Westinghouse Electric Company
Nuclear Power Plants
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-6206
Direct fax: 724-940-8505
e-mail: sisk1rb@westinghouse.com

Your ref: Docket No. 52-006
Our ref: DCP_NRC_002681

November 2, 2009

Subject: AP1000 Response to Request for Additional Information (SRP 18)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 18. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP18-COLP-29	RAI-SRP18-COLP-36	RAI-SRP18-COLP-47
RAI-SRP18-COLP-31	RAI-SRP18-COLP-37	RAI-SRP18-COLP-48
RAI-SRP18-COLP-32	RAI-SRP18-COLP-41	RAI-SRP18-COLP-49
RAI-SRP18-COLP-33	RAI-SRP18-COLP-42	RAI-SRP18-COLP-50
RAI-SRP18-COLP-34	RAI-SRP18-COLP-44	
RAI-SRP18-COLP-35	RAI-SRP18-COLP-45	

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 18

D063
NRO

cc:	D. Jaffe	-	U.S. NRC	1E
	E. McKenna	-	U.S. NRC	1E
	P. Donnelly	-	U.S. NRC	1E
	T. Spink	-	TVA	1E
	P. Hastings	-	Duke Power	1E
	R. Kitchen	-	Progress Energy	1E
	A. Monroe	-	SCANA	1E
	P. Jacobs	-	Florida Power & Light	1E
	C. Pierce	-	Southern Company	1E
	E. Schmiech	-	Westinghouse	1E
	G. Zinke	-	NuStart/Entergy	1E
	R. Grumbir	-	NuStart	1E
	B. Seelman	-	Westinghouse	1E

ENCLOSURE 1

Response to Request for Additional Information on SRP Section 18

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-29
Revision: 0

Question:

When there is a failure on a trial, an assessment is made using the HED resolution procedure (APP-OCS-GEH-420). If the evaluation leads to a design change, e.g., to HSIs, procedures, or training, "the impact on the ISV itself must also be considered." The ISV Plan provides guidelines for adjusting the test plan when failures are encountered, including the following statement:

> 3. If the apparent cause of the problem is personnel or training, then testing may continue with the addition of a third replication for the scenario. Training may be revised during the ISV without implications.

What exactly does "without implications" mean? Since ISV addresses the integration of the HSI, procedures, and training, how can training be revised without implications?

If the assessment leads to a change in HSIs or procedures, modifications are made prior to the next replication. We understand the logic for taking this approach; not to run many additional trials after you know there is an issue. However, there are some concerns with this approach:

- If many such changes occur across testing, the design is a moving target and the impact of such cumulative changes on the results of successful replications run before the changes is unclear. Even if the ISV team considers the impacts of changes on the results, we are not confident the team can anticipate how a series of changes impacts the overall results.

- A trial-by-trial approach to design change may result in resolutions that address narrowly defined issues and preclude the team from looking at the bigger picture, e.g., where several related issues suggest a broader deficiency that needs to be addressed. For example, an HED resolution may lead to a change in the navigation system to address the problem. However, if navigation issues are identified in many scenarios, it may suggest a problem with the whole approach to navigation.

Please provide justification for the approach in the Plan or modify the approach to address the above concerns.

Westinghouse Response:

Each failure during a trial will result in a HED and formally recorded and tracked, per APP-OCS-GEH-420 (Reference 1). If a failure occurs that is simply and obviously due to a training inadequacy, and is amenable to straightforward correction, then these inadequacies will be

rectified prior to conducting further trials. This will enable subsequent trials to be undertaken without the results being confused by a simple correction to operator training. Therefore the results of the subsequent trials will be of greater value as they will not be affected by a training issue. Any rectification due to a training inadequacy will not impact the number of trials to be conducted.

The same does not apply to failures and HEDs created due to issues associated with the procedures or the HSI designs. A correction to the procedures or the HSI designs will not be made part way through ISV; even if the problem or failure was a simple, isolated occurrence, and not indicative of a larger problem. For example, if during the first trial of a particular scenario, an operator identified an incorrect valve number on a process display, this will be recorded as an HED. The second and third trials will continue to be run without any changes to the process displays to correct the problem i.e., the test remains unchanged and is not a moving target. If the operators in the second and/or third trials identified the same problem, then this will be recorded in the HED to note that the problem was identified two or three times, as appropriate.

