ENCLOSURE 4

(Non-Proprietary)

APP-OCS-GEH-521 Revision B

"AP1000 Plant Startup Human Factors Engineering Design Verification Plan"

RAI-SRP18-COLP-23 Revision 3

RAI-SRP18-COLP-46 Revision 2

Westinghouse

Westinghouse Non-Proprietary Class 3

AP1000

Plant Startup Human Factors Engineering Design Verification Plan (Non-Proprietary)

APP-OCS-GEH-521, Rev. B

July 2010

APPROVALS

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REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Completed
A	Ruiqi Ma	Preliminary Issue	05/2009
B	Ruiqi Ma	Added scope under Section 1.2.2. Added clarification on the responsibility of potential identified issues or discrepancies during the plant startup HFE design verification under Section 2. Made minor changes on the revision of the references. Added proprietary markings.	See EDMS

DOCUMENT TRACEABILITY & COMPLIANCE

Created to Support the Following Document(s)	Document Number	Revision
AP1000 Human Factors Engineering Program Plan	APP-OCS-GBH-001 (Reference 2)	1

OPEN ITEMS

Item	Description	Status
None.		

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None.

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None.

ACRONYMS AND TRADEMARKS

Acronyms used in the document are defined in WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 1), or included below to ensure unambiguous understanding of their use within this document.

Acronym **Definition**

None.

AP1000™ is a trademark of Westinghouse Electric Company LLC.

GLOSSARY OF TERMS

Standard terms used in the document are defined in WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 1), or included below to ensure unambiguous understanding of their use within this document.

Term	Definitions
Historical Review	Historical review is most useful for evaluating issues related to system effectiveness in the real setting where the system performance can be evaluated during testing, startup and operation. This technique involves the examination of historical records related to the performance of systems that are identical or similar to the system under evaluation.
Human Engineering Discrepancy	A departure of the AP1000™ Human Factors Engineering (HFE) design from guidance and criteria identified during execution of HFE verification and validation activities.
Independent Verifier	A competent engineer who is not responsible for the design work, who reports through a different management structure to at least the second level of the organization, and who is not responsible for the schedule or financial performance of the design group.
Physical Measurement Techniques	Where appropriate control room environments exist, physical measurements can be taken in relation to key features, including lighting, thermal conditions, acoustics, etc. These measurements are then compared to environment and design specifications.
Walk-Through/Talk-Through	The walk-through/talk-through technique is the most widely used observation technique. The technique consists of having potential users of the system under test "walking and talking through" (in the sense of physically showing and verbally describing) one or more of the tasks that will be done using the system when it is operational.

REFERENCES

Following is a list of references used throughout this document.

1. WNA-PS-00016-GEN, Rev. 4, (Proprietary) "Standard Acronyms and Definitions," Westinghouse Electric Company LLC.

2. APP-OCS-GBH-001, Rev. 1, (Proprietary) "AP1000 Human Factors Engineering Program Plan," Westinghouse Electric Company LLC.

3. APP-OCS-GEH-020, Rev. 2 (WCAP-15860) (Proprietary), "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Westinghouse Electric Company LLC.

4. NUREG-0711, Rev. 2, "Human Factors Engineering Program Review Model," U.S. Nuclear Regulatory Commission.

5. ISO 11064-7, First Edition, "Ergonomic Design of Control Centers, Part 7: Principles for the Evaluation of Control Centers," International Organization for Standardization.

6. APP-OCS-J1-002, Rev. 1, (Proprietary) "AP1000 Human System Interface Design Guidelines," Westinghouse Electric Company LLC.

7. APP-GW-GRP-001, Rev. 0, (Proprietary) "AP1000 Local Panels and Maintainability Human Factors Design Guidelines," Westinghouse Electric Company LLC.

8. APP-GW-GL-011, Rev. 0, "AP1000 Identification of Critical Human Actions and Risk Important Tasks," Westinghouse Electric Company LLC.

