
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.: 128-7980
SRP Section: 18 – Human Factors Engineering
Application Section: 18.6 Treatment of Important Human Actions (TIHAs)
Date of RAI Issue: 08/05/2015

Question No. 18-15

Section 18.6.3, "Results," of DCD Chapter 18 states that the TIHA ReSR includes the list of IHAs and their corresponding HFE characteristics. APR1400-E-I-NR-14006-P, "Treatment of Important Human Actions Implementation Plan" (TIHA IP), Revision 0, Section 6, "Results Summary Report," discusses an ITAAC associated with completion of the TIHA ReSR; however, Table 2.9-1, "Human Factors Engineering ITAAC," in DCD Tier 1 does not include ITAAC for completion of the TIHA ReSR.

Revise the DCD, Tiers 1 and 2, and the TIHA IP, to conform with each other respect to an ITAAC in DCD Tier 1, Table 2.9-1 for the completion of the TIHA ReSR.

Response

The human factors (HF) verification and validation (V&V) determines that the final human system interface (HSI) design conforms to accepted human factors engineering (HFE) design principles including treatment of important human action (TIHA).

The HF V&V is a way to verify that the HSI is sufficient, since the results of other program elements are fed into the HF V&V.

Therefore, the only HFE program elements that would have an ITAAC are the HF V&V and the design implementation.

The TIHA implementation plan will be revised as indicated in the Attachment associated with this response.

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-14006-P/NP, Rev. 0 "Treatment of Important Human Actions," Subsection 6 will be revised as indicated in the Attachment associated with this response.

6. RESULTS SUMMARY REPORT

The results of the TIHA are documented in the ReSR, which demonstrates that the TIHA PE was conducted in accordance with this IP. ~~Demonstrating conformance to this IP, as documented through the ReSR, is a requirement of the TIHA inspections, tests, analyses, and acceptance criteria (ITAAC) closure defined in Tier 1 of the APR1400 DCD.~~

The TIHA ReSR includes the following:

- The TIHA results overview, which describes the principal findings of the HFE program element
- Name of each TIHA team member, SME position fulfilled, and the TIHA outputs generated by each team member
- The TIHA execution results, including the following details, which demonstrate conformance with Sections 3 and 4 of this IP:
 - Identified RIHAs, the source of the RIHAs in the PRA, and the HFE characteristics assumed in the PRA
 - Identified DIHAs, the source of the DIHAs in the TAA or D3CA, the HFE characteristics assumed in those analyses, and the basis for concluding any HAs identified in those analyses are not DIHAs
- A conclusion that the TIHA:
 - Has been conducted in accordance with the TIHA IP
 - Demonstrates that the IHAs identified in the TIHA output reflect all of the RIHAs from the PRA and all DIHAs from the TAA and D3CA
 - Has consolidated the IHAs with an adequate level of detail for use in other HFE PEs

The TIHA is a one-time, nonrecurring HFE PE whose closure is marked by the TIHA ReSR. The HSI to support IHAs is ultimately reflected in the APR1400 HSI design, which is tested during V&V. After completion of V&V, site-specific changes, including any required changes to the TIHA output, are managed within the DI PE, which is a recurring PE for each plant.

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Question No. 18-19

Review Criteria 7.4 (3) of NUREG-0711 states, “The applicant should specify how important HAs are addressed by the HFE program, in Function Allocation, Task Analysis, HSI Design, Procedural Development, and Training Program Development, in order to minimize the likelihood of human error and facilitate error-detection and recovery capability.” Additionally, review criteria 9.4 (4) in NUREG-0711, which is a subset of the review criteria for Section 13.5.2.1, “Operating and Emergency Operating Procedures,” in Chapter 13, “Conduct of Operations,” of NUREG-0800, states in part that the applicant’s procedures should contain important human actions.

The staff reviewed DCD Section 18.6, Treatment of Important Human Actions, which states that all IHAs are addressed in the procedure development program element. DCD Section 18.8, Procedure Development, states that IHAs are considered when procedures are developed in accordance with Section 9.4, “Review Criteria,” of Chapter 9, “Procedure Development,” of NUREG-0711.

The staff also reviewed APR1400-E-I-NR-14006-P, “Treatment of Important Human Actions Implementation Plan” (TIHA IP), Revision 0. Section 3.5.5, “Procedure Development,” of the TIHA IP states that procedure development is a COL applicant responsibility, and the second sentence is ambiguous. It is not clear that the COL applicant will know that the TIHA ReSR is an input to procedure development.

Clarify if the TIHA ReSR is an input to procedure development.

Additionally, clarify the meaning of the ambiguous second sentence of TIHA IP section 3.5.5.

Revise the submittal to reflect the RAI response.

Response

The treatment of important human actions (TIHA) results summary report (ReSR) is an input to procedure development.

DCD Section 18.8 will be revised as indicated in the Attachment 1.

Moreover, Section 3.5.5 of the TIHA implementation plan (IP) will be revised to indicate that procedure development considers IHAs in the TIHA ReSR, as indicated in the Attachment 2 associated with this response.

