

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

8/3/2011

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 18 - Human Factors Engineering

Application Section: 18.10

QUESTIONS for Operating Licensing and Human Performance Branch (AP1000/EPR Projects) (COLP)

18-178

Acceptance Criteria:

10 CFR 52.47: The application must contain a level of design information sufficient to enable the Commission to judge the applicant's proposed means of assuring that construction conforms to the design and to reach a final conclusion on all safety questions associated with the design before the certification is granted.

Evaluation:

DCD, Chapter 18, Section 18.7, "Human-System Interface Design" does not reference MUAP-10009, "'US-APWR HSI Design Implementation Plan" of April, 2010. This document provides additional detail the staff used to reach their conclusion on safety.

Information Request:

With the next revision of the DCD ensure that MUAP-10009 is appropriately referenced to include the information it provides.

18-179

Acceptance Criteria:

MUAP-10009, revision 0, Section 2.0, "Scope," states that phase 2 does not change the US-Basic design *unless Phase 2 V&V indicates a design change is needed.*

Information Request:

Please clarify how this feedback will be accomplished. Are there changes to the US-Basic HSI design that will be added to MUAP-07007 before the NRC SER is issued? Are changes made as part of the US-APWR submittal?

Note: The staff's intent with this question is to understand whether there is potential for iterative reviews of MUAP-07007 that could affect the schedule for completing the US-APWR review.

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

18-180

Acceptance Criteria:

NUREG-0711 Criterion 8.4.4(2): Alternative approaches for addressing HSI functional requirements should be considered. A survey of the state-of-the-art in HSI technologies should be conducted to:

- Support the development of concept designs that incorporate advanced HSI technologies
- Provide assurance that proposed designs are technically feasible
- Support the identification of human performance concerns and tradeoffs associated with various HSI technologies

Also criteria 8.4.4(3)-(5)

Evaluation:

DCD, Section 18.7.2.4 and MUAP-10009, Section 4.4 both discuss alternative design approaches and state-of-the-art surveys relative to the US-Basic HSI design. The MUAP in particular indicates, "Additional approaches for addressing HSI functional requirements will be assessed for resolving Phase 1 design related HEDs." Phase 1 develops the US-Basic HSI design not the US-APWR design. The list of changes in the US-APWR HSI design (Section 18.7.2.4) contains several changes that would appear to warrant application of this criterion. (For example: automatic isolation of a failed SG, automatic recirculation, accommodations for 2 operators)

Information Request:

1. Explain how this criterion is applied within the US-APWR HSI design process.
2. Similarly, explain how criteria 8.4.4(3), (4), and (5) are applied to the US-APWR HSI design process.

The staff understands that the US-Basic HSI design is the foundation for the US-APWR design and therefore the 3 criteria referenced above are addressed via the incorporation of the US-Basic HSI design. What is not clear is why these 3 criteria wouldn't still be applicable to design work specific to the US-APWR.

3. If these criteria are not applicable to the US-APWR HSI design, explain why.
4. Also please explain why MUAP-10009 refers to resolving Phase 1 design related HEDs in the future tense. It is the staff understands that these HED's were resolved in phase 1b the results of which are summarized in MUAP-09019 and will be (?) reflected in MUAP-07007 revision 4. (The staff is trying to understand where phase 1B stops and 2A begins. The descriptions of the phases are clear. Where the results of phase 1B will be documented is still confusing.)

18-181

Acceptance Criteria:

Criterion 8.4.5(6): Personnel and task performance should be supported during minimal, nominal, and high-level staffing.

Evaluation:

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

Minimal and nominal staffing are satisfactorily defined, described, quantified and incorporated into the HSI design and V&V activities. Maximum staffing is satisfactorily incorporated in the HSI design and V&V activities but there is no description of what constitutes maximum staffing.

Information Request:

Describe the maximum staffing assumption used as input to the HSI design and V&V activities. How many people are considered and what are their backgrounds? (Maximum operations staffing is clear; support staffing levels are not)

18-182

Acceptance Criteria:

Criterion 8.4.5(8): HSI characteristics should support human performance under the full range of environmental conditions, e.g., normal as well as credible extreme conditions. For the main control room requirements should address conditions such as loss of lighting, loss of ventilation, and main control room evacuation. For the remote shutdown facility and local control stations, requirements should address constraints imposed by the ambient environment (e.g., noise, temperature, contamination) and by protective clothing (if necessary).

Evaluation:

The Topical Report, Section 5.7.3.2 states, "The HSI characteristics support human performance under a full range of environmental conditions. The control of the control room environmental conditions, including emergency lighting, ventilation, and control room habitability, are discussed in plant licensing documentation."

RAI response 412 COLP-2546, Question 18-60 states that extreme conditions are addressed in Table 5.4-1 of the Topical report. The table lists lighting, temp, and noise as examples of extreme environmental conditions considered during the task analysis.

The DCD, Section 18.7.2.5 states, "How the HSI characteristics support human performance under a full range of environmental conditions – highly controlled environment without a significant fluctuation of environmental conditions, including emergency lighting, Subsection 9.5.3; ventilation, Section 9.4; and control room habitability, as discussed in Section 6.4."