BIBLIOGRAPHY

Following is a list of sources that were considered in preparing this document, or that provide additional information.

1. APP-OCS-GEH-120, Rev. B, (Proprietary) "AP1000 Human Factors Engineering Design Verification Plan," Westinghouse Electric Company LLC.

2. APP-OCS-GER-120, "AP1000 HFE Design Verification Report," Westinghouse Electric Company LLC. [LATER]

3. APP-OCS-GEH-220, Rev. B, (Proprietary) "AP1000 Human Factors Engineering Task Support Verification Plan," Westinghouse Electric Company LLC.

4. APP-OCS-GER-220, "AP1000 HFE Task Support Verification Report," Westinghouse Electric Company LLC. [LATER]

5. APP-OCS-GEH-320, Rev. D (Proprietary) "AP1000 Human Factors Engineering Integrated System Validation Plan," Westinghouse Electric Company LLC.

6. APP-OCS-GER-320, "AP1000 HFE Integrated System Validation Report," Westinghouse Electric Company LLC. [LATER]

7. APP-OCS-GEH-420, Rev. B (Proprietary) "AP1000 Human Factors Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC.

8. APP-OCS-GER-420, "AP1000 Human Engineering Discrepancy Resolution Report," Westinghouse Electric Company LLC. [LATER]

9. APP-OCS-GER-520, "AP1000 Plant Startup HFE Design Verification Report," Westinghouse Electric Company LLC. [LATER]

10. NUREG-0700, Rev. 2, "Human-System Interface Design Review Guidelines," U.S. Nuclear Regulatory Commission.

11. WEC 3.3.1, Rev. 1, "Design Reviews," (Proprietary) Westinghouse Electric Company LLC, effective August 3, 2009.

12. WEC 6.1, Rev. 2, "Document Control," (Proprietary) Westinghouse Electric Company LLC, effective February 8, 2010.

13. NSNP 3.3.3, Rev. 2, (Proprietary) "Design Verification by Independent Review or Alternate Calculations," Westinghouse Electric Company LLC, February 8, 2010.

14. APP-GW-GJP-100, Rev. H, "Writers Guideline for Normal Operating Procedures," Westinghouse Electric Company LLC.

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SECTION 1
INTRODUCTION

1.1 OVERVIEW

1.1.1 Purpose

The purpose of this document is to define the Human Factors Engineering (HFE) design verification plan at plant startup for the AP1000™ plant. This document is part of the AP1000 verification and validation (V&V) assessments.

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1.1.2 Prerequisite

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1.1.3 Process Strategy

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1.2 SCOPE

1.2.1 Applicability

This document is applicable to the AP1000 HSI resources and OCS as identified in Section 1.2.2 of the document.

1.2.2 List of Design Features Requiring Verification

Following is a list of specific aspects of the AP1000 OCS/HSI design that can not be evaluated in a simulator, and specific HSI resources and OCS that require design verification at plant startup. Additional design features, HSI resources and OCS may be added to this list as they are identified by HFE personnel.

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2. [

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1.2.3 Limitation of Scope

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1.3 OBJECTIVE

The overall objective of HFE V&V is to ensure that the AP1000 OCS/HSI design attains a high standard of human factors adequacy and thereby contributing to the safety, operability and maintainability of the plant.

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SECTION 2
VERIFICATION PROCESS

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SECTION 3
METHODOLOGY AND MEASUREMENTS

3.1 PERSONNEL REQUIREMENTS AND TECHNIQUES

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3.2 DELIVERABLES

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AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-23
Revision: 3

Question:

DCD Tier I contains V&V ITAAC in Table 3.2-1, #4 and #5. ITAAC #4 states in part: "A report exists and concludes that the HFE V&V Implementation was developed in accordance with the programmatic level description ..." WCAP-16769-P provides the Westinghouse logic for closing ITAAC #4. WCAP-16769P does not state such conclusions, as specified in the ITAAC, although it seems as if that would be the appropriate place to do so. Please provide the report specified by the ITAAC.