However, it is important to note that the completion of other V&V activities prior to ISV, and the ISV preparation itself, should avoid this type of procedure and HSI design issue from occurring. By the time ISV is implemented, it is anticipated that corrections required due to simple errors in the procedures and HSI designs should be minimal and highly unlikely. These activities include procedure validation, task support verification (APP-OCS-GEH-220, Reference 2), design verification (APP-OCS-GEH-120, Reference 3) and the ISV pilot testing. In addition, if a procedure or a HSI design does need to be revised before all of the scenario trials are completed, then the scenario will be performed three times using the revised procedure or HSI design. Changes to procedures and HSI designs will be subject to configuration control procedures.

It is recognized that if a relatively large number of HEDs are generated, the appropriate corresponding changes are likely to impact the results of prior successful trials. APP-OCS-GEH-420 (Reference 1) describes the process to evaluate the possible combined effects of multiple HEDs and their potential solutions. If there are numerous HEDs and changes to training, procedures and/or the HSI designs, the associated scenario will be revalidated.

Westinghouse considers that this approach addresses the concerns stated in the RAI question. This approach will be described in detail in ISV Plan, Revision C, to be issued by 31st January 2010.

References:

1. APP-OCS-GEH-420, "AP1000 Human Factors Engineering Discrepancy Resolution Process," Westinghouse Electric Company LLC.

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

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

Design Control Document (DCD) Revision:

None.

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-31
Revision: 0

Question:

The ISV Plan contains considerable detail in some areas, but not others. As noted in the ISV Plan itself, Section 3.4 indicates that detailed procedure development and scenario development must be completed before validation testing can begin. Such detail also must be completed before the staff can conduct a complete Implementation Plan Review. Additional examples of areas where additional detail is needed are given in the other RAIs in this Table. Please provide the added detail.

Westinghouse Response:

The detailed scenario descriptions will be completed in Revision C of the ISV Plan, to be issued by 31st January 2010. This will include the scenario-specific descriptions, initial conditions, sequence of events, participants, termination criteria, plant performance and personnel performance measures and criteria. The observer guides for each of the scenarios will be completed in later revisions of the ISV Plan (i.e., after Rev C), following the completion of corresponding ISV detailed scenario descriptions and operating procedures.

Numerical revisions of all EOPs are currently available for NRC review at any time. Walk-through validations being conducted by the AP1000 Operations Procedure group will continue to improve the fidelity and accuracy of these procedures.

The process for the development, review and approval of AP1000 Operations Procedures is included in the Writer's Guidelines, APP-GW-GJP-100 and APP-GW-GJP-200 (References 1 and 2, respectively). These documents have been placed on the docket with the NRC for the AP1000, and this process is additionally defined in APP-GW-GLR-040 (Reference 3), which has been submitted to the NRC for review and approval. This process incorporates proven techniques and operational experience to ensure that the AP1000 Operations Procedures are developed in accordance with regulatory guidelines and industry standards.

It is noted that the actual implementation of ISV is not scheduled to take place for some time. Between now and ISV implementation, Westinghouse will continue to progress the preparations for ISV taking into account further detailed and final information on the OCS and HSI designs, the simulator, procedures and training programs. To assist the preparation activities, there will be further interim revisions of the ISV Plan (i.e., after Rev C) to support preparation activities. Prior to ISV, the ISV Plan will be issued as Revision 0 and placed under formal configuration control. Revision 0 will contain the final approved details of the scenarios, including all the aspects mentioned in the first paragraph of this RAI Response. It is recognized that the NRC needs detailed information in order to complete the implementation plan review process. Therefore, Westinghouse will provide detailed information in ISV Plan, Rev C, (by 31st January

2010) to facilitate the review process with the aim of demonstrating that the detailed scenario-specific information will meet the NRC's expectations. Some of the detailed information may be subject to change as the design finalization program continues; although this should not impact the outcome of the NRC's review.

