identify and discuss the periodic leakage testing and examination of the containment in accordance with 10 CFR 50, Appendix J. The applicant is requested to provide this information in the DCD.

- d. From the information provided in Section 3.8.1.7.2 of the DCD, it is not clear to the staff whether all applicable positions of Regulator Guides (RG) 1.35 and 1.35.1 are performed for the inservice inspection of the tendon systems or whether there are any exceptions. From the information provided in Section 3.8.1.7.2 of the DCD, it is not clear to the staff whether all applicable positions of Regulator Guides (RG) 1.35 and 1.35.1 are performed for the inservice inspection of the tendon systems or whether there are any exceptions. The applicant is requested to provide this information in the DCD.

Response

- a. The structural configuration of the reactor containment building (RCB) of the APR1400 is identical, with the exception of wall thickness, with that of Shin-Kori Unit 3, which has been tested and verified as a prototype. Therefore, the RCB of the APR 1400 is classified as a non-prototype containment, according to ASME Section III, Div.2, Subarticle CC-6150.

The 6 inch linear increase in wall thickness may result in different stresses, strains and displacement from Shin-Kori Units 3&4. However, inherent behavioral characteristics are not changed due to the structure's shape and composition being the same as Shin-Kori Units 3 & 4.

The design parameters, such as compressive strength and elastic modulus of concrete, mix design, cut-off date of material standards, and site conditions affect stress, strain, and displacement. However, these design parameters do not affect inherent structural behaviors. Therefore, those design parameters are not the principle variables used to determine whether the APR1400 RCB is a prototype or not.

As a reference, Regulatory Guide (RG) 1.18, which was withdrawn in 1981, provided the definition of prototype RCB. At present, no regulatory document clearly defines classification criteria to be used to determine if a containment is prototype. Based on RG 1.81, Revision 1 (1972), Appendix A, the following discussion is prepared to demonstrate that the APR1400 RCB is not a prototype. Review items in RG 1.81 demonstrate that changes made in the APR1400 containment should not be considered reasons to classify the RCB as a prototype.

In addition, there is a comparison between APR1400 and Shin-Kori Units 3&4 under ultimate pressure. The static behavior and ultimate pressure capacity (UPC) of the APR1400 RCB under internal pressure is almost the same as those of Shin-Kori Units 3&4. The increased wall thickness affects the ultimate pressure capacity of the RCB, but the behavior of both NPP RCBs is almost the same, as shown in Figure 1.

Table 1 Review Results according to RG 1.18 Revision 1 (1972)

Review Items	SKN 3 Unit	APR1400 Unit	Review Result
A number of buttresses other than six	Three	Same	Non-prototype
Any buttresses in the dome	Three	Same	Non-prototype
A pattern of tendons other than vertical tendons and hoop tendons in the wall, and three groups of tendons oriented at 60 degree in the dome	240 degree	Same	Non-prototype
A prestressed dome with a shape other than ellipsoidal on top	Hemispherical	Same	Non-prototype
A base other than a conventionally reinforced flat slab	RC flat slab	Same	Non-prototype
A general containment shape different than a vertical cylinder	Cylindrical Shell	Same	Non-prototype
Individual tendons with ultimate strength greater than 500 tons	ASTM A416 Grade 270	Same	Non-prototype
An opening larger than 0.2D	Diameter of Equipment hatch & Airlock etc.	Same	Non-prototype
Two openings with a diameter greater than 0.15D separated by a distance less than 0.2D	Diameter of all penetrations	Same	Non-prototype
A connection of the cylindrical wall to the bottom slab or to the top dome by a sliding joint, a hinge, or a combination of hinge and sliding joint	All connections	Same	Non-prototype
An intermediate interior floor connected to the wall	Separation with 2 inch gap	Same	Non-prototype
Any other structural design feature that may decrease the safety margins from that of a containment confirmed by an acceptance test	UPC (Refer to Figure 1)	Margin increased	Non-prototype

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Figure 1 Radial or Vertical Displacements of RCB under Internal Pressure, Nonlinear Analysis Results for UPC Evaluation (Dot line: APR1400, Solid line: SKN34)

- b. The structural integrity test (SIT) complies with the requirements of Article CC-6000 of ASME Section III. The in-service inspection (ISI) performed in accordance with the requirements of ASME Section XI, Subsection IWL, IWE, RG 1.35.1 and 10 CFR 50.55a. [ASME Section XI, Subsection IWL and IWE are applied to DCD Subsection 3.8.1 for the concrete containment structure and Subsection 3.8.2 for MC components, respectively.](#) The examination requirements of the tests will be added to DCD Tier 2, Subsections 3.8.1.7.1.1, 3.8.1.7.2.1 and 3.8.2.7.2 as shown in the attachment associated with this response.
- c. The periodic leakage rate testing of containment is described in DCD Tier 2, Subsection 6.2.6. A brief description will be added to DCD Tier 2, Subsection 3.8.1.7.2.1 and 3.8.2.7.2 as shown in the attachment associated with this response.
- d. The in-service inspection (ISI) is performed in accordance with [ASME Section XI, Subsection IWL, 2007 Edition with 2008 Addenda, RG 1.35.1 and 10 CFR 50.55a](#) with no exceptions. [Although RG 1.35 was withdrawn as of August 2015, it remains valid for the APR1400 DC according to the code cutoff date \(July 2014\) of the APR1400 DC. However, RG 1.35 is not needed for the design of the APR1400 DC since the requirements of RG 1.35 have been incorporated into ASME IWL. Thus, RG 1.35 will be deleted from the APR1400 DCD.](#)

Impact on DCD

DCD Tier 2, Subsections [3.8.1.2.2](#), [3.8.1.7.1](#), [3.8.1.7.1.1](#), [3.8.1.7.2.1](#), [3.8.1.7.2.3](#), [3.8.2.7.2](#), [3.8.7](#), and [Table 1.9-1](#) will be revised as indicated in the attachment associated with this response.

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.

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