

## **KHNPDCDRAIsPEm Resource**

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**Sent:** Friday, January 22, 2016 1:17 PM  
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**Subject:** APR1400 Design Certification Application RAI 374-8481 (18 - Human Factors Engineering)  
**Attachments:** APR1400 DC RAI 374 COLB 8481.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

**18-96 : 60days**  
**18-97 : 60days**  
**18-98 : 45days**  
**18-99 : 60days**  
**18-100 : 60days**  
**18-101 : 60days**  
**18-102 : 60days**  
**18-103 : 45days**

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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# REQUEST FOR ADDITIONAL INFORMATION 374-8481

Issue Date: 01/22/2016  
Application Title: APR1400 Design Certification Review – 52-046  
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.  
Docket No. 52-046  
Review Section: 18 - Human Factors Engineering  
Application Section:

## QUESTIONS

### 18-96

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. This regulatory basis applies to all questions in this Request for Additional Information (RAI).

NUREG-0711, Criterion 8.4.3(1), states that "the topics in the applicant's style guide(s) should address the scope of human-system interfaces (HSIs) included in the design, and address their form, function, and operation, as well as the environmental conditions in which they will be used that are relevant to human performance."

The staff reviewed APR1400-E-I-NR-14012-P, Rev. 0, "Style Guide" (Style Guide), and found that environmental conditions for the main control room are described in Section 6.2, "Environment Design." The Style Guide, Section 1.1, "Scope," states that guidance in the Style Guide is applicable to the design of the main control room, technical support center, emergency operations facility, and remote shutdown room. However, the guidance in the Style Guide, Section 6.2, "Environment Design," states that the guidance is applicable to the main control room.

1. Clarify if the guidance in the Style Guide, Section 6.2, "Environment Design," is applicable also to the design of the technical support center, emergency operations facility, and remote shutdown room.
2. The Style Guide, Section 6.3, "Local Control Panel," states, "This HFE guideline is applicable to the LCSs associated with IHAs." No guideline is listed. Please provide some information in this section to clarify what guideline is applicable to LCSs associated with IHAs.
3. The Style Guide, Section 6.2.2, "Humidity," provides a lower limit for humidity that is different than the lower limit in NUREG-0700, Section 12.1.2.1-1, "Comfort Zone." Please justify the basis for the lower limit for humidity.

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18-97

NUREG-0711, Criterion 8.4.3(2), states, "The guidance in the applicant's style guide(s) should be developed from generic HFE guidance and HSI design-related analyses. It should be tailored to reflect the applicant's design decisions in addressing specific goals of the HSI design." Additionally, NUREG-0711, Section 1.2.2, "Review Elements," states that an acceptable implementation plan (IP) is complete, verifiable, and describes the methodology in a step-by-step format to ensure that design personnel can reliably use the IP and consistent results will be obtained from executing the methodology.

DCD Tier 2, Section 18.7.1, "Objectives and Scope," state that "the detailed design for the APR1400 basic HSI is an extension of the conceptual design described in the APR1400 Basic HSI Technical Report (TeR)." APR1400-E-I-NR-14007-P, Rev. 0, Human-System Interface Design Implementation Plan," (HD IP), Section 4.1.6, "Implementation Plan for Basic HSI Detailed Design," identifies sections in the HD IP that describe how the conceptual design is "expanded;" however, the staff reviewed these sections (the HD IP, Sections 4.1.6.1-4.1.6.4) and also Section 2.2, "APR1400 HSIS," which describes some outputs from this process in the fourth paragraph, and found that these sections provide a description of what will be provided instead of a method. The staff did not find that inputs, activities, and acceptance criteria had been identified. Therefore, it is not clear to the staff how the conceptual design is "expanded" to produce the products described in the HD IP, Section 2.2.

Also, Section 4.1.6.2, "Basic HSI Style Guide," discusses development of a style guide; however, a style guide was submitted with the application (APR1400-E-I-NR-14012-P, Rev. 0, "Style Guide." ), and the relationship between the style guide that was submitted and the style guide described in the HD IP, Section 4.1.6.2 is not clear to the staff.

1. Provide a method to develop the outputs identified in the HD IP, Sections 4.1.6.1 – 4.1.6.4 that is detailed, complete, and verifiable (i.e., identifies inputs, steps or actions that need to be taken, outputs, and any acceptance criteria).
2. Describe the difference between (if any), and the relationship between, the style guide described in the HD IP, Section 4.1.6.2, "Basic HSI Style Guide," and APR1400-E-I-NR-14012-P, Rev. 0, "Style Guide."
3. Clarify the extent to which the design described in the Basic HSI TeR conforms to the guidance described in the "Style Guide."
4. Also, please describe how the APR1400 HSI Design that results from the process described in the HD IP will conform to the Style Guide that was submitted with the application and to the other style guide described in the HD IP, Section 4.1.6.2, "Basic HSI Style Guide," if it is different.
5. Revise the submittal as necessary.

