

## **KHNPDCDRAIsPEm Resource**

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**Sent:** Friday, March 11, 2016 5:32 PM  
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**Subject:** APR1400 Design Certification Application RAI 440-8551 [19 - Probabilistic Risk Assessment and Severe Accident Evaluation]  
**Attachments:** APR1400 DC RAI 440 SPRA 8551.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.

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

Thank you,

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## REQUEST FOR ADDITIONAL INFORMATION 440-8551

Issue Date: 03/11/2016

Application Title: APR1400 Design Certification Review – 52-046

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

Docket No. 52-046

Review Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation

Application Section: 19

### QUESTIONS

#### 19-95

The staff reviewed the applicant's response to RAI 7864, Question 19-5. In this RAI, staff requested KHNP to justify reliable operator action for hatch closure in the Shutdown Evaluation Report, given the presence of (1) steam, (2) high humidity, (3) low visibility due to fog, and (4) high temperatures. The staff also requested KHNP to clarify in Chapter 19 of the DCD whether the 160 degree Fahrenheit (160F) upper limit was used, when the hatch is permitted to be opened, to develop the likelihood of the operator failing to re-close the equipment hatch, with vessel level above reduced inventory conditions.

In the RAI response, KHNP responded that the 160 degree temperature limit comes from NUREG 1449. However, Section 6.9.4.2 of NUREG-1449, "Radiological Considerations," states, "Boiling of coolant within an opened reactor system following a postulated loss of shutdown cooling would release dissolved fission products within the containment atmosphere." In NUREG-1449, PWR equivalent doses are depicted in Figures 6.2 and 6.3. These calculations indicate that self-contained breathing apparatus would be required for an extended stay within the containment because of the dose and humidity, since the filtration type would not function adequately in high humidity above about 106F (41C). NUREG-1449 also states, "It may be difficult to perform containment closure operations in self-contained breathing apparatus because the air supply will limit how long personnel can stay on the job. In evaluating recovery actions following a potential loss of shutdown cooling, licensees should avoid plant conditions in which steaming could occur before the containment was closed, unless reduced coolant activities or limited requirements for personnel entry indicated that the associated risk was acceptable."

The staff also reviewed NUMARC 91-06, Guidelines for Industry Actions to Assess Shutdown Management, dated December 1991. Section 4.1.1, Loss of Decay Heat Removal, Guideline 3, states, "Containment hatches (equipment and personnel) and other penetrations that communicate with the containment atmosphere (primary or secondary, as appropriate) should either be closed or capable of being closed prior to core boiling following a loss of DHR and should be addressed in procedures."

KHNP also responded that the low power and shut down (LPSD) Level 2 PRA assumed that the containment equipment hatch is closed during reduced inventory conditions as well as above reduced inventory conditions when reactor coolant system (RCS) is not intact for RCS fillup and drainout operation at mode 5. This assumption is based on procedure guidance of Shutdown Evaluation Report Table 2.1-1 "Administratively require containment integrity to remain intact during fillup and drainout in mode 5."

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Based on this response, the staff reviewed the Basis for Technical Specification (TS), 3.6.7, which requires containment closure during reduced inventory operations. The KHNP TS states that Reduced RCS Inventory is defined as the plant condition when the RCS level is below the 38.72 m (127 ft 1/4 in) elevation and fuel is in the reactor vessel. The 38.72 m (127 ft 1/4 in) elevation corresponds to 91.44 cm (3 ft) below the reactor vessel flange.

Based on staff review of: (1) KHNP's response to RAI 19-5, (2) NUREG-1449, (3) KHNP TS 3.6.7, and (4) KHNP's proposed DCD Table 19.1-93, the staff has the following questions:

1. The applicant's proposed combined license (COL) action item for the development of containment closure procedures that will be in effect until containment temperatures reach 160F appear to be inconsistent with NUREG-1449 and NUMARC 91-06. The staff is requesting KHNP to revise this COL action item to be consistent with NUMARC 91-06 or explain the basis for not revising the item.
2. Based on the TS definition of reduced inventory, Plant Operational State (POS) 6, which is defined as having RCS vessel level at the vessel flange, may have the containment hatch open. According to TS, POS 4B and POS 10 may also have the containment hatch open. However, DCD Section 19.1.6.2.1.1, states that a single Containment Event Tree (CET) model is developed for evaluation of POS 4B, 5, 6, 10, 11, and 12A. DCD Section 19.1.6.2.1.1 also states, for each of these POSs, "the containment is closed per Technical Specifications and the pressurizer manway open, the accident progressions considered are similar and can be assessed with a single CET." The staff is requesting KHNP to resolve the technical inconsistency between Technical Specifications and DCD section 19.1.6.2.1.1.