References:

1. APP-GW-GJP-100, Rev. H, "Writer's Guideline for Normal Operating Procedures," Westinghouse Electric Company LLC.

2. APP-GW-GJP-200, Rev. E, "Writer's Guideline for Two Column Procedures," Westinghouse Electric Company LLC.

3. APP-GW-GLR-040, Rev. 1, "Plant Operations, Surveillance, and Maintenance Procedures," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

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-32
Revision: 0

Question:

The plan distinguished between measures used for pass/fail (P/F) criteria and those used for diagnostic purposes. P/F measures are measures reflecting tech spec performance and risk-important human actions (RIHAs) as defined in the PRA. This seems to provide a limited perspective on overall crew performance. Section 4.4 of the WCAP discusses "Risk important tasks" as including potential task identified in the OSA and EOPs as well as those identified in the PRA. The EOP tasks are likely captured in the scenarios. Are there any added important tasks from the task analysis?

Westinghouse Response:

The P/F criteria provide the lower limits on acceptable operation and are consistent with the AP1000 plant safety and risk analyses. However, the P/F criteria are not the only means to assess successful trial performance. The P/F criteria also ensure that a margin is maintained to unsafe conditions and unacceptable accident results.

In contrast to the P/F criteria, diagnostic criteria allow a wider perspective on crew performance, including scenario-specific measures. This allows any concerns for acceptable performance to be identified and raised as an HED. The conclusion as to whether performance is acceptable also takes into account the integrated evaluation of all the validation results.

It can be confirmed that the risk-important tasks (and outlined in WCAP-15860 Section 4.4, Reference 1) are included in the ISV scenarios. Also, the following tasks from the OSA-2 task analysis (APP-OCS-J1R-220, Reference 2) are included:

- OSA-2 Task 22, "Failure to Close Equipment Hatch and Personnel Airlocks" – This task will be incorporated as a complication to one of the lower operating mode scenarios.

- OSA-2 Task 23, "Data Display and Processing System (DDS) Failure" – The ISV scenario Plant Shutdown from PMS based on the loss of the DCIS is representative of a DDS failure task.

- OSA-2 Task 24, "Loss of Computerized Procedure System" – Anticipated Transient Without SCRAM (Steamline Break) will include the loss of the computerized procedure system as a scenario complication.

- OSA-2 Task 25, "Technical Specification Monitoring" – This activity is implicit across a number of the ISV scenarios. The evaluation criteria in each scenario will specify a

representative sample of Technical Specification monitoring tasks, and will incorporate maintenance, test, inspection and surveillance tasks.

- OSA-2 Task 26, "Control Room Evacuation" – Plant Shutdown and Cooldown from the Remote Shutdown Panel based on a fire in the MCR. This scenario will address the transfer of control and operation from the MCR to the Remote Shutdown Room, establish plant control and utilize the Remote Shutdown Workstation to conduct plant cooldown.

The tasks derived from the OSA-2 analysis results which were not previously included in the ISV Plan, Rev B, will be added to the ISV Plan, Rev C, to be issued by 31st January 2010. The ISV Plan will clearly identify the source of the selection. Therefore, it can be confirmed that the risk-important tasks and the additional important tasks identified in the OSA-2 analysis will be incorporated in ISV.

References:

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

2. APP-OCS-J1R-220, Rev. B, "Operational Sequence Analysis (OSA-2) Summary Report," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

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-33
Revision: 0

Question:

The ISV Plan indicates that risk-important actions will be measured. In addition, operator task performance will also be measured using observer guides for each scenario. An example is provided in Appendix F. However, the ISV plan does not address how these behaviors are selected for assessment. Please discuss.

In addition, Appendix F provides an example only. The task behaviors to be assessed for each scenario are needed for the implementation plan review. Please provide.

Westinghouse Response:

Observer guides will be provided for each individual scenario, and will be based on the associated procedures, job and task analysis information. The operator behaviors (actions or tasks) selected for assessment are the actions identified by the procedures to address the conditions of the scenario. The observer guides are in part a subset of the applicable procedures, formatted to facilitate the identification of the expected course of events, the operator behaviors and the applicable criteria for those behaviors. Where applicable, the observer guides will also incorporate the task identification, task breakdown and job analysis information developed as part of the operator training program and training materials.

Westinghouse will provide the scenario-specific observer guides in later revisions of the ISV Plan (i.e., after Rev C). The observer guides cannot be completed until the detailed ISV scenario descriptions are finished (which will be incorporated into the ISV Plan, Rev C, to be issued by 31st January 2010). However, to assist the implementation plan review process, the ISV Plan, Rev C, will contain an example of a detailed observer guide for at least one of the ISV scenarios.

References:

None.

Design Control Document (DCD) Revision:

None.

