
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.: 250-8282
SRP Section: 18 – Human Factors Engineering
Application Section: 18.6 – Treatment of Important Human Actions (TIHAs)
Date of RAI Issue: 10/14/2015

Question No. 18-27

10CFR 52.6(a) states in part, “Information provided to the Commission by...an applicant for a standard design certification...shall be complete and accurate in all material respects.”

Section 5, “Implementation Team,” in APR1400-E-I-NR-14006-P, Treatment of Important Human Actions Implementation Plan (TIHA IP), Revision 0 lists the types of subject matter experts involved in the TIHA program element. The information in the table is not consistent with the information in the following sections of the TIHA IP:

- Identifying DIHAs:
Section 4.2, page 10 (this sections says that a safety analysis engineering SME selects DIHAs, but it does not include the plant operations SME)
- Review of DIHAs:
Section 3.3, page 5 (this section says that DIHAs are reviewed by a plant operations SME, not a safety analysis SME)
- Review of RIHAs:
Section 3.3, page 5 (this section says that RIHAs are reviewed by a plant operations SME, not an HSI/I&C SME)
 1. Ensure that these sections of the TIHA IP and Table 5.1 contain the same information about the types of SMEs who will perform the TIHA program element. Ensure that any other submitted HFE documents referencing specific positions (SME's, engineers, etc.) are internally consistent with each other.
 2. Additionally, clarify whether or not a safety analysis engineering SME, which is described in the TIHA IP, is the same as a systems safety engineer, which is

described in Section 5, "Implementation Team," of APR1400-E-I-NR-14001-P, "Human Factors Engineering Program Plan," Revision 0 (the Program Plan does not describe qualifications for a safety analysis SME).

3. Revise the documentation as necessary.

Response

The Treatment of Important Human Actions Implementation Plan (TIHA IP), APR1400-E-I-NR-14006, Rev. 0, and other submitted HFE documents will be revised, as indicated in the attachments associated with this response.

1. Types of subject matter experts (SMEs) and consistency of documentation

The activities for risk-important human action (RIHA) reviews will be revised and the independent review activities by plant operation SMEs will be added to Table 5-1 in the TIHA IP.

Throughout descriptions of the HFE program elements, members of the HFE design team are referred to as SMEs. However, engineer and expert are also used in the HFE documents to describe the composition of the HFE design team and team members' qualifications, consistent with the appendix to NUREG-0711, Rev.3. "HSI/I&C SME" will be revised to "I&C engineering SME," as indicated in Attachments 2, 4, and 5 to this response, and "HSI/I&C engineer" will be deleted in the HFEPP, as indicated in the attachments, since I&C engineers design the human-system interfaces (HSIs) in the practical design process.

2. Use of "safety analysis engineering SME"

The term "safety analysis engineering SME" in the TIHA IP will be revised to "systems safety engineering SME," as indicated in the Attachments 1 and 2 to this response, to be consistent with the HFEPP, and its description of the members of the NSSS group.

Impact on DCD

APR1400 DCD, Tier 2, Subsection 18.6.2 will be revised, as indicated in Attachment 1 to 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-14006-P/NP, Rev.0, "Treatment of Important Human Actions Implementation Plan," Subsection 3.2, 4.1, 4.2, 5, and 7 will be revised, as indicated in the Attachment 2 to this response.
- Technical report APR1400-E-I-NR-14001-P/NP, Rev.0, "Human Factors Engineering Program Plan," Section 5 will be revised, as indicated in Attachment 3 to this response.
- Technical report APR1400-E-I-NR-14007-P/NP, Rev.0, "HSI Design Implementation Plan," Subsection 3.1, 3.2, 3.3, 4.1, 4.2, and Section 5 will be revised, as indicated in Attachment 4 to this response.
- Technical report APR1400-E-I-NR-14011-P/NP, Rev.0, "Basic Human-System Interface," Section 5 will be revised, as indicated in Attachment 5 to this response.