Westinghouse Response:

WCAP-16769-P (Reference 1) described the basis for closing COL Information Item 18.11-1 via stating that the confirmation of completion of the HFE V&V implementation plans will be accomplished via ITAAC #4. WCAP-16769-P did not propose to address ITAAC #4. At this stage in the licensing process, it is not considered necessary to revise WCAP-16769-P or provide an additional report to describe the logic for closing ITAAC #4.

The wording provided in DCD Revision 15, Tier 1, Table 3.2-1 Item 4 (ITAAC item #4) Acceptance Criteria column is a based on a generic statement used to denote when documentation is required to fulfill the corresponding design commitment. This design commitment has been addressed by the submission of the following V&V implementation plans:

1. APP-OCS-GEH-120, "AP1000 Human Factors Engineering Design Verification Plan," Westinghouse Electric Company LLC. (Reference 2).

2. APP-OCS-GEH-220, "AP1000 Human Factors Engineering Task Support Verification Plan," Westinghouse Electric Company LLC. (Reference 3).

3. APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Westinghouse Electric Company LLC. (Reference 4)

4. APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC. (Reference 5).

5. APP-OCS-GEH-520, "AP1000 Plant Startup Human Factors Engineering Verification Plan," Westinghouse Electric Company LLC. (Reference 6).

It is WEC's understanding that the NRC intends to close DCD Revision 15 COL Information Item 18.11-1 as being redundant with ITAAC #4. Therefore, ITAAC #4 is not included in the DCD Revision 17, Tier 1, Table 3.2-1.

Question Rev 1:

The response states that there is no report to satisfy the requirements of ITAAC #4. However, Rev. 17 has removed ITAAC #4. This is not acceptable particularly since exceptions are being taken from the programmatic level description for V&V. Provide this report and ensure it explicitly states where exceptions are taken to the program plan. As discussed at the public meeting held 12/09/2009 this report can be integrated into the ITAAC closure documents as was done for other ITAACs or into the DCD.

Westinghouse Response Rev 1:

As discussed at the public meeting held 12/9/2009, Revision 18 of the DCD will include text to state that DAC Item #4 from Revision 15 of the DCD is closed via the issuance of the five V&V documents (References 2 to 6). These five V&V documents will be referenced as Tier 2* in Revision 18 of the DCD.

The total number of exceptions from WCAP-15860 "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan" (Reference 7) is small and applies only to the ISV Plan (Reference 3). Therefore, the exceptions will be clearly documented at the relevant points within the ISV Plan, and will not be integrated into the DCD.

Question Rev 2:

Evaluation based on W response letter dated 2/2/10 – WEC states that closure of ITAAC #4 will be justified in DCD Rev. 17/18. This is an acceptable approach but the draft DCD markup did not fully address the wording of ITAAC #4. This should be done and further since exceptions are being taken, the DCD should reference where the exceptions are justified.

Westinghouse Response Rev 2:

The DCD Revision 18 will be updated to reference the five V&V documents as Tier 2* and to state that the V&V activities are in accordance with WCAP-15860 "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan" (Reference 7). The DCD will also state that there are exceptions relating to ISV and these exceptions are described and justified in the ISV Plan.

Question Rev 3 – Received in a NRC email dated June 23, 2010:

RAI-23 R1 commits to note the closure of DAC item #4 from Revision 15 of the DCD. The DCD revision provided in Rev 2 of the response does not address this commitment. Does

Westinghouse still plan to make a statement in the DCD addressing the closure of DAC/ITAAC #4?

Westinghouse Response Rev 3:

Westinghouse deleted the HFE program verification and validation implementation plan (Activity No. 4) from the AP1000 Design Control Document Revision 17, Tier 1 Section 3.2 Human Factors Engineering. Per the request of the Staff, WEC will revise the current Activity No. 1 to include a statement that the development of the plan is compete with the issuance of the five Verification and Validation documents. These documents and their numbers will be identified within that same section of the DCD.

