

## KHNPDCDRAIsPEm Resource

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**From:** Ciocco, Jeff  
**Sent:** Tuesday, October 20, 2015 2:08 PM  
**To:** KHNPDCDRAIsPEm Resource  
**Subject:** FW: APR1400 Design Certification Application RAI 260-8283 (18 - Human Factors Engineering)  
**Attachments:** APR1400 DC RAI 260 COLP 8283.pdf

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**From:** Ciocco, Jeff  
**Sent:** Monday, October 19, 2015 1:26 PM  
**To:** apr1400rai@khnp.co.kr; Harry (Hyun Seung) Chang <hyunseung.chang@gmail.com>; Andy Jiyong Oh <jiyong.oh5@gmail.com>; Erin Wisler <erin.wisler@aecom.com>  
**Cc:** Kent, Lauren <Lauren.Kent@nrc.gov>; Junge, Michael <Michael.Junge@nrc.gov>; Ward, William <William.Ward@nrc.gov>; Lee, Samuel <Samuel.Lee@nrc.gov>  
**Subject:** APR1400 Design Certification Application RAI 260-8283 (18 - Human Factors Engineering)

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 response times for this RAI. We may adjust the schedule accordingly.

18-30: 60 days  
18-31: 60 days  
18-32: 60 days  
18-33: 90 days  
18-34: 90 days  
18-35: 45 days  
18-36: 45 days  
18-37: 60 days  
18-38: 90 days  
18-39: 60 days  
18-40: 90 days

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

Thank you,

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**Hearing Identifier:** KHNP\_APR1400\_DCD\_RAI\_Public  
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**Recipients:**  
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| APR1400 DC RAI 260 COLP | 8283.pdf    | 107839                 |
| image001.jpg            | 5040        |                        |

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## REQUEST FOR ADDITIONAL INFORMATION 260-8283

Issue Date: 10/19/2015  
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: 18.6

### QUESTIONS

18-30

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.

Section 10 CFR 50.34(f)(3) requires an applicant to provide sufficient information to demonstrate that the following requirement(s) has been met.... "(i) Provide administrative procedures for evaluating operating, design and construction experience and for ensuring that applicable important industry experiences will be provided in a timely manner to those designing and constructing the plant."

NUREG-0711, Section 5.4(1), "Review Criteria," describes the types of tasks that should be selected for task analysis. Additionally, Section 1.2.2, "Review Elements," of NUREG-0711 states in part, "To determine whether an implementation plan (IP) is acceptable, the NRC staff evaluates whether the IP is:... detailed, i.e., the IP describes the methodology in a step-by-step format to ensure that the applicant's design personnel can reliably use the IP, and that knowledgeable engineers will obtain consistent results from executing the methodology..."

Task selection is described in DCD Tier 2 Section 18.4, "Task Analysis," and also in several places in the "Task Analysis [TA] Implementation Plan [IP]", APR1400-E-I-NR-14004-P, Rev 0:

- Section 4.1, "Task Selection" of the TA IP describes the types of tasks that are selected for task analysis. This list is similar to the list under the second bullet in NUREG-0711, Criterion 5.4(1).
- Section 2, "Scope," of the TA IP and DCD Tier 2 Section 18.4.1, "Objectives and Scope," describe the types of tasks to be included in the scope. This list includes some selection criteria that are not specifically listed in NUREG-0711 Criterion 5.4(1), and that is acceptable, but this list does not include some of the criteria that are listed in Section 4.1, "Task Selection," and in NUREG-0711 Criterion 5.4(1).

Because the information in these three places in the application are not the same, the staff cannot be certain that the subject matter experts (SMEs) will select tasks reliably and obtain consistent results.

1. Align DCD Tier 2, Section 18.4.1, Section 2.0 of the TA IP, and Section 4.1 of the TA IP so that the information about the scope of task selection is the same in each of the sections.
2. Revise the documentation to reflect the RAI response.

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18-31

Section 5.4 (1), "Review Criteria," of NUREG-0711 states that the applicant should select tasks for analysis that represent the "full range of plant operating modes...The chosen tasks should cover...tasks related to monitoring of automated systems that are important to plant safety..."

Section 4, "Implementation, APR1400-E-I-NR-14004-P, "Task Analysis Implementation Plan" (TA IP), Revision 0, includes wording which differs from the NUREG-0711 wording above.