APR1400 DCD TIER 2

18.6.2 TIHA Methodology

The TIHA identifies risk-important human actions (RIHAs) and deterministic important human actions (DIHAs) as follows:

a. RIHAs

The list of RIHAs is developed from the analysis results of Chapter 19. RIHAs are those that have a significant impact on plant risk. These actions are identified from the Level 1 and Level 2 PRAs for internal and external events of all operating modes. The RIHAs are identified using more than one importance measure and an HRA sensitivity analysis to provide reasonable assurance that an important action is not overlooked because of the selection of the measure or the use of a particular assumption in the analysis. For each RIHA, the PRA identifies assumptions regarding factors that lead to human performance error probability, including the action location, time available to take the action, and action complexity.

Since RIHAs and associated HFE characteristics are clearly identified in the PRA documentation, they are extracted from the PRA for inclusion in the TIHA results summary report (ReSR), without additional HFE judgment or evaluation.

b. DIHAs

DIHAs are identified from the D3 (Chapter 7) and transient accident analysis (TAA) (Chapter 15). Operator actions directly credited to mitigate an accident and achieve plant stabilization, as identified for any accident examined in the TAA or D3, are considered DIHAs. These manual actions are credited because automatic actions, such as reactor trip (RT) and engineered safety feature (ESF) actuation, are not triggered. Operator actions needed to maintain a stable plant condition for the long term are not DIHAs, even though they may be identified in the TAA or D3.

systems safety engineering



A plant operations or ~~safety analysis~~ subject matter experts (SME) reviews the TAA and D3 to extract the DIHAs. DIHAs are listed in the TIHA ReSR along

3.1 Risk-Important Human Actions

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3.2 Deterministically-Important Human Actions

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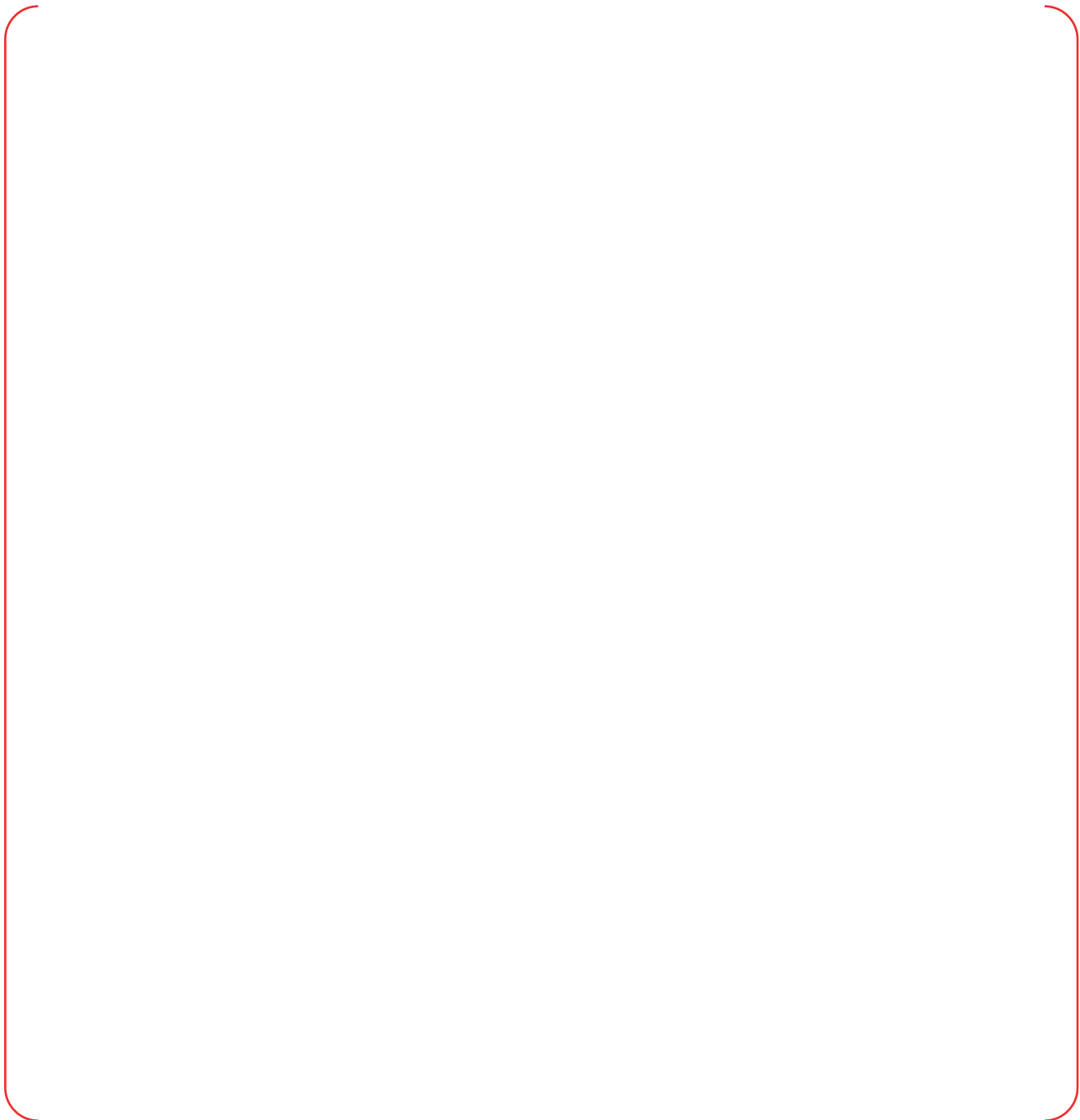
4. IMPLEMENTATION