References:

1. WCAP-16796-P (APP-GW-GLR-084), Rev. A, "AP1000 Human Factors Engineering Verification and Validation," Westinghouse Electric Company LLC.

2. APP-OCS-GEH-120, "AP1000 Human Factors Engineering Design Verification Plan," Westinghouse Electric Company LLC. (Reference 1).

3. APP-OCS-GEH-220, "AP1000 Human Factors Engineering Task Support Verification Plan," Westinghouse Electric Company LLC. (Reference 2).

4. APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Westinghouse Electric Company LLC. (Reference 3).

5. APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC. (Reference 4).

6. APP-OCS-GEH-520, "AP1000 Plant Startup Human Factors Engineering Verification Plan," Westinghouse Electric Company LLC. (Reference 5).

7. WCAP-15860, Rev. 2, "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

The DCD markup below is provided below to indicate the proposed changes in section 18.11. The markup is based on DCD Revision 17.

Tier 1, Section 3.2 Human Factors Engineering

Design Description

The AP1000 human-system interface (HSI) will be developed and implemented based upon a human factors engineering (HFE) program. Figure 3.2-1 illustrates the HFE program elements. The HSI scope includes the design of the operation and control centers system (OCS) and each of the HSI resources. For the purposes of the HFE program, the OCS includes the main control room (MCR), the remote shutdown workstation (RSW), the local control stations, and the associated workstations for each of these centers. The HSI resources include the wall panel information system, alarm system, plant information system (nonsafety-related displays), qualified data processing system (safety-related displays), and soft and dedicated controls. Minimum inventories of controls, displays, and visual alerts are specified as part of the HSI for the MCR and the RSW.

The MCR provides a facility and resources for the safe control and operation of the plant. The MCR includes a minimum inventory of displays, visual alerts and fixed-position controls. Refer to item 8.a and Table 2.5.2-5 of subsection 2.5.2 for this minimum inventory.

The remote shutdown room (RSR) provides a facility and resources to establish and maintain safe shutdown conditions for the plant from a location outside of the MCR. The RSW includes a minimum inventory of displays, controls, and visual alerts. Refer to item 2 and Table 2.5.4-1 of subsection 2.5.4 for this minimum inventory. As stated in item 8.b of subsection 2.5.2, the protection and safety monitoring system (PMS) provides for the transfer of control capability from the MCR to the RSW.

The mission of local control stations is to provide the resources, outside of the MCR, for operations personnel to perform monitoring and control activities.

~~4.An HFE program verification and validation implementation plan is developed in accordance with the programmatic level description of the AP1000 human factors verification and validation plan. The implementation plan establishes methods for conducting evaluations of the HSI design.~~

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Implementation of the HFE program includes activity 1 below. The MCR includes design features specified by items 2 through 4 below. The RSW includes the design features specified by items 5 through 8 below. Local control stations include the design feature of item 9.

~~(1)~~1. ~~An HFE program verification and validation implementation plan is developed in accordance with the programmatic level description of the AP1000 human factors verification and validation plan. The implementation plan establishes methods for conducting evaluations of the HSI design.~~

The HFE program verification and validation implementation plans ~~program~~ are~~is~~ ~~performed~~ developed in accordance with the ~~HFE~~ programmatic level description of the AP1000 human factors verification and validation plan ~~and includes the following activities:~~. The implementation plans establish~~e~~ the~~s~~ methods for conducting evaluations of the integrated HSI design. The development of the HFE verification and validation plans~~p~~ are ~~rogram is~~ complete. The following documents were developed:

a) HSI t~~T~~ask support verification - APP-OCS-GEH-220, "AP1000 Human Factors Engineering Task Support Verification Plan," Westinghouse Electric Company LLC

b) HFE design verification - APP-OCS-GEH-120, "AP1000 Human Factors Engineering Design Verification Plan," Westinghouse Electric Company LLC

c) Integrated system validation - APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Westinghouse Electric Company LLC

d) Issue resolution verification - APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC

e) Plant HFE/HSI (as designed at the time of plant startup) verification - APP-OCS-GEH-520, "AP1000 Plant Startup Human Factors Engineering Verification Plan," Westinghouse Electric Company LLC

2. The MCR includes reactor operator workstations, supervisor workstation(s), safety-related displays, and safety-related controls.

