

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.: 352-8205
SRP Section: 18 – Human Factors Engineering
Application Section: 18.10
Date of RAI Issue: 12/22/2015

Question No. 18-72

NUREG-0711, Criterion 11.4.3.5.2(2), "Performance Measure Information and validation Criteria," states that the applicant should specify when each measure is obtained (recorded), such as continuously, at specific points during the scenario, or after the scenario ends.

Evaluation: The applicant's description of when measures are collected is contained in Section 4.5.5 of the IP and in the detailed scenario descriptions contained in the HF V&V Scenarios document. The staff has the following questions about when measures are taken.

Actions:

1. It appears that the situational awareness global assessment technique (SAGAT) measure of situational awareness (SA) is taken twice for each scenario; once during a scenario stoppage and the second time at the end of the scenario. One of the values of the SAGAT method is that the changes in SA over the course of a scenario can be measured since the assessment is usually made at several points. The staff is concerned that a onetime measurement of SA during the scenario may not provide an accurate assessment. For example, in the Anticipated Transient without Trip with Distributed Control System Failures scenario, SA isn't measured until approximately two hours into the event. The staff is also concerned that use of the SAGAT measure following scenario termination may be of limited value. SAGAT is designed to capture the operators' SA as events unfold. Some of the questions typically assess the operators' awareness of where events are leading. At the end of the scenario, the plant has been stabilized. Since SAGAT is not a retrospective measure, all it may show is that the operators' are aware they have achieved the stable condition. Revise the V&V IP to provide:
 - the rationale for selecting the number of scenario stoppages for SAGAT data collections,

- specific information on when the scenarios are stopped, and
- detailed information about SAGATs use once the scenario is completed.

The IP states that the task load index (TLX) will be collected at the end of each scenario. However, the detailed scenario descriptions in the HF V&V Scenarios document do not include the TLX in the list of “Post Exercise Evaluation” items. Within the scenarios, provide information describing where and when the TLX will be used.

Response

TS

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-14010-NP, Rev.0, "Human Factors Verification and Validation Scenarios," Appendix A through Appendix G will be revised, as indicated in the attachment associated with this response.