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-34
Revision: 0

Question:

The plan generally indicates that plant measures will be obtained, but the specific measures for each scenario are not identified. For example, the plant measures section in the scenarios is generic and repeated for all 29 scenarios. This should be made scenario specific and identify parameters of particular interest. Since the ISV Plan is using the tech specs (TS) as key criteria, the scenario description should identify which TS are expected to automatically be violated as a result of the scenario imposed failures. Then all the remaining TS should be required to be met; otherwise the scenario should fail to meet the acceptance criteria. The scenario should identify those TS particularly important and at risk during the scenario. Please provide this added information.

Westinghouse Response:

A standard wide range of events and plant measures will be collected for all the scenarios using the recording features of the simulator. Specific plant measures of particular interest, which will be a subset of the previously mentioned range of events and plant measures, will be specified for each scenario.

Each scenario description will reference the Technical Specifications of particular interest and importance. This will include the identification of any Technical Specifications that are expected to be violated as a result of any complications or failures that are an integral part of the scenario. The Technical Specifications are a highly interrelated, and include the measured variables, applicable limits (i.e., criteria) and the required responses when the limits are exceeded. Therefore, they provide a very useful means to assist in measuring performance.

In the detailed scenario descriptions, Westinghouse will identify the scenario-specific Technical Specifications which are required in order for the individual scenarios to meet the associated acceptance criteria. This will be provided in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-35
Revision: 0

Question:

The ISV Plan does not address measurement characteristics. It is recognized that most of the measurement characteristics identified in Review Criterion 1 in NUREG-0711, Section 11.4.3.2.5.1 will not be applicable to many of the measures, but the plan should at least address the characteristics identified in Section 11.4.3.2.5.1 that are applicable. For example, the plan can explain how the questionnaire in Appendix D measures those variables listed on page 6-1 (workload, situation awareness, teamwork, usability, and goal achievement) and why their approach to measuring these variable in this way is a good one. The plan also indicates that the questionnaire will be filled out by both participating operators and observers. But, it is not clear how observers can answer many of the questions presented, e.g., "Was there anything about the PMS, PDSP, or SDSP surprising, misleading, or unclear?" Please update the Plan to address these issues.

Westinghouse Response:

The measurement characteristics used in the ISV are described in Section 6.1 of the ISV Plan, Rev B. These are described below along with the corresponding measurement characteristics identified in Section 11.4.3.2.5.1 of NUREG-0711, which are noted at the applicable points in italics:

1. Workload Rating Scales - The Task Load Index (TLX) is a widely used measure of subjective mental workload and has been subject to many years of research and application by NASA (*construct validity*). After each scenario is completed, the TLX is administered to the test subjects (*unintrusiveness*), and the data is relatively straightforward to process (*simplicity*). The TLX ratings capture both high and low levels of workload (*sensitivity/scale*), although whether the workload levels are acceptable or appropriate is determined in respect to the situation and scenario. In addition, separate TLX subscales for different components of subjective workload (*resolution*) will provide useful information as to the sources of workload (*diagnosticity*).

2. Questionnaires (Appendix D) – Likert scale ratings are general tools of subjective measurement. In ISV, a post-test questionnaire will be given to the operators and observers in order to investigate specific areas of interest and to assess workload, situation awareness, team work, and goal achievement (*construct validity*). The questionnaires will administered to the test participants after the trail is completed (*unintrusiveness*) and the data is straightforward to process (*simplicity*). Likert scales are developed to give a full and uniform rating range for each answer (*sensitivity*), reflecting

both good and bad results (*impartiality*). In addition, multiple questions for each of the areas of interest (*resolution*) will provide an insight into observed operator performance (*diagnosticity*).

The questionnaire (Appendix D) will be modified to take into account that certain questions cannot be readily answered by both the operators and the observers alike. Two versions of the questionnaire will be provided – one for operators and one for observers.

3. Observer Checklists (Appendix F) – These checklists will assist observers in focusing on and identifying the key instances of task performance that correspond to successful operator performance, as planned for each scenario (*objectivity*). The observer checklists use the operating procedures as a basis, and therefore, the checklists are highly valid in terms of content (*construct validity*). The use of the observer checklists does not interfere with the test performance by the subjects/operators. The results obtained from the checklists are straightforward to process (*simplicity*).