3. The MCR provides a suitable workspace environment for use by MCR operators.

4. The HSI resources available to the MCR operators include the alarm system, plant information system (nonsafety-related displays), wall panel information system, and nonsafety-related controls (soft and dedicated).

5. The RSW includes reactor operator workstation(s) from which licensed operators perform remote shutdown operations.

6. The RSR provides a suitable workspace environment, separate from the MCR, for use by the RSW operators.

7. The HSI resources available at the RSW include the alarm system displays, the plant information system, and the controls.

8. The RSW and the available HSI permit execution of tasks by licensed operators to establish and maintain safe shutdown.

9. The capability to access displays and controls is provided (controls as assigned

Tier 2, Table 1.6-1 (Sheet 19 of 20)

Table 1.6-1 (Sheet 19 of 20)

MATERIAL REFERENCED

DCD Section Number	Westinghouse Topical Report Number	Title
18.6	WCAP-14694	Designer's Input to Determination of the AP600 Main Control Room Staffing Level, July 1996
18.7	[*WCAP-14651*	*Integration of Human Reliability Analysis with Human Factors Engineering Design Implementation Plan, Revision 2, May 1997]**
18.8	[*WCAP-14651*	*Integration of Human Reliability Analysis with Human Factors Engineering Design Implementation Plan, Revision 2, May 1997]**
	[*WCAP-15860*	*Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan, Revision 2, October 2003]**
	[*WCAP-14695*	*Description of the Westinghouse Operator Decision Making Model and Function Based Task Analysis Methodology, July 1996]**
	WCAP-14655	Designer's Input to the Training of the Human Factors Engineering Verification and Validation Personnel, Revision 1, August 1996
	WCAP-14690	Designer's Input to Procedure Development for the AP600, Revision 1, June 1997
	WCAP-10170	Emergency Response Facilities Design and V&V Process, April 1982
	WCAP-14694	Designer's Input to Determination of the AP600 Main Control Room Staffing Level, July 1996
	[*WCAP-14396*	*Man-in-the-Loop Test Plan Description, Revision 3, November 2002*]*
18.9	WCAP-14690	Designer's Input to Procedure Development for the AP600, Revision 1, June 1997
18.10	WCAP-14655	Designer's Input to the Training of the Human Factors Engineering

		Verification and Validation Personnel, Revision 1, August 1996
18.11	[*WCAP-15860*	*Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan, Revision 2, October 2003*]*
	[APP-OCS-GEH-120	*AP1000 Human Factors Engineering Design Verification Plan, Revision B, Westinghouse Electric Company LLC.*]*
	[APP-OCS-GEH-220	*AP1000 Human Factors Engineering Task Support Verification Plan, Revision B, Westinghouse Electric Company LLC.*]*
	[APP-OCS-GEH-320	*AP1000 Human Factors Engineering Integrated System Validation Plan, Revision D, Westinghouse Electric Company LLC.*]*
	[APP-OCS-GEH-420	*AP1000 Human Factors Engineering Discrepancy Resolution Process, Revision B, Westinghouse Electric Company LLC*]*
	[APP-OCS-GEH-520	*AP1000 Plant Startup Human Factors Engineering Verification Plan, Revision B, Westinghouse Electric Company LLC.]**

Tier 2, Section 18.11 Human Factors Engineering Verification and Validation

A programmatic level description of the AP1000 human factors engineering verification and validation program is provided by Reference 1. Figure 18.11-1 shows the verification and validation activities conducted as part of AP1000 human factors engineering program. Using the programmatic level description, the development of an implementation plan for the AP1000 human factors engineering verification and validation is executed and documented as discussed in Reference 2. The implementation of the verification and validation activities is detailed in the five documents References 3 to 7.