1. Describe how "tasks related to the monitoring of automated systems that are important to plant safety" are included in the task analysis scope.
2. Revise the submittal as necessary.

18-32

Section 5.4 (2), "Review Criteria," of NUREG-0711 states that "the applicant should describe the screening methodology used to select the tasks for analysis, based on criteria specifically established to determine whether analyzing a particular task is necessary." Additionally, Section 1.2.2, "Review Elements," of NUREG-0711 states in part, "To determine whether an implementation plan (IP) is acceptable, the NRC staff evaluates whether the IP is:... detailed, i.e., the IP describes the methodology in a step-by-step format to ensure that the applicant's design personnel can reliably use the IP, and that knowledgeable engineers will obtain consistent results from executing the methodology..."

Section 4.1.2, "Plant Operating Procedures," in the TA IP describes the use of plant procedures to select tasks. It is not clear if the SME is supposed to identify each procedure step as a task or subtask in the TA database, or if screening criteria will be applied.

1. Specify how the personnel performing the task analysis will use the emergency operating procedures/guidelines and the procedures listed in Section 4.1.2 of the TA IP to select tasks for task analysis. Clarify whether or not all of the procedure steps should be listed, or if screening criteria are to be applied.
2. If any screening criteria are to be applied, clearly describe it.
3. Revise the submittal as necessary.

18-33

Section 5.4 (2), "Review Criteria," of NUREG-0711 states that "the applicant should describe the screening methodology used to select the tasks for analysis, based on criteria specifically established to determine whether analyzing a particular task is necessary." Additionally, Section 1.2.2, "Review Elements," of NUREG-0711 states in part, "To determine whether an implementation plan (IP) is acceptable, the NRC staff evaluates whether the IP is:... detailed, i.e., the IP describes the methodology in a step-by-step format to ensure that the applicant's design personnel can reliably use the IP, and that knowledgeable engineers will obtain consistent results from executing the methodology..."

Section 4.1.1.3, "Functional Requirements Analysis/Function Allocation" (FRA/FA) of the TA IP, Revision 0 describes at a general level of detail how the SME performing the task analysis will use the FRA/FA results (and the FRA/FA database) to select tasks. Section 4.5, "Allocation of

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Functions,” of APR1400-E-I-NR-14003-P, “Function Requirements Analysis and Function Allocation Implementation Plan” (FRA/FA IP), Revision 0 describes the range of function allocation from manual to fully automatic, and identifies how these function allocations are labeled in the FRA/FA database (refer to Table 4-3, Column 8). It is not clear if the SMEs will evaluate control actions that are allocated to a combination of manual and automatic actions, as described in Section 4.5 of the FRA/FA IP (under the heading, “Column 8 Control”).

1. Specify the types of control allocations the SME should review and decompose to identify and select tasks.
2. Revise the submittal as necessary.

18-34

Section 5.4 (2), “Review Criteria,” of NUREG-0711 states that “the applicant should describe the screening methodology used to select the tasks for analysis, based on criteria specifically established to determine whether analyzing a particular task is necessary.” Additionally, Section 1.2.2, “Review Elements,” of NUREG-0711 states in part, “To determine whether an implementation plan (IP) is acceptable, the NRC staff evaluates whether the IP is:... detailed, i.e., the IP describes the methodology in a step-by-step format to ensure that the applicant’s design personnel can reliably use the IP, and that knowledgeable engineers will obtain consistent results from executing the methodology...”

DCD Tier 2 Section 18.4.1, “Objectives and Scope,” and Section 2, “Scope,” of the TA IP, and Section 4.1.3, “Subject Matter Expert Experience,” of the TA IP state that SMEs will use their experience and training to add additional tasks to the TA database that have challenged predecessor plant operating crews. Section 4.1.3 goes on to list specific areas where SME judgments are applied.

SME judgment is not quantitative, and results obtained from only using SME judgment would not be verifiable.

1. In order to obtain consistent results, provide a minimum amount of criteria that will be used by the SMEs to identify tasks from these areas for task analysis.
2. Additionally, specify any documentation that the SMEs will need to use from the predecessor plants or reference plants.
3. Revise the submittal as necessary.

18-35

Table 5-1, “TA Implementation Summary,” in the TA IP identifies the applicable IP subsection and SME for specific implementation activities.

Table 4-1, “Responsibilities for the Human Factors Engineering Design Team,” in APR1400-E-I-NR-14001-P, “Human Factors Engineering Program Plan” (HFEPP), Revision 0, provides a matrix of responsibilities for various design groups during the defined stages of HFE design.