TS

3.3. Debrief

3.3.1. Post Exercise Evaluation

TS

3.3.2. Data Acquisition

TS

2. FACILITATORS INFORMATION

2.1. Scenario Timeline

TS

TS

3.2.5. EVENT-5 ATWT

TS

TS

TS

3.3. Debrief**3.3.1 Post Exercise Evaluation**

TS

3.3.2 Data Acquisition

TS

2. FACILITATORS INFORMATION

2.1 Scenario Timeline

TS

2.2 Procedure Flowpath

TS

2.3 Emergency Plan

TS

2.4 Technical Specifications

TS

2.5 Scenario Termination Criteria

TS

2.6 Anticipated Scenario Length

TS

TS

3.2.6 Event-6 Main Steam Line 2B Break IRC

TS

3.3 Debrief**3.3.1 Post Exercise Evaluation**

TS

**3.3.2 Data Acquisition**

TS



2. FACILITATORS INFORMATION

2.1 Scenario Timeline

TS

TS

2.2 Procedure Flowpath

TS

3.3 Debrief**3.3.1 Post Exercise Evaluation****TS****3.3.2 Data Acquisition****TS**

2. FACILITATORS INFORMATION

2.1 Scenario Timeline

TS

TS

2.2 Procedure Flowpath

TS

2.3 Emergency Plan

TS

2.4 Technical Specifications

TS

2.5 Scenario Termination Criteria

TS

2.6 Anticipated Scenario Length

TS

TS

3.2.4 EVENT-4 100% to 75% Power Operation and Severe Weather (Tornado Warning)

TS

TS

3.3 Debrief

3.3.1 Post Exercise Evaluation

TS

3.3.2 Data Acquisition

TS

2. FACILITATORS INFORMATION

2.1 Scenario Timeline

TS

TS

2.2 Procedure Flowpath

TS

2.3 Emergency Plan

TS

2.4 Technical Specifications

TS

2.5 Scenario Termination Criteria

TS

2.6 Anticipated Scenario Length

TS

TS

3.2.5 Event-5 Steam Generator Tube Leak with Secondary Radiation Monitor Failures

TS

TS

3.3 Debrief

3.3.1 Post Exercise Evaluation

TS

2. FACILITATORS INFORMATION

2.1 Scenario Timeline

TS

HF V&V Scenarios

APR1400-E-I-NR-14010-NP, Rev.0

TS

2.2 Procedure Flowpath

TS

2.3 Emergency Plan

TS

2.4 Technical Specifications

TS

2.5 Scenario Termination Criteria

TS

HF V&V Scenarios

APR1400-E-I-NR-14010-NP, Rev.0

TS

3.3 Debrief

3.3.1 Post Exercise Evaluation

TS

3.3.2 Data Acquisition

TS

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.: 352-8205
SRP Section: 18 – Human Factors Engineering
Application Section: 18.10
Date of RAI Issue: 12/22/2015

Question No. 18-74

NUREG-0711, Criterion 11.4.3.5.2(4), states that the applicant should identify the specific criterion for each measure used to judge the acceptability of performance and describe its basis.

Evaluation: The applicant's description of the specific criterion to be used for each measurement and its basis is contained in Section 4.5.5 of the IP and in the HF scenarios document. The staff has the following questions related to the specific criterion for each measure:

Actions:

1. The specific criteria to be used for many of the measures are in the detailed instructions for the validation scenarios. However, specific criteria are not provided for all measures, e.g., for the BARS, SA, and workload measures. Revise the V&V IP to provide the specific criteria to be used in the evaluation of all of the performance measures.
2. The bases for the criteria are summarized in Table 4-5, "Basis for Performance Criteria." The IP states that the criteria basis for SAGAT and TLX are benchmarked to "a predecessor or reference plant." The staff was unable to determine which plant SAGAT and TLX were benchmarked. Revise the V&V IP to identify the benchmarking plant and how the criteria were established for SAGAT and TLX.

Response

1. Sections 4.5.5.1 and 4.5.5.2 of the Human Factors Verification and Validation Implementation Plan (HF V&V IP) will be revised to include the specific criteria to be used to assess performance measures, as indicated in the attachment associated with this response.

TS

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-14008-NP, Rev.0, "Human Factors Verification and Validation Implementation Plan," Sections 4.5.5.1 and 4.5.5.2 will be revised, as indicated in the attachment associated with this response.

LOCA	loss of coolant accident
MCR	main control room
NRC	Nuclear Regulatory Commission
NASA	National Aeronautics and Space Administration
OER	operating experience review
P&ID	pipng and instrumentation diagram
PRA	probabilistic risk assessment
RCS	reactor coolant system
ReSR	results summary report
RIHA	risk-important human action
RG	Regulatory Guide
RO	reactor operator
RSC	remote shutdown console
RSR	remote shutdown room
SAGAT	situation awareness global assessment technique
S&Q	staffing and qualifications
SG	steam generator
SI	safety injection
SIAS	safety injection actuation signal
SME	subject matter expert
SOC	sampling of operational conditions
SOP	system operating procedure
SRO	senior reactor operator
SS	shift supervisor
STA	shift technical advisor
TA	task analysis
TIHA	treatment of important human actions
TLX	task load index
TO	turbine operator
TS	trade secret
TSC	technical support center
V&V	verification and validation
VDU	visual display unit

SART

situation awareness rating technique

TS

4.5.5.1. Types of Performance Measures Used

TS

TS

TS

TS

TS

TS

Page intentionally blank

Table 4-6 Summary of Performance Measures

TS

4.5.6. Test Design

TS

4.5.6.1. Scenario Sequencing

TS