   It is noted that the observer checklist entries are most helpful when the events and behavior follow the anticipated course of the scenario (*sensitivity*), as they are prepared in terms of 'good' performance (*impartiality*). Also, note that the level of detail is relatively less than contained in the actual procedures, due to the real-time needs and limitations of observation (*resolution*). The repeatability of the checklist results is anticipated to be relatively high, because there is redundancy across observers; plus the results can be subsequently confirmed by the event and plant performance recordings (*reliability*).

4. Debriefing (Appendix G) – Debriefing supports the clarification of the other more structured results (*diagnosticity*), and allows for both good and bad results to be reported (*impartiality*). The debriefing process consisting of a guided but open discussion on the participants' test experiences, perceptions and concerns (*simplicity*). While individual and group dynamics may affect the course and results of any discussion, the repeatability of the process and results will be supported by provision of a debriefing protocol and the use of meeting recorders (*reliability*).

5. Discrete Event Recording – Computer-generated records of time-stamped actions, status changes of equipment, and other discrete events are used to evaluate time margins and will assist in confirming the results of the subjective observations (*objectivity*). The event records provide a factual history, the event recording does not interfere with test performance by the subjects (*unintrusiveness*), and because the event records are generated in computer form, these results will be relatively easy to process (*simplicity*). Furthermore, the event records are not influenced by any subjective judgments of performance quality (*impartiality*). The level of detail is defined intrinsically by the events themselves and the I&C database structure (*resolution*). Finally, the event

records are particularly useful for understanding the overall course of events and operator responses (diagnosticity) and provide a repeatable measure (*reliability*).

6. Plant Performance Recording – The continuous recording of plant parameter values over time has much in common with discrete event recording as previously described in terms of measurement characteristics (*objectivity, construct validity, unintrusiveness, simplicity, impartiality, resolution* and *diagnosticity*). A major difference is that the sampling intervals for plant performance recordings are taken at fixed 1 second intervals. This interval is imposed to help make the relatively large amount of data more manageable. However, it is sufficient for the identification and subsequent assessment of operator actions and the plant response (*sensitivity*). As a result of the fixed sampling intervals, the repeatability of plant performance recording is high *(reliability)*.

7. Video and Audio Recording - The use of video and audio recording supports the capturing of events and will assist in the use of the other measurement characteristics described above (*diagnosticity*). This data will record both good and bad results (*impartiality*). Also, it is relatively straightforward, consisting of the application of familiar equipment and technologies (*simplicity*).

Westinghouse will include the information described above, and the modified Appendix D (Post-Test Questionnaire), in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-36
Revision: 0

Question:

Acceptance criteria for Pass/Fail measures are generally discussed in Section 6.2. Each scenario has "Scenario Criteria," but it is not clear which criteria are mandatory and would result in scenario failure if not satisfied. The criteria are applied on a trial-by-trial basis. The general acceptance criteria are (1) no violation of safety limits (e.g., Tech Specs) due to operator error, and (2) completion of all RIHAs within available time windows of PRA. The acceptance criteria for diagnostic measures determine whether an HED is defined. These criteria are only briefly discussed. For example, sustained unawareness of the situation leading to error and extreme workload leading to error are diagnostic criteria. How either is determined is not identified. Also, the necessity of linking these measures to error seems unnecessarily liberal. Sustained unawareness of the situation and extreme workload would seem to be worthy of HED assessment in their own right. The specific measures and acceptance criteria to be used for each scenario are not given. Please update the Plan to address these issues.

Westinghouse Response:

Section 6.2 of the ISV Plan distinguishes between acceptance criteria and diagnostic criteria. Both types of criteria provide a basis for determining that if HED is required to be generated. However, diagnostic criteria do not necessarily define trial failure, and an assessment will be conducted to summarize the HED results and determine the overall conclusion as to whether the trial has indeed passed or failed.

In the ISV Plan, Rev B, Appendix E, the applicable subsections entitled "Scenario Criteria" in the individual scenario descriptions did not distinguish between the diagnostic criteria and acceptance criteria. Westinghouse will add this distinction for each scenario, and will provide scenario-specific acceptance criteria and diagnostic criteria as part of completing each detailed scenario description in the ISV Plan, Rev C, to be issued by 31st January 2010.