The verification and validation activities are in accordance with Reference 1. There are a number of exceptions in respect to Integrated System Validation. The details of these exceptions and the corresponding justifications are provided in Reference 5.

18.11.1 Combined License Information

The Combined License information requested in this subsection has been fully addressed in Reference 2 (APP-GW-GLR-084). No additional work is required by the Combined License applicant to address the Combined License information requested in this subsection.

The following words represent the original Combined License Information Item commitment, which has been addressed as discussed above:

> Combined License applicants referencing the AP1000 certified design will address the development, execution and documentation of an implementation plan for the verification and validation of the AP1000 human factors engineering program. The programmatic level

description of the AP1000 verification and validation program, presented and referenced by Section 18.11, will be used by the Combined License applicant to develop the implementation plan.

18.11.2 References

[1. *WCAP-15860, "Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan," Revision 2, October 2003.*]*

2. APP-GW-GLR-084, "AP1000 Human Factors Engineering Verification and Validation," Westinghouse Electric Company LLC.

[3. *APP-OCS-GEH-120, "AP1000 Human Factors Engineering Design Verification Plan," Revision B, Westinghouse Electric Company LLC.*]*

[4. *APP-OCS-GEH-220, "AP1000 Human Factors Engineering Task Support Verification Plan," Revision B, Westinghouse Electric Company LLC.*]*

[5. *APP-OCS-GEH-320, "AP1000 Human Factors Engineering Integrated System Validation Plan," Revision D, Westinghouse Electric Company LLC.*]*

[6. *APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Revision B, Westinghouse Electric Company LLC*]*

[7. *APP-OCS-GEH-520, "AP1000 Plant Startup Human Factors Engineering Verification Plan," Revision B, Westinghouse Electric Company LLC.*]*

PRA Revision:

None.

Technical Report (TR) Revision:

None.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-46
Revision: 2

Question:

Margin for error - NUREG-0711 Section 11.4.3.2.7 (5) recommends that there be some allowance for margin of error in validation. In some cases the time criteria for RIHAs do not appear to provide sufficient margin. For example,

- ADN-MAN03 (3 min. estimated time versus 5 min. required time window)
- ATW-MAN03 (0.5 min. estimated time versus 1 min. required time window)
- RHN-MAN04 (6 min. estimated time versus 10 min. required time window).

Please discuss and justify.

Westinghouse Response:

It is recognized that in a number of cases the estimated time and the required time windows for the Risk-Important Human Actions (RIHA) are relatively close. The time information was derived from the PRA, and therefore it can not be altered (in the ISV Plan). The detailed AP1000 design has been demonstrated to have a very low likelihood of violating critical limits. For example, design requirements, safety analysis, the PRA and Technical Specifications each incorporate conservative assumptions and explicit margins to provide this assurance. In addition, the ISV includes a number of general conservatisms to provide added confidence in the results. Some of the scenarios are demanding, and coupled with the relative inexperience of the test subjects, actual crew performance in an operating plant is highly likely to be better than that demonstrated in ISV.

The time to perform RIHAs will be closely monitored. If a case is occurs where the time available (i.e., the required time window) is potentially insufficient to ensure reliable operator performance, this will be identified as an HED. Subsequently, the cause of the problem and an appropriate resolution (e.g., added training, revised procedures, change to the HSI design, etc.) will be determined. Resolution of the corresponding HED will seek to mitigate any actual problem in the design. It is also noted that insufficient time to complete a RIHA in ISV will suggest that the human error probability (HEP) for that action in the PRA may have been underestimated. This information will be communicated to the group responsible for the PRA.