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### 18-98

NUREG-0711, Criterion 8.4.3(4) states in part that “the applicant’s style guide(s) should contain procedures for determining where and how HFE guidance will be used in the overall design process.”

The last sentence in the Style Guide, Appendix D, Section 1.9, “Channel Identification,” appears to the staff to be missing because it indicates that some information is to be provided.

Please provide any missing information.

### 18-99

NUREG-0711, Criterion 8.4.3(5), states in part that the “applicant should maintain the style guide(s) in a form that is readily accessible and usable by designers, and is easily modified and updated as the design matures.”

The process described in the HD IP, Section 4.1.7, “Basic HSI Tests and Evaluations,” may result in changes to the APR1400 Basic HSI, which includes the Style Guide. The staff could not infer from the application how the style guide and other design guidance described in the HD IP, Sections 4.1.6.1 – 4.1.6.4 are maintained in a form that is readily accessible and usable, and are easily modified and updated.

Please describe how the style guide(s) will be accessible and easily modified as the design matures.

### 18-100

NUREG-0711, Criterion 8.4.4.1(6), states in part that for the local control stations, the applicant’s HFE design should consider the ambient environment (e.g., noise, temperature, contamination) and the need for and type of protective clothing.

APR1400-E-I-NR-14004-P, Rev. 0, "Task Analysis Implementation Plan" (TA IP), Section 4.2.1, “Task Narratives,” provides guidance for the SMEs to identify protective clothing that may be required during task performance. The HD IP, Section 4.2.9, “Local Control Stations” (LCS), Item 2b, identifies how some input from task analysis is used in the HSI design process for LCSs, and Item 1a identifies a starting point for the LCS design. However, it’s not clear to the staff how these items in the HD IP, Section 4.2.9 will ensure that the need for protective clothing is considered in the design of LCSs used for important human actions (IHAs).

Please clarify how the need for and type of protective clothing will be considered for tasks associated with IHAs at LCSs.

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### 18-101

NUREG-0711, Criterion 8.4.4.1(7), states, “the applicant should identify how in an operating plant:

- the HSIs are modified and updated
- temporary HSI changes are made (such as modifying the set points)
- personnel-defined HSIs are created (such as temporary displays that personnel define for monitoring a specific situation).”

The HD IP, Appendix A, states that this criterion is not applicable. The criterion is applicable because the design must be able satisfy the criterion when the design is implemented.

Please describe how this criterion is satisfied by either identifying where the submittal describe this or providing the information.

### 18-102

NUREG-0711, Section 1.2.2, “Review Elements,” states in part that implementation plans should be complete (i.e., identify outputs), detailed, and verifiable. Please clarify the following items in the application:

1. The HD IP, Section 6, “Results Summary Report,” discusses an ITAAC for the HD results summary report. However, the ITAAC listed in DCD Tier 1, Section 2.9, “Human Factors Engineering,” state that only two generic ITAAC will be used. Please revise the HD IP, Section 6, to align with DCD Tier 1, Section 2.9.
2. The HD IP, Section 4.1 “APR1400 Basic HSI,” last paragraph says “Subsections 4.1.1 through 4.16 describe...” However, there is no section 4.16, and it appears to be referring to Section 4.1.6.
3. The HD IP, Section 1, “Purpose,” #3: this item says, “The APR1400 HSI, which are...” and then lists facilities. It seems that the item should say “The APR1400 HSI facilities, which are...” Please clarify.
4. The way that the arrows are pointing in the HD IP, Figure 3-1 “HSI Design Overview,” seem to indicate that a different design process will be used than the one that is described in Section 3.1, “APR1400 Basic HSI.” Please revise the figure (e.g., adjust the arrows or label boxes in the figure with numbers) so that it accurately portrays the process described in the HD IP.
5. APR1400-E-I-NR-14004-P, “Task Analysis Implementation Plan” (TA IP), Section 4.2.2.1, “Process Monitoring,” Item 14, “Alarms,” discusses the APR1400 Basic HSI Component Control and Instrumentation Design Guide and states that it is Reference 3. Section 7, “References,” does not have a Reference 3. Also, the TA IP, Section 3.5.5, “Human-System Interface Design,” discusses the APR1400 Basic HSI and states that it is Reference 4. Section 7, “References,” does not have a Reference 4. Please clarify which references are applicable.

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### 18-103

APR1400-E-I-NR-14001-P, Rev. 0, "Human Factors Engineering Program Plan" (HFE PP), Section 3, "Methodology Overview," states, "By reference, these eight IPs are incorporated into the HFEPP." The HFE PP and the eight IPs are listed in Tier 2, Chapter 1, Table 1.6-2, "List of Technical Reports." However, the Basic HSI TeR and the Style Guide are not included. Since Chapter 18 has been submitted as DAC, the detail in these documents is needed to provide a complete design certification.

Please add these documents to Table 1.6-2.