

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, November 14, 2016 3:05 PM
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Cc: Talbot, Frank; Kavanagh, Kerri; Kendzia, Thomas; Ward, William; Roy, Tarun; McCoppin, Michael
Subject: APR1400 Design Certification Application RAI 528-8709 (14.02 - Initial Plant Test Program - Design Certification and New License Applicants)
Attachments: APR1400 DC RAI 528 QVIB 8709.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, 45 days to respond to this RAI. 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 528-8709

Issue Date: 11/14/2016

Application Title: APR1400 Design Certification Review – 52-046

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

Docket No. 52-046

Review Section: 14.02 - Initial Plant Test Program - Design Certification and New License Applicants

Application Section: DCD Section 14.2

QUESTIONS

14.02-70

General Design Criterion (GDC) 19 in Appendix A to 10 CFR Part 50 states that, "A control room shall be provided from which actions can be taken to operate the nuclear power unit under normal conditions..." Normal operating conditions include the shutting down of a reactor; therefore, since the residual heat removal (RHR) system is one of several systems involved in the normal shutdown of all reactors, this system must be operable from the control room.

The guidance for the review of the design requirements for the RHR system are provided in NUREG-0800, Branch Technical Position (BTP) 5-4. NUREG-0800, BTP 5-4, "Design Requirements of the Residual Heat Removal System," Section 5, "Test Requirements" for boron mixing states:

"The preoperational and initial startup test program shall be in conformance with Regulatory Guide 1.68. The programs for PWRs shall include tests with supporting analysis to (1) confirm that adequate mixing of borated water added before or during cooldown can be achieved under natural circulation conditions and permit estimation of the times required to achieve such mixing, and (2) confirm that cooldown under natural circulation conditions can be achieved within the limits specified in the emergency operating procedures. Comparison with the performance of previously tested plants of similar design may be substituted for these tests."

In RG 1.68, Appendix A, Section A-4t, "Low-Power Testing" states:

"Perform natural circulation tests of the reactor coolant system to confirm that the design heat removal, boron mixing plant cool down/depressurization, and stable natural circulation conditions are maintained throughout the test or by comparison of the plant's reactor coolant system hydraulic data to a reference prototype plant of similar design and configuration (PWR)."

In DCD Table 14.2-7, the DC applicant cross referenced DCD Subsection 14.2.12.4.22 to RG 1.68, App. A, Section 4t, which identified this test has a low power test. The CE System 80+ DCD Section 14.2.12.4.23, "Natural Circulation Test," included in Step 5.2 the test acceptance criteria (in DCD Chapter 5, Appendix 5d) to confirm adequate boron mixing during natural recirculation flow. The NRC staff requests the DC applicant add similar test acceptance criteria to the APR1400 DCD Section 14.2.12.4.22 "Natural Circulation Test," to be consistent with the NRC regulatory basis and this CE System 80+ test.

Additionally, as acknowledged by KHNP in the revised response to RAI 91-7867, Question 14.02-7 (ML16182A597), the NRC staff requests that the words "(First-of-a-Kind Test)" be deleted from the title of the test listed in 14.2.12.4.22.

In the DC applicant's response to RAI 384-8100, Question 05.04.07-03 (ML16077A291), the DC applicant stated:

"The thermal stratification on RCS loop during natural circulation is not expected based on the tests referred in BNL-NUREG-41512 which says that the boron mixing in main flow

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path of the RCS would be very rapid under natural circulation condition. However, flow in RVUH [reactor vessel upper head] is stagnant and concern for the thermal stress during natural circulation is issued on Generic Issue 79. However, the NRC also issued the Generic Letter 92-02, "Resolution of Generic Issue 79, Unanalyzed Reactor Vessel (PWR) Thermal Stress during Natural Convection Cooldown," which does not require generic or plant-specific actions for safety reason. Therefore, this issue is not addressed in DCD Section 1.9.3, "Generic Issues," which presents proposed technical resolutions for USI and medium- and high-priority GSI identified in the NUREG-0933."

The NRC staff determined that the DC applicant did not adequately justify use of BNL-NUREG-41512 to not perform boron mixing. The NRC staff determined that the DC applicant should verify sufficient boron mixing to cooldown the reactor from hot standby to hot shutdown conditions when the Shutdown Cooling System (SCS) is placed in-service. The DC applicant should consider revising the natural circulation test to include other SSCs to safely complete this test and verify boron mixing and natural circulation can be used to cooldown the reactor from hot standby to hot shutdown conditions with suitable test acceptance criteria to place the SCS in-service.

