

## 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.: **534-8723**

SRP Section: **18 – Human Factors Engineering**

Application Section:

Date of RAI Issue: **01/23/2017**

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### **Question No. 18-132**

#### **Regulatory Basis**

Title 10 of the Code of Federal Regulations (10CFR) Section 52.47(a)(8) requires an applicant for a design certification to provide an FSAR which includes the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), with certain exceptions. Section 10 CFR 50.34(f)(2)(ii) requires an applicant to "Establish a program, to begin during construction and follow into operation, for integrating and expanding current efforts to improve plant procedures. The scope of the program shall include.....human factors engineering..." The current NRC guidance for developing a human factors engineering (HFE) program is NUREG-0711, Rev 3, "Human Factors Engineering Program Review Model." The applicant stated in the FSAR, Tier 2, Chapter 18 "Human Factors Engineering," that it was working in accordance with the criteria of NUREG-0711 in establishing its HFE program.

NUREG-0711, Criterion 11.4.3.4(3), says, "In selecting personnel for participating in the tests, the applicant should consider the minimum shift staffing levels, nominal levels, and maximum levels, including shift supervisors, reactor operators, shift technical advisors, etc." Additionally, NUREG-0711, Criterion 11.4.3.2 lists an objective of the integrated systems validation (ISV) is "...validating minimum shift staffing levels."

#### **Application**

APR1400-E-I-NR-14011, "Basic Human System Interface Technical Report" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15009A212), Section 3.5.1, "Crew Composition," describes the APR1400 control room staffing concept. It is possible that at times when the plant is operating, one senior reactor operator (SRO) and one reactor operator (RO) could be the only personnel in the main control room.

APR1400-E-I-NR-14010, "Human Factors Verification and Validation Scenarios" (ADAMS Accession No. ML15009A226) include the scenarios for the ISV. The staff reviewed the scenarios and found that one of the scenarios described in Section 5.1, "Small Break Loss-of-Coolant Accident with Computer-Based Procedure and Human-System Interface Display Failure, simulates one possible control room staffing level at the start of an event that is less than the nominal staffing level. However, the staff did not find that any of the scenarios had only the minimum control room staff (i.e., only one SRO in the control room and only one RO at the controls) at the start of the event. The NRC staff wants to understand how the ISV will validate the minimum control room staffing level with the existing scenarios.

### **Question**

Please justify why the existing scenarios are sufficient to validate that the minimum number of people that could be in the main control room (i.e., only one SRO in the control room and only one RO at the controls) at the start of an event is sufficient to ensure safe plant operation even though the existing scenarios do not test this staffing level.

Or, please revise the application to ensure that the ISV validates the minimum staffing level in one or more scenarios. If any scenarios are revised to validate the minimum staffing level, please also justify why the scenario or scenarios were selected to validate the minimum staffing level.

### **Response**

The APR1400 has a main control room (MCR) crew five, which represents the normal, maximum and minimum crew size. Section 4.1 of the Human Factors Engineering Program Plan lists the makeup of this crew. Section 3.5 of the Basic Human-System Interface Technical Report describes the concept of operations that is applicable to all plant modes and conditions, considering both the minimum and maximum staffing. Therefore, this five-person crew composition has been applied to the ISV scenarios, as described in Section 4.5.4 of the Human Factors Verification and Validation Implementation Plan.

However, under the direction of the Shift Supervisor (SS), the Turbine Operator, Electrical Operator and Shift Technical Advisor may leave the MCR as indicated in Section 3.5.1.3 through 3.5.1.5 of the Basic Human-System Interface Technical Report, and the crew composition can be less than minimum requirement of 10 CFR 50.54(m)(2)(i) within two hours as indicated in Section 5.2.2 of the Technical Specifications.

The crews outside the MCR must be able to return to their stations in the MCR within specific time after a plant page announcement. This time constraint is under administrative control. Section 5.1 of the Human Factors Verification and Validation Scenarios has been designed to test this special case, which represents a complex test suitable to evaluate this limited time crew configuration. When the SS initiates the emergency plan, the RO is expected to complete the post-trip actions during the absence of remaining crews. It will take the remaining crews to return to the MCR and assume their respective duties. Therefore, no revisions to the scenarios are required.

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**Impact on DCD**

There is no impact on the DCD.

**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.