In addition, Westinghouse acknowledges that if workload is considered to be extreme relative to the situation, then a HED will be generated. Likewise, if crew situation awareness is determined to be poor, a HED will be generated. These HEDs will be created even if there is no actual operator error. Workload and situation awareness will be assessed by means of the Task Load Index (TLX) and the responses to the Likert-scaled questions that will be part of the post-test questionnaire completed by the scenario participants and scenario observers. Again, this additional information will be included in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-37
Revision: 0

Question:

The ISV Plan indicates that the test staff will be "trained in their respective roles." No information is provided concerning what the training will address. Please provide.

Westinghouse Response:

It can be confirmed that the training for the test staff will be sufficient to ensure effective execution of the test scenarios and data collection. The test staff will include Westinghouse personnel.

The training will incorporate specific instructions and schedules for the tasks to be performed over a given trial or trial period. In addition, training will be given on the importance of the test procedures and the possible impact of not following the test procedures. These instructions will be specific to each role, and roles will be rehearsed prior to testing. The training will include how and when to communicate with the test participants and provide preplanned responses to questions from the participants, wherever possible. This will help ensure consistency of test staff performance and behavior across the scenarios.

Additional details will be provided on the roles and training of test staff in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-41
Revision: 0

Question:

Anthropometrics - WCAP Section 4.8 lists several performance measures in the anthropometric and physiological area that will be evaluated in ISV, but the ISV plan has little treatment of them and indicates that these aspects of performance will be assessed using questionnaire items. They do not appear to be addressed in the observer checklist. Please address.

Westinghouse Response:

Westinghouse confirms that the ISV will evaluate the anthropometric and physiological features of the Main Control Room (MCR). These aspects of the design will be assessed using the questionnaires and observer checklists. Specifically, feedback will be solicited regarding the following items:

- Control room layout, such as room dimensions, physical access, carpeting, finishes, viewing distances and angles of view.
- Workstation and console configurations, such as workspace, reach, seating, console and panel dimensions.
- Climate environment, such as temperature, humidity and air movement.
- Visual environment, such as lighting, glare, display brightness and contrast, and visual fatigue.
- Auditory environment, such as noise levels and reverberation, auditory signals, verbal communication.

Not all of the above items will be exactly the same in the ISV facility as they will be in the actual MCR (once AP1000 is built). For example, the ISV facility floor area is the identical to the final plant design, but the ISV facility room has a lower ceiling height than the actual MCR, the ISV facility lighting system was developed prior to the MCR lighting design being available, the heating and ventilation is obviously provided by a typical office building ventilation system, and not a plant ventilation system, and so on. However, these aspects will be addressed in ISV. The results will provide useful information that can be extrapolated to the final plant design (e.g., if it is demonstrated that glare on the VDU screens is a potential problem, then this can be addressed via the HED process and rectified prior to plant startup activities).

Also note that HFE design verification process (APP-OCS-GER-120, Reference 1) will involve evaluating the above mentioned areas according to HSI design guidelines (APP-OCS-J1-002,

Reference 2). The objective of HFE design verification is to confirm that HSI resources and Operation and Control Centers Systems (OCS), including anthropometric and physiological features of the MCR, conform to the AP1000 HFE design guidelines, identify deviations, resolve deviations, and formally document the results.

This information will be added to the revised questionnaires being provided in Rev C of the ISV Plan, to be issued by 31stJanuary, 2010, and the revised observer guides will be provided in a later version of ISV Plan (i.e., after Rev C).

References:

1. APP-OCS-GER-120, "AP1000 Human Factors Engineering Design Verification Report", Westinghouse Electric Company LLC.

2. APP-OCS-J1-002, Rev. 0, "AP1000 Human System Interface Design Guidelines," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

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-42
Revision: 0

Question:

ISV test procedures - NUREG-0711 criterion 11.4.3.2.6.2, Test Procedures, provides guidance on the details of ISV test procedures. The ISV Plan does not provide this detail for each scenario. Please address.

Westinghouse Response:

Issues included in NUREG-0711 11.4.3.2.6.2, Test Procedure, have been addressed in the following sections of ISV Plan:

- Section 3, Test Design (i.e. identification of which crews receive which scenarios and the order that the scenarios will be presented).

- Section 6, Data (i.e. instructions regarding when and how to collect and store data, procedures for documentation).

- Appendix E, Scenario Specifications (i.e. detailed criteria for the conduct of specific scenarios).