Section 4.3.3, “Human Factors Engineering Organizational Composition,” in the HFEPP identifies the members of various design groups, but does not list plant operations SMEs as members.

1. Align the information in the TA IP with the information in the HFEPP.
2. Revise the documentation as necessary.

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18-36

Section 5.4(3), "Review Criteria," of NUREG-0711 states in part that, "The detailed task descriptions should address (as applicable to the task) the topics listed in Table 5-1." Table 5-1, "Task Considerations," of NUREG-0711 states in part that the task descriptions should address information about the accuracy of parameters.

Subsection 3.2.4, "Display Update, Freeze and Data Quality," of APR1400-E-I-NR-14012-P, "Style Guide," Revision 0, states that "each variable should be displayed with an accuracy sufficient for the users to perform their tasks." Additionally, Subsection 3.1.2, "Human-System Interface Inventory," in the TA IP includes a similar statement; however, accuracy for instrumentation used to monitor and/or control plant parameters is not listed as a field in the HSI database in Subsection 4.2.2, "Human-System Interface Inventory," of the TA IP. (There may have been an attempt to include this information in Item #10 in Section 4.2.2.1, "Process Monitoring," but the information in this item is not clearly worded and the identified parameter is not the same as 'accuracy'.)

1. Describe how task analysis addresses information about the accuracy of parameters monitored and/or controlled by operators.
2. Revise the submittal as necessary.

18-37

Section 5.4(3), "Review Criteria," of NUREG-0711 states in part that "the detailed task descriptions should address (as applicable to the task) the topics listed in Table 5-1." Table 5-1 of NUREG-0711 states in part that the task descriptions should address information about the situational and performance shaping factors.

Item 22 in Section 4.2.1, "Task Narrative," in the TA IP discusses performance shaping factors (PSFs). The TA IP lists examples of PSFs; however, some of the examples from Table 5-1 of NUREG-0711 are not listed (e.g., stress, time pressure, and reduced staffing).

1. Describe how the examples of performance shaping factors (PSFs) listed in Table 5-1 of NUREG-0711 are included in the task narrative.
2. Revise the documentation as necessary.

18-38

Section 5.4(5), "Review Criteria," of NUREG-0711 states that "the applicant should estimate the time required to perform each task."

Section 18.4.2.2, "Task Timing Analysis," in DCD Chapter 18 and Section 4.3, "Task Timing Analysis," in the TA IP state that an estimate of the time required to perform the task is part of the task timing analysis (TTA); however, a TTA is not performed for all tasks.

The staff requests that the submittal be updated to state that an estimate of the time required to perform the task will be provided for each task to satisfy Criterion 5.4(5) of NUREG-0711, Revision 3. If the estimate of the time required will be developed differently for tasks that are not

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selected for a TTA, describe any techniques or tools the SMEs can use to make an estimate of the time required.

18-39

Section 5.4(7), "Review Criteria," of NUREG-0711 states "the applicant should identify the knowledge and abilities required to perform each task."

Item 18, "Staff," in Subsection 4.2.1, "Task Narrative," of the TA IP discusses entering the knowledge and abilities required to perform the task into the TA database, but with caveats and without details.

Also, Section 4.5.3, "Task Analysis," of APR1400-K-I-NR-14005-P, "Staffing and Qualifications Implementation Plan," Revision 0, dated December 2014, states that the staffing and qualifications analysis relies on the TA, including the knowledge and abilities required.

1. Describe how the knowledge and abilities required to perform each task will be identified in the task analysis program element.
2. Revise the documentation as necessary.

18-40

Criterion 5.4(3) of NUREG-0711 states in part that "the detailed task descriptions should address (as applicable to the task) the topics listed in Table 5-1, "Task Characteristics." One topic is workload (e.g., overlap of task requirements).

Item 23, "Administration," and Item 24, "Critical Functions," in Section 4.2.1, "Task Narrative," of the TA IP each contain a statement that certain information related to administrative workload or workload associated with plant monitoring is "well understood." The meaning of this sentence is not clear, and the direction to the SME to document administrative tasks or monitoring tasks that may overlap with and/or affect task performance is not clear. Information about administrative tasks and monitoring tasks is also needed for the task timing analysis.

1. Clarify the information that the SME should include in these fields in the database.
2. Revise the submittal as necessary.