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4.1 Risk-Important Human Actions

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Table 4-1 TIHA Output for RIHAs

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4.2 Deterministically-Important Human Actions Analyses

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Table 4-2 TIHA Output for DIHAs

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5. IMPLEMENTATION TEAM

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Table 5-1 TIHA Implementation Summary

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7. REFERENCES

1. IEEE Std. 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2002.
2. Regulatory Guide 1.97, "Criteria For Accident Monitoring Instrumentation for Nuclear Power Plants," Rev. 4, U.S. Nuclear Regulatory Commission, June 2006.
3. NUREG-0711, "Human Factors Engineering Program Review Model," Rev. 3, U.S. Nuclear Regulatory Commission, November 2012.
4. APR1400-K-X-FS-14002, "APR1400 Design Control Document Tier 2," Rev. 0, KHNP, December 2014.
5. APR1400-E-I-NR-14011-P, "Basic Human-System Interface," Rev. 0, KHNP, December 2014.

6. APR1400-E-I-NR-14001-P, "Human Factors Engineering Program Plan," Rev. 0, KHNP, December 2014.



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3.2 APR1400 HSIS

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3.2.1 Critical Safety Function Displays

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3.2.2 System Displays

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3.2.3 Task Displays

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3.2.4 Application Displays

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3.2.5 Alarms

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3.2.6 Computer-Based Procedures

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3.2.7 Performance-Based Tests

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3.2.8 Safety Console

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3.2.9 Local Control Stations

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3.3 APR1400 Facilities

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3.3.1 Central Facilities

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3.3.2 Local Control Station Facilities

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3.4 Independent Review

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3.5 HD Interfaces with Other HFE Program Elements

The HD interfaces with other HFE PEs as described in Subsections 3.5.1 through 3.5.9.

3.5.1 Operating Experience Review

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3.5.2 Functional Requirements Analysis and Function Allocation

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4.1.6.1 Functional Specifications

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4.1.6.2 Basic HSI Style Guide

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4.1.7 Basic HSI Tests and Evaluations

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4.2.2 System Displays

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4.2.4 Application Displays

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4.2.5 Alarms

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4.2.6 Computer-Based Procedures

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4.2.7 Safety Console

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4.2.8 Central Facilities

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4.2.9 Local Control Stations and Facilities

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5 IMPLEMENTATION TEAM

SMEs are used for various functions throughout the HD process. The SMEs who implement the HD PE activities for each HD output are described in Section 4 and summarized in Table 5-1.

Table 5-1 HD Implementation Summary

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