KHNPDCDRAIsPEm Resource

From:	Ciocco, Jeff
Sent:	Tuesday, February 02, 2016 12:53 PM
To:	apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; James Ross
Cc:	Pohida, Marie; Mrowca, Lynn; Steckel, James; Lee, Samuel
Subject:	APR1400 Design Certification Application RAI 393-8432 (19.03 Beyond Design Basis External Event (APR1400))
Attachments:	APR1400 DC RAI 393 SPRA 8432.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 questions. 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 393-8432

Issue Date: 02/02/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 19.03 Beyond Design Basis External Event (APR1400)
Application Section: 19.3

QUESTIONS

19.03 Beyond Design Basis External Event (APR1400)-13

NRC Commission paper SECY-12-0025 stated that the NRC staff expected new reactor design certification applications to address the Commission-approved Fukushima actions in their applications to the fullest extent practicable. In performing its review of the APR1400 design certification application, the NRC staff followed the guidance for satisfying the Commission directives regarding beyond-design-basis external events (BDBEE) mitigation strategies in Japan Lesson-Learned Project Directorate JLD-ISG-2012-01, Revision 0, which endorsed with clarifications the methodologies described in NEI 12–06, Revision 0. The guidance in JLD-ISG-2012-01 describes one acceptable approach for satisfying the Commission directives regarding BDBEE mitigation strategies (i.e., Order EA-12-049). In NEI 12-06, Revision 0, Table 3-2, "PWR FLEX Baseline Capability Summary, for Core Cooling," one of the Safety Functions for Core Cooling is identified as "RCS Inventory Control and Core Heat Removal (shutdown modes with steam generators not available)." Also in Table 3-2, the referenced Method states, "All Plants Provide Means to Provide Borated RCS Makeup." And the referenced Baseline Capability in Table 3-2 states "Diverse makeup connections to RCS for long-term RCS makeup and shutdown mode heat removal." Based on the KHNP Fukushima, Technical Report, the staff requests the following:

1. The KHNP Fukushima Technical Report, Section 5.1.2.3.2.2, "FLEX Strategy for Mode 4 and Mode 5 with SGs Available," states that the strategy includes RCS heat up and pressurization to hot standby conditions so that the full power core cooling strategy can be employed. Specifically, after the RCS temperature increases to the low temperature overpressure protection (LTOP) disable temperature (136.11 °C [277 °F]), the operator must manually isolate the RCS from the shutdown cooling system (SCS) by manually closing the SCS isolation valves. The operator must complete this action before the RCS temperature exceeds the SCS entry temperature 176.67 °C (350 °F). After that, a postulated RCS over pressurization can be protected by pilot-operated safety relief valves (POSRVs). The staff also understands that LTOP valves may be challenged during this core cooling strategy. To ensure that this core cooling strategy is feasible, the staff requests the following:

   a. This core cooling strategy for Modes 4 and 5 with the steam generators available needs to be documented in Section 19.3 of the DCD.

   b. The presence of alarms to indicate that the LTOP disable temperature has been exceeded needs to be documented in

Section 19.3 of the DCD. The power for these alarms needs to be documented in Section 19.3 of the DCD.

c. The time required for the operators to manually close the SCS isolation valves, the number of operators necessary to perform the task, and any necessary equipment to perform the task needs to be documented in Section 19.3 of the DCD.

d. Given that the LTOP relief valves may be challenged during this scenario, the staff is requesting the applicant to update Section 19.3 of the DCD to evaluate the plant impact if the LTOP valves, which are spring operated, stick open.

2. The KHNP Fukushima Technical Report, Section 5.1.2.3, "FLEX Strategy for Shutdown Operation with SGs Not Available," indicates in phase 1 that the safety injection tanks (SITs) are used as a water source for gravity feed to the RCS. To ensure that this core cooling strategy is feasible, the staff requests the following:

a. Please document in Section 19.3 of the DCD how the safety injection tanks (SITs) can keep the core covered assuming the RCS is vented via the pressurizer given possible pressurizer surge line flooding. Surge line flooding following an extended loss of decay heat removal (DHR) may negate the elevation head necessary for SIT flow. Based on the shutdown evaluation report, the staff understands "With the earliest nozzle dam installation occurring at 4 days after shutdown, the decay heat present would require approximately 481 L/min (127 gpm)".

b. The number of operators and the time required for the operators to manually open the SIT isolation valves needs to be documented in Section 19.3 of the DCD.

c. Any support systems or equipment necessary to manually open the SIT isolation valves needs to be documented in Section 19.3 of the DCD.

d. Please document what alarms and instrumentation will be used to verify core coverage in Section 19.3 of the DCD. In this discussion, please document the impact of boiling through the pressurizer manway on the accuracy of the RCS level indication, including the midloop ultrasonic indication.

3. The KHNP Fukushima Technical Report, Section 5.1.2.3, "FLEX Strategy for Shutdown Operation with SGs Not Available," indicates in phase 2 that the plant is expected to be maintained at cold shutdown by RCS feed-and-bleed operation using the FLEX pump. Decay heat is removed by boil off from the core, while the steam generated from the core is released through the pressurizer manway. In this feed-and-bleed operation, the RCS is expected to be maintained at the initial boron concentration because the rate of unborated water injection is expected to be balanced with the rate of steam discharge. The rate of injection flow is expected to be controlled to maintain the RCS water level between the

core top and the hot leg center line. To ensure that this core cooling strategy is feasible, the staff requests the following:

a. Please confirm whether any additional alarms and instrumentation will be used to maintain RCS level between the top of the core and the hot leg centerline beyond what is being credited in phase 1 in Section 19.3 of the DCD. In this discussion please document the impact of boiling through the pressurizer manway on the accuracy of the additional instrumentation and alarms. .

b. Please document in Section 19.3 of the DCD the plant impact if the operators raise RCS level above midloop conditions.

c. In Table 3-2, “PWR FLEX Baseline Capability Summary, for Core Cooling,” the Method states, “All Plants Provide Means to Provide Borated RCS Makeup.” Please justify in Section 19.3 of the DCD why this approach of injecting unborated water is acceptable.


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