Question Rev 1:

Evaluation based on review of 320 Rev. C, and 321: The wording of the response was acceptably added to 320 Rev. C, Section 6.2.1. Review of 321, including the observer guide for Scenario 12, noted that for RIHAs, the document is not completely clear on how the actual times to complete a RIHA would be measured/determined. Also there didn't seem to be a specified place for recording this information. The observer guide only has a SAT/UNSAT column. WEC

needs to clearly specify the events that start and stop the time clock. This didn't seem consistent between the scenario description (Table A12-1) and the observer guide. The Scenario 12 guide seems to start on red path announcement rather than a physical parameter such as CET ≥1200 °F. Please clarify and update documents as necessary. Open

Westinghouse Response Rev 1:

For all scenarios containing a Risk-Important Human Action, the scenario descriptions in APP-OCS-GEH-321 (Appendix A) state the Risk-Important Human Actions. This information comprises a table denoting the basic event identification, event description, time window trigger, procedures and the corresponding time windows. Three of the scenario descriptions have been updated in APP-OCS-GEH-321, Rev B. One of these scenarios (Scenario 12) contains two Risk-Important Human Actions, and the information in the aforementioned table will be expanded to include the starting and ending steps. In future revisions of APP-OCS-GEH-321, all of the other applicable scenario descriptions will be updated to include the starting and ending step information.

The Observer Guides will be modified to ensure that the starting and ending time for the Risk-Important Human Actions are recorded. The Sequence of Events column will include the starting step and a designated space for the observer to record the time. Likewise, the ending step will be included in the Sequence of Events column, and the observer will be provided with a clearly marked space to enter the end time. From the starting and ending times, it will be straightforward to calculate the total task time for the Risk-Important Human Action and compare it against the 'available time window' as per the PRA. In APP-OCS-GEH-321, Rev B, the Observer Guide for Scenario 12 will be modified accordingly. The Observer Guides for the other scenarios containing a Risk-Important Human Action(s) will be updated to include this information in a future revision

It is recognized that it may not be 'easy' for the observers to accurately identify the time of the start and ending step. For example, the observers' attention may be elsewhere and they could be inaccuracies in their time recording. However, there will be multiple observers, plus there will be discrete event recording (providing a time-stamped record of manual actions, automatic actions and component state changes), plant performance recording (providing a time-stamped record of plant behavior and operating performance) and video and audio recording. This data will be utilized to confirm the results obtained via the Observer Guides and support the evaluation of the time taken to complete the Risk-Important Human Actions.

Question Rev 2 – Received in a NRC email dated June 23, 2010:

Scenario 12 contained Risk Important Human Actions (RIHA). Four issues were identified as a result of the review of scenario 12. These issues need to be addressed. A supplement to RAI-46 containing the changes required can be treated as a confirmatory item in the SER.

1. The observer guide for scenario 12 still does not calculate and record the actual total task time for the RIHA for comparison with the time window.

2. Table A.12.1 provides a column for the time window trigger and a column with the time window (e. g., 20 min). The time window col. also gives a bracketed comment regarding when the time starts, which should be the time window trigger. This bracketed note differs from the trigger for both RIHAs.

3. It appears from Table A.12.1 that you need both hi core temp. and hi containment rad. level for the trigger. Note that Table A.12-3 has hi containment rad. level 23 minutes after the hi core temp. But the PRA/HRA and the Scenario 12 Observer Guide imply the time trigger is just hi core temp.

4. The Scenario 12 Observer Guide, for the RIHA VLN-MAN01, on page B-10 states that crew completes action within 15 minutes of completion of step 1. But that appears to shorten the actual time which should start earlier, on hi core temp., according to the PRA/HRA and Table A.12.1.

Westinghouse Response Rev 2:

Each of the above questions are discussed below:

1. The 'Sequence of Events' column in the Observer Guides include a marked space where the observer records the time of the initiating condition and the time when the risk-important human action is completed. This is denoted by the completion of the associated step in the procedure. The actual task time will be calculated and recorded off-line by the HFE analysts following the trial completion. It was considered unnecessary to request the observers to carry out this calculation.