MUAP-09019, Section 2.4.2.2.1 states, "Specific elements of the overall work environment (e.g., temperature, humidity, ventilation, illumination, and noise) that are not anticipated to influence the specific HA are not required to be identified. The range of situational factors that are known to challenge human performance are specified, including adverse or inhospitable environmental conditions such as poor lighting, extreme temperatures, high noise, and radiological issues (dose rate or contamination). When evaluating performance associated with the use of HSI components located remotely from the main control room, the specific effects on crew performance due to potentially harsh environments (i.e., high radiation) are considered (i.e., additional time to don protective clothing and access radiologically controlled areas)."

Information Request:

With respect to the control room, clarify how environmental conditions are evaluated. Specifically address the following points.

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

- The documents provide a clear commitment to evaluate environmental conditions but the staff is not clear on the process being used to complete the evaluation. The Topical Report and the DCD both appear to be implying that emergency lighting and ventilation bound certain environmental conditions but this is not clearly stated. The limits on environmental conditions imposed by these systems (or how these limits will be identified) are not specified.
- The DCD uses the phrase, "highly controlled environment without a significant fluctuation of environmental conditions." It is unclear how this phrase is being applied.
- MUAP-07007 refers to plant licensing documentation. This could imply the COL applicant is responsible for this work. This seems inconsistent with the other documentation.
- Is the first sentence from MUAP-09019 quoted above just saying you are not going to document environmental conditions that do NOT affect task performance or is there additional context we are missing?

18-183

Acceptance Criteria:

NUREG-0711, Sections 8.4.6.1 and 8.4.6.2 contain specific criteria for trade-off evaluations and performance-based tests to be incorporated within the HSI design.

Evaluation:

The RAI response to DCD RAI no. 412 COLP-2546 (UAP-HF-09398) states the criteria referenced above are addressed in appendix A, B and C of MUAP 07007. The staff used this information plus that provided in MUAP-08014, Part 1 and MUAP-09019, Part 3 as input to the evaluation of the Topical Report since this material is all described as being part of Phase 1 and thus applicable to the US-Basic HSI design.

If these practices are carried over into phase 2, the staff believes that the NUREG-0711 test and evaluation criteria would be satisfied. MUAP-09019, Section 1 seems to imply they are saying, "The iterative process of analysis, design and test will continue over the next 2 years as the HSI for the US-APWR is refined, leading up the full Verification and Validation as recommended by NUREG-0711 Rev.2, in Phase 2 as described earlier in this report." However, no specific criteria were found for performing the iterative testing. MUAP-08014, Section 2.3.3 mentions a static portable HSI system analysis tool but it does not provide the detail necessary for the staff to understand how the test and evaluation criteria are applied. That being said, the staff realizes phase 2 develops the HSI inventory rather than the physical HSI design and so, perhaps testing and evaluation of design assumptions is unnecessary given the integrated System Validation will be performed.

Information Request:

1. Will validation activities similar to what is described for phase 1 be accomplished during phase 2? (This would be validation activities that precede the Integrated System Validation.) If so, when are they done and what do they evaluate? Can the staff assume the methods described for phase 1 continue into the phase 2

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

- validation? If not, why? Is it because minimum testing and evaluation of design assumptions is unnecessary?
2. MUAP-08014, Section 2.3.3 states that the static portable HSI system analysis tool is used to evaluate the consistency of the HSI inventory between displays and operating procedures. This appears to be a method used to verify completeness rather than test or evaluate a design option. Is this correct? If not, please explain its purpose and how the NUREG criteria referenced above are addressed.
 3. Please provide any additional information that would help the staff understand the relevancy of the referenced NUREG criteria to the design processes used in Phase 2.

18-184

Acceptance criteria:

Not applicable

Evaluation:

MUAP-09019, Part 1 contains multiple references to a "Reference 0." The reference list at the end of the section does not contain a Reference 0.

Information request:

Provide corrected referencing in MUAP-09019, Part 1.

18-185

Acceptance criteria:

NUREG -0711, Section 8.4.7, Criterion 1 The HSI design should be documented to include:

- The detailed HSI description including its form, function and performance characteristics
- The basis for the HSI requirements and design characteristics with respect to operating experience and literature analyses, tradeoff studies, engineering evaluations and experiments, and benchmark evaluations
- Records of the basis of the design changes.

Evaluation:

DCD, Section 18.7.3 states that the US-APWR HSI design results and description are documented in the HSI Design Technical Report and references MUAP-09019. The material that appears in the subsequent subsections is not addressed in MUAP-09019.

Similarly, DCD, Subsections 18.7.3.2 and 18.7.3.3 reference MUAP-09019 but subsequent topics are not addressed in this MUAP.

The staff does not understand how the US-APWR specific HSI design is documented. MUAP-10009 provides a succinct summary of documentation associated with the US-Basic HSI design but limits the explanation of the US-APWR documentation to the statement, "The design documentation for the US-APWR HSI is developed based on the US Basic HSI design documentation."

REQUEST FOR ADDITIONAL INFORMATION 797-5835 REVISION 3

Information request:

1. Correct the referencing referred to above or add the relevant information to MUAP-09019.
2. Explain how US-APWR specific design information is documented. Ensure the explanation includes how design details needed for procurement, construction and inspection activities are documented. For example: Will there be detailed specifications for the US-APWR specific design that supplement the specifications that exist for the US-Basic design (like the ones reviewed during the audit)?
3. Explain how the basis for the US-APWR specific design is documented.

Note: The staff understands that US-Basis HSI design documentation exists and is the foundation for the US-APWR. The DCD need only reference this in a generic manner, similar to the way it is done in MUAP-10009, since MUAP-07007 is being approved under a separate safety evaluation.