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.: **553-9084**

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

Application Section:

Date of RAI Issue: **09/06/2017**

Question No. 18-137

Acceptance Criteria

NUREG-0711, Criterion 4.4(2), states, “The applicant’s FRA [function requirements analysis] and FA [function allocation] should be performed iteratively to keep it current during design development and operation up to decommissioning, so that it can be used as a design basis when modifications are considered.” Also, NUREG-0711, Criterion 5.4(8), states, “The applicant’s task analysis should be iterative, and updated as the design is better defined.”

Application

- DCD Tier 2, Rev. 1, Section 18.4.1, “Objectives and Scope,” states, “For tasks related to plant systems that are site specific, such as the switchyard and ultimate heat sink, the TA [task analysis] is based on generic assumptions that are made to establish a complete plant design that is ultimately reflected in the complete APR1400 HSI design for V&V. These generic assumptions are modified as necessary for each plant-specific application of the APR1400 during the design implementation (DI) program element.”

- APR1400-E-I-NR-14004-P, “Task Analysis Implementation Plan” (TA IP), Rev. 1, Section 2, “Scope,” contains similar statements.

- Additionally, APR1400-E-I-NR-14003-P, “Functional Requirements Analysis and Function Allocation Implementation Plan” (FRA/FA IP), Rev. 1, Section 4.3.3, “Specification of Functional Hierarchy, Success Paths, and Requirements,” contains a similar statement that generic assumptions will be used during the FRA and FA.

The criteria in NUREG-0711 explain that the task analyses and FRA/FA should be iterative and updated as the design is developed. Because the COL applicant will perform task analysis, functional requirements analysis, and function allocation, it is not clear to the staff why it would be necessary to make generic assumptions during these activities when the COL applicant will

be able to use site-specific information to develop the control room design at the site. Using generic assumptions when the site-specific information is available may result in some functions being inappropriately allocated to humans or some tasks not being identified.

Question

Either: (1) explain why it is necessary to use generic assumptions for site-specific information when the COL applicant will perform the activities in the HFE implementation plans, or

(2) revise the DCD Tier 2, Section 18.4.1; the TA IP; and the FRA/FA IP to remove statements that generic assumptions may be used in lieu of site-specific information.

Response – (Rev. 1)

The generic assumptions support the preliminary results of the FRA/FA and TA, and those results provide the basis for the HSI design. As site-specific information is known, the generic assumptions are modified as necessary. When the COL applicant performs the HFE activities, the site specific information is applied to develop the APR1400 HSI design at the site, and the preliminary results of the FRA/FA and TA are updated accordingly. The updated information leads to the complete HSI design which is verified and validated during the HF V&V program element (PE). DI PE confirms the as-built design with the application of the site-specific information. Where the site-specific information is not reflected, the DI PE conducts a regression analysis to define the necessary HFE rework.

The DCD Tier 2, Rev. 1, Section 18.4.1, the FRA/FA IP, Rev. 1, Section 4.3.3, and the TA IP, Rev. 1, Section 2 will be revised as indicated in the attachment associated with this response.

Impact on DCD

DCD Tier 2, Rev. 1 will be revised, as indicated in 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

Technical Report APR1400-E-I-NR-14003-NP, Rev. 1, “Functional Requirements Analysis and Function Allocation Implementation Plan,” and APR1400-E-I-NR-14004-NP, Rev. 1, “Task Analysis Implementation Plan,” will be revised, as indicated in Attachment associated with this response.

The tasks identified in the TA scope defined above originate from other HFE program elements or plant procedures. The tasks include tasks executed with both paper and computer-based procedures. SME judgment is therefore not required in the task selection. The following areas are evaluated by SMEs using their plant operations and simulator training experience to identify and select additional tasks that have challenged predecessor plant operating crews:

a. Surveillance, test, inspection, and maintenance, with special focus on tasks that pose potential threats to personnel safety and plant safety.

b. Operational tasks that are precursors to plant transients that are not procedure based and are not IHAs. These tasks include unusual failure modes that may not have alarm response procedures, such as spurious opening of a pressurizer spray valve and a spurious control rod withdrawal, or situations in which the operators had to revert to skill-based manual operation (e.g., low-power steam generator level control).

c. Beyond-design-basis conditions such as station blackout and severe accident

d. Tasks associated with the APR1400 fire safe shutdown analysis

In addition, SMEs use their judgment and experience to identify and select tasks they believe challenge plant operations crews based on new or unique features of the APR1400 plant design, with consideration of both workload and complexity. These tasks include tasks that are performed significantly differently from predecessor plants and tasks that use new automated support aids such as computer-based procedures.

The additional tasks selected by SMEs are those that are not already encompassed by previous HFE program elements and operating procedures.

~~For tasks related to plant systems that are site specific, such as the switchyard and ultimate heat sink, the TA is based on generic assumptions that are made to establish a complete plant design that is ultimately reflected in the complete APR1400 HSI design for V&V. These generic assumptions are modified as necessary for each plant-specific application of the APR 1400 during the design implementation (DI) program element.~~

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18.4.2 Methodology

TA includes the following methods:

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4.3.2 Identification of Power Production Functions

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4.3.3 Specification of Functional Hierarchy, Success Paths, and Requirements

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is applied

The TA is based on generic assumptions that are made to establish a plant design that is reflected in the initial APR1400 HSI design. As site specific information is known, the generic assumptions are modified. When the COL applicant performs the HFE activities, the site specific information such as the switchyard and ultimate heat sink, ~~that is applicable~~ to develop the APR1400 HSI design at the site, and the TA is updated accordingly. The updated information is ultimately reflected in the complete APR1400 HSI design for V&V. The design implementation (DI) program element confirms the as-built design with the application of the site specific information.

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