   It is also noted that the risk-important human action total task times will be determined by using the digital simulator recordings and the video and audio recordings (See the ISV Plan, APP-OCS-GEH-320, Section 6.2 'Methods', Reference 1). In particular, the digital simulator recordings will not be influenced by the observers' judgment or the observer missing a task step, event or operator action. Therefore, the digital recordings will provide objective confirmation of the results of the observations.

2. The procedure to perform the risk-important human action REN-MAN03 and VLN-MAN01 is FR-C.1 (APP-GW-GJP-210, Rev. 2, "Response to Inadequate Core Cooling", Reference 2). The only trigger for entry into FR-C.1 is high core exit temperature >1200^{0}F. Therefore, the trigger for both these risk-important human action is high temperature. The procedure steps require the operator to perform REN-MAN01 (Step 1) by actuating containment recirculation. Once this action is complete, the time window for VLN-MAN01 starts (Step 2).

From discussions with the Procedures Group and the PRA Group, it was confirmed that high containment radiation is not a trigger.

Table A.12-1 will be modified as shown below to clarify the time window triggers and the sequence of events. This will be included in a later revision of APP-OCS-GEH-321, "Human Factors Engineering Integrated System Validation Scenario Information".

Table A.12-1. Risk-Important Human Actions

Basic Event ID	Event Description	Time Window Trigger	Procedures	Time Window
REN-MAN03	Failure to recognize the need and failure to open recirculation valves to flood reactor cavity after core damage	Simulation of high incore temperatures (> 1200°F)	F-0 FR-C.1	5 minutes [following red condition on core cooling]
VLN-MAN01	Failure to recognize the need and failure to actuate the hydrogen control system, given core damage following a LOCA	Simulation of high incore temperatures (> 1200°F)	F-0 FR-C.1	15 minutes [following completion of containment recirculation actuation]

3. As described above, it was clarified with the Procedures Group and the PRA Group that the trigger for entry into FR-C.1 is high core exit temperature >1200^{0}F. Based on updated information, high containment radiation is not a procedure trigger. Therefore, the Scenario 12 Observer Guide is correct in that high temperature is the time window trigger for the risk-important human action REN-MAN03, followed by VLN-MAN01.

4. It is acknowledged that the documentation concerning REN-MAN03 and VLN-MAN01 is confusing. However, based on the latest PRA documentation and discussions with the PRA Group, the time windows and the justifications are as follows:

   REN-MAN03: The available time window is 5 minutes (and not 20 minutes as stated in APP-OCS-GEH-321, Scenario 12).

   The operator floods the reactor cavity at step one, upon entry into the procedure. This is earlier than the AP600 functional restoration guideline indicates cavity flooding. With the

single highest resistance flooding line open, the 98'elevation is reached within 65 minutes of opening the valves. For the lower resistance line, the 98' elevation is reached within 50 minutes. A minimum of 5 minutes is available for the operator to open the cavity flooding valves after the core-exit thermocouples reach 1200^{0}F. The criterion used for operator action to flood the cavity is the manual opening of at least 1 of 2 cavity flooding lines within 5 minutes of a core-exit thermocouple reading of 1200^{0}F.

VLN-MAN01: The available time window is 15 minutes (as currently stated in APP-OCS-GEH321, Scenario 12).

The time from core-exit temperature >1200^{0}F to the global flammability hydrogen limit (0.10 mass fraction hydrogen) is 19 minutes per analysis. This supports the 15-minute risk-important human action time window.

Table A.12-1 will be modified as shown in response to question 1 to update the available time windows, and the Observer Guide 'Expected Response' column will be changed to state that the available time window for REN-MAN03 is 5 minutes. This will be included in a later revision of APP-OCS-GEH-321, "Human Factors Engineering Integrated System Validation Scenario Information".

References:

1. APP-OCS-GEH-320, Rev. D, "AP1000 Human Factors Engineering Integrated System Validation Implementation Plan," Westinghouse Electric Company LLC.

2. APP-GW-GJP-210 (FR-C.1) (Proprietary), Rev. 2, "Response to Inadequate Core Cooling," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.