

## 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.: 298-8356  
SRP Section: 18 – Human Factors Engineering  
Application Section: 18.1  
Date of RAI Issue: 11/09/2015

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### **Question No. 18-41**

NUREG-0711 Section 2.4.4 “Tracking HFE Issues” Criterion 2, "Method," states “The applicant’s method should:

- *track issues until the potential for negative effects on human performance is reduced to an acceptable level.”*

The September 11, 2015 RAI response letter (ADAMS Accession No. ML15254A492) to RAI 54-7963, Question No 18-8 response indicates that the prioritization and justification for no actions being needed for Priority 3 HEDs are documented in the ITS. In addition, Section 4.6.1.4 “Human Engineering Discrepancies Closeout” in APR1400-E-I-NR-14001, Rev. 0, suggests that HEDs that do not “require any actions” do not “require further tracking.” This statement is inconsistent with this NUREG-0711 criterion.

It remains unclear how these Priority 3 HEDs are tracked to assure that they do not create synergistic effects that can affect safety. In other words, although a single Priority 3 HED may not have any likely safety effects, it may be possible for multiple Priority 3 HEDs to sum together to cause safety issues. The HED tracking system should be capable of tracking/trending all HEDs until it is clear that the potential negative effects are reduced to acceptable levels.

For instance, if a switch is mistakenly installed in an inappropriate position, the corresponding HED may be correctly classified as Priority 3 if erroneous operation of the switch will not cause a degradation of safety (Priority 1 HED) or have a negative effect on efficiency (Priority 2 HED). If however, if a systematic error in installation caused many similar switches to be installed in the wrong positions, there may be synergistic effects that result from the resulting confusion in operators.

Additional information is needed to explain how Priority 3 HEDs are tracked/trended to assure there are no cumulative effects caused by multiple unresolved Priority 3 HEDs.

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**Response**

Section 4.6.1.4 of Human Factors Engineering Program Plan (HFEPP) states that closed HEDs require no further action and are documented in the ITS.

Priority 3 HEDs will be tracked and trended to ensure that cumulative effects of the HEDs do not impact human performance. All priorities of HEDs are documented in the ITS, and tracked and trended until the issues are closed.

Some examples of Priority 3 HEDs generated in the reference plant are as follows:

- Provide 'signal' and 'page' function on the grip of the paging phone installed on each operator console
- Provide hand writing function to CPS to keep the advantage of paper procedures
- Correct typos in the display drawings

Regarding the example cited in the fifth paragraph of Question 18-41, if a switch has been mistakenly installed in an inappropriate position, the corresponding HED should be classified as Priority 2, since it may cause potential safety consequences to plant operability.

The cumulative effects of HEDs will be evaluated during the V&V process, as described in Section 4.5.9.1(3) of the HF V&V IP.

The definition of Priority 3 HEDs in Section 4.6.1.4 of the HFEPP and Section 4.5.9.2 of Human Factors Verification and Validation Implementation Plan will be revised, as shown in the attachment associated with this response.

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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**

Technical report APR1400-E-I-NR-14004-P/NP, Rev.0, "Task Analysis Implementation Plan," Section 4.6.1.4 and APR1400-E-I-NR-14008-P/NP, Rev.0, "HF V&V Implementation Plan," Section 4.5.9.2 will be revised, as indicated in the attachment associated with this response.

Direct safety consequences, including potential adverse effects on personnel performance. (e.g., the margin of plant safety may be reduced below an acceptable level, and must be corrected.)

2) Priority 2 HED

Not direct safety significant consequences but potential safety consequences to plant performance/operability, non-safety personnel performance/efficiency, or other factors affecting overall plant operability; corrected unless leaving the HED in an as-is condition is justified.

3) Priority 3 HED

Not Priority 1 and 2 and acceptable as-is.

The HEDs which do not affect plant safety or operability are classified as Priority 3. Priority 3 HEDs, by definition, require no action other than tracking and trending to ensure there are no negative cumulative effects on human performance.

#### 4.6.1.5 Documentation

HED resolutions that require a design changes are documented in the ITS and are summarized in the respective program element of the HFE program and in design documents/change orders.

The results of the HFE design program elements are documented in the respective ReSR, which includes summaries of the identified HEDs and their status. All Priority 1 HEDs and a summary of Priority 2 HEDs are included in the ReSR of HF V&V.

#### 4.6.1.6 Responsibility

When an HED is identified and entered into the ITS, the HEF design team leader is responsible for assigning a cognizant-engineer to assess and resolve the HED and to implement the resolution into the design. The HFE design team leader approves the official HED entry, resolution, and closeout of ITS issues.

### 4.7 Technical Program

#### 4.7.1 Design Process Elements

The development of implementation plans for the HFE design process, analyses, and evaluations for the following HFE elements is described in Figure 4-3. Each HFE program element, with the exception of the HFEPP, results in a ReSR being issued once the element has been completed according to its IP.

Evaluations and analyses using a full-scope MCR simulator, part-task simulator, mock-ups, and special tools and equipment are performed in support of the HFE program elements. Predecessor plant, predecessor design, and reference plant operations are also used, as described in the IPs, to provide inputs into the determination of the adequacy of the HSI design.

For use in the APR1400 HSI design, the prior resources, predecessor plant, predecessor design and reference plant are described in Section 8.

Testing and evaluation of HSI designs are conducted and documented throughout the HSI development process.

#### 4.7.2 Element Structure

Each IP has the same structure, which is based on the review criteria in NUREG-0711. In addition, a conformance matrix is developed to ensure that all review criteria are addressed by each IP and therefore addressed in the implementation of the IP. Appendix A of each IP contains the conformance table.

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**4.5.9.1. Human Engineering Discrepancy Analysis**

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**4.5.9.2. Selection of HEDs to Correct**

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**4.5.9.3. HED Analysis and Development of Design Solutions**

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