Westinghouse recognizes that some scenario-specific details concerning the test procedures will be added, as part of completing each detailed scenario description in the ISV Plan, Rev C, to be issued by 31st January 2010. This includes the following information:

- Instructions for briefing the participants.

- Scripted response for test personnel who will be acting as plant personnel during the test scenarios.

- Guidance on when and how to interact with participants if simulator or testing difficulties occur.

Please note that the any information on test procedure may be subject to change, depending on factors such as the actual number of crew available for the ISV.

References:

None.

Design Control Document (DCD) Revision:

None.

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-44
Revision: 0

Question:

Pilot testing - The ISV plan does not discuss the participants in the pilot testing. The ISV crews should not be used for the pilot testing. Please confirm that they will not be used.

Westinghouse Response:

It can be confirmed that the test subjects for ISV will not be involved in pilot testing. The pilot testing will be performed by the Westinghouse simulator development staff, with support as needed from other Westinghouse personnel. In addition, care will be taken to ensure that the test participants do not obtain any prior knowledge of the scenarios to be used in ISV. This information will be added to the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-45
Revision: 0

Question:

Convergent validity - The ISV plan does not discuss convergent validity as recommended by NUREG-0711, Section 11.4.3.2.7(3). Please provide.

Westinghouse Response:

It is confirmed that Westinghouse will evaluate the convergence or consistency of the measures of performance, as recommended by NUREG-0711, Section 11.4.3.2.7. This is addressed in Section 7.2, "Analysis and Interpretation" in the ISV Plan, Rev B.

The degree to which convergent (i.e., consistent) results are obtained from different evaluation techniques will be analyzed qualitatively and documented in the ISV results report. In addition, it is noted that an independent verification of the analysis of the results will be performed.

Further details regarding the method to address convergent results will be included in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-47
Revision: 0

Question:

RI Systems - NUREG-0711, Sec. 11.4.1.2.1(2) states that the dominant systems (as measured by the PRA RAW and FV measures) should be represented in the validation scenarios. Please provide specifics to confirm that this is the case (i.e., which systems are considered dominant and in which scenarios they are tested).

Westinghouse Response:

Based on the Probabilistic Risk Assessment importance and sensitivity analysis (Reference 1), the most important AP1000 systems for core damage prevention are the Protection and Safety Monitoring System (PMS), Class 1E DC, Automatic Depressurization System (ADS) and the In-Containment Refueling Water Storage Tank (IRWST). These are all safety systems. By contrast, none of the non-safety systems have a high importance.

Westinghouse confirms that these dominant systems will be thoroughly represented in the ISV scenarios. In each scenario, the emphasis on one or another system will vary. For example, based on whether the system is given to operate properly or not, or whether a particular scenario places unusual demands on that system. The scenarios leading from Mode 1 through to safeguards actuation involve the dominant/safety system to varying degrees. In addition, a number of other abnormal and emergency events, including lower mode events, exercise these systems in a number of diverse ways.

This information will be included in the ISV Plan, Rev C, to be issued by 31st January 2010. The representation of the dominant systems by the scenarios will be explicitly identified in the ISV Plan, Rev C.

References:

1. APP-GW-GL-022, Rev. 0, "AP1000 Probabilistic Risk Assessment, Chapter 50, Importance and Sensitivity Analysis," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

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-48
Revision: 0

Question:

Scenario definition - Section 11.4.3.2.4 of NUREG-0711 provides guidance for scenario definition. Two areas require more information, based on review of the 3 nearly complete scenarios.

1. One item is "the precise specification of what, when and how data are to be collected and stored." Each scenario currently provides general guidance rather than scenario-specific data (e. g., Section 12.8). Please clarify how and when the scenario-specific data will be specified.
2. One item is "specific criteria for terminating the scenario. " For Scenario E.12 this is given as "The opening of the ... valves to flood the reactor core." This seems too simplistic, in that perhaps operators may take this action incorrectly very early in the scenario, short-cutting much of the actions that the scenario is testing. What about possible multiple criteria and selecting the later of two of more, as an example?

Westinghouse Response:

In response to the two areas requiring more information:

1. Westinghouse agrees that the precise specification of what, when and how data are to be collected and stored will be added as part of completing each scenario in the ISV Plan, Rev C, to be issued by 31st January 2010.