Impact on DCD

APR1400 DCD, Tier 2, Subsection 18.8.2 will be revised as indicated in the 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

Section 3.5.5 of the TIHA IP will be revised as indicated in the attachment associated with this response.

APR1400 DCD TIER 2

18.8 Procedure Development18.8.1 Objective and Scope

The objective of this section is to apply human factors engineering (HFE) processes and principles to develop plant procedures that are technically accurate, understandable, easy to use, and validated. The development plan and scope of procedures are described in Section 13.5.

18.8.2 Methodology

The scope and contents of the APR1400 plant operating procedures are addressed in Section 13.5.

The following HF aspects are considered during the procedures development as described in Section 9.4 of NUREG-0711 (Reference 1):

- a. Task analysis (TA) results
- b. ~~Important human actions (IHAs) treated in the human-system interface (HSI) design~~

Treatment of important human actions (TIHAs) results

18.8.3 Results

No results are required for this section.

18.8.4 Combined License Information

No COL information is required with regard to Section 18.8.

18.8.5 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," Rev. 3, U.S. Nuclear Regulatory Commission, November 2012.

		TS
3.5.5	Procedure Development	TS
3.5.6	Training Program Development	TS
3.5.7	Human Factors Verification and Validation	TS
3.5.8	Design Implementation	TS
3.5.9	Human Performance Monitoring	TS
3.6	Treatment of Important Human Actions Interface with the APR1400 Plant Design	TS

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Question No. 18-20

Review Criteria 7.4 (3) of NUREG-0711 states, “The applicant should specify how important HAs are addressed by the HFE program, in Function Allocation, Task Analysis, HSI Design, Procedural Development, and Training Program Development, in order to minimize the likelihood of human error and facilitate error-detection and recovery capability.”

The staff reviewed DCD Section 18.6, “Treatment of Important Human Actions,” which states that all IHAs are addressed in the training program development program element. Additionally, Section 4.7.3.5 in APR1400-E-I-NR-14001-P, “Human Factors Engineering Program Plan,” Revision 0 describes how IHAs are used in the training program development.

Section 3.5.6 of APR1400-E-I-NR-14006-P, “Treatment of Important Human Actions Implementation Plan” (TIHA IP), Revision 0 TIHA IP states that training program development is a COL applicant responsibility. Additionally, the first sentence in this section is ambiguous. It is not clear whether or not the COL applicant will know that the TIHA ReSR is an input to training program development.

Describe in the TIHA IP if, and how, the TIHA ReSR is an input to training program development.

Additionally, clarify the meaning of the ambiguous first sentence of TIHA IP Section 3.5.6.

Response

The treatment of important human actions (TIHA) result summary report (ReSR) is an input to training program development.

The training program, including the use of TIHA inputs, will be developed by the combined license (COL) applicant.

Section 3.5.6 of the TIHA implementation plan (IP) will be revised as indicated on the Attachment associated with this response.

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

Section 3.5.6 of the TIHA IP will be revised as indicated in the Attachment associated with this response.

		TS
3.5.5	Procedure Development	TS
		TS
3.5.6	Training Program Development	TS
		TS
3.5.7	Human Factors Verification and Validation	TS
		TS
3.5.8	Design Implementation	TS
		TS
3.5.9	Human Performance Monitoring	TS
		TS
3.6	Treatment of Important Human Actions Interface with the APR1400 Plant Design	TS
		TS

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Question No. 18-22

“Section 7.4 (2), “Review Criteria,” of NUREG-0711, states in part that the applicant should identify deterministically-important human actions from the DCD Chapter 15, “Transient and Accident Analyses.” Section 4.2, “Deterministically Important Human Actions Analyses,” (DIHA) of the “Treatment of Important Human Actions Implementation Plan” (TIHA IP) provides examples of the types of operator actions that are excluded during the DIHA selection process.

The staff reviewed DCD Chapter 15. Section 15.6.5.2.3, “Description of Post Loss-of-Coolant Accident Long-Term Cooling,” which states that the purpose of long-term cooling, including aligning the ECCS for simultaneous hot leg and direct vessel injection, is to maintain the core at safe temperature levels and to avoid the precipitation of boric acid in the core region.

Additionally, DCD Chapter 15 states, “During the long term, operator action is needed to provide reasonable assurance that the core cooling is maintained until the plant is brought to a cold shutdown condition.” This information appears to conflict with the information in the 4th bullet of Section 4.2 of the TIHA IP.

Align the statement in Section 4.2 of the TIHA IP with the information in Chapter 15, or describe why aligning the ECCS for long term cooling is not a DIHA. Revise the documentation as necessary to reflect the RAI response.”

Response

The operator actions during the post-LOCA long term phase will be treated as DIHAs because the operator actions for the emergency core cooling system (ECCS) aligning is safety functions for the plant safety.

Therefore, Section 4.2 of the TIHA implementation plan (IP) will be revised as indicated in the attachment to align with the information in DCD Chapter 15.

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

Section 4.2 of the TIHA IP will be revised as indicated in the attachment associated with this response.