   A standard set of discrete events and plant parameters will be collected for all scenarios using the installed recording features of the simulator. Variables of particular interest, which is a subset of this data set, will be specified for each scenario. This will include reference to key Technical Specifications.

2. Westinghouse agrees that termination criteria should be selected to promote the exercise of each scenario in its entirety. This will include the consideration of using multiple criteria to assist in ensuring that short-cuts do not occur. Westinghouse will revise and complete the scenario-specific termination criteria as part of completing each scenario n the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

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-49
Revision: 0

Question:

Selection of Scenarios - Scenarios selected for validation generally appear to comply with the criteria in WCAP-15860 and NUREG-0711. A few areas appeared to either be missing or the staff could not identify the specific scenario that addressed the below areas:

- OER-identified difficult tasks
- use of administrative procedures
- communication between MCR and offsite (e. g., plant management, EOF or NRC)
- situational factors in NUREG-0711 section 11.4.1.2.1 (3)

Westinghouse Response:

The AP1000 human factors engineering program incorporates the results from the Operating Experience Review (Reference 1) during the design phase. However, there are relatively few cases where specific tasks suitable for scenario-based assessment in ISV are identified. Nevertheless, there are two specific cases identified from the Operating Experience Review that will be incorporated into the ISV. These are as follows:

- Low-power feedwater control (Item 122, Reference 1) – The resolution of difficult low-power feedwater control and the transition to main feedwater control will be exercised in the scenario for plant startup from Mode 2 to Mode 1 (Scenario 6 in the ISV Plan, Rev B). In addition, a number of other scenarios will make routine but limited use of startup feedwater.

- Remote valve stroke testing (Item 152, Reference 1) – Remote stroke testing, for example, of the CMT discharge valves, will be performed in the scenario for large break LOCA with inadequate core cooling (Scenario 12 in the ISV Plan, Rev B).

Many of the ISV scenarios will address the situational factors identified in Section 11.4.1.2.1(3) of NUREG-0711. In addition, complications are utilized to introduce or emphasize particular aspects of operator performance, as follows:

- Operationally difficult tasks, high-workload conditions, and varying-workload situations – These are addressed in a majority of the ISV scenarios to varying degrees. All emergency events, and particularly those with risk-important human actions, include beyond design basis failures and other complications. Normal operating scenarios include similar complications and will span the full range of operations from Modes 1 to 5. Tasks of notable concern, such as the drain-down to midloop plant conditions in Mode 5, will be identified as an operator task of particular importance within the individual scenario specifications.

- Error-forcing contexts – Although the AP1000 design strives to preclude error-forcing contexts, they will be incorporated in scenarios where plausible opportunities to do so are identified. For example, the unrecognized existence of a protective system block, or a common mode alignment error of certain level instruments, may invite the operators to overlook and consequently omit the timely manual actuation of a protective function.

- Fatigue and circadian factors (e.g., due to shift rotation or sleep deprivation) – These are uncontrolled conditions of the test subjects across scenarios, and are not addressed in the scenarios. However, some self-report data (e.g., on schedule history) will be collected in order to characterize the subjects at the time of testing.

- Environmental factors – The degradation of the environmental conditions in the main control room (MCR) will be addressed by isolation of the MCR and a station blackout.

The use of administrative procedures will be incorporated in a number of the scenarios (as appropriate) and as added complications. The occurrence of communications between the personnel located in the MCR and offsite personnel will be incorporated in a number of accident scenarios.

Westinghouse will provide the information described above in the detailed scenario descriptions in the ISV Plan, Rev C, to be issued by 31st January 2010.

References:

1. APP-OCS-GJR-001, Rev. 0, "Human Factors Engineering Operating Experience Review Report for the AP1000 Nuclear Power Plant," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

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-50
Revision: 0

Question:

Development of ISV scenarios - WCAP-15680 page 4-3 states that the ISV scenarios will be developed by a Multi-disciplinary team. This information is not in the ISV plan. Please confirm that this was the case.

Westinghouse Response:

It can be confirmed that the ISV scenarios are developed by a multi-disciplinary team. This team includes human factors specialists, procedure writers, operator training developers and personnel from the simulation group. In addition, a number of the team members possess previous operating experience, and this also contributes to the development of the detailed scenario descriptions. This information will be included in the ISV Plan, Rev C, to be issued by 31st January 31 2010.

References:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.