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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-38
RAI-SRP18-COLP-39
RAI-SRP18-COLP-43
RAI-SRP18-COLP-46

RAI-SRP18-COLP-51
RAI-SRP18-COLP-52
RAI-SRP18-COLP-53

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,

A handwritten signature in black ink, appearing to read 'Robert Sisk'.

Robert Sisk, Manager
Licensing and Customer Interface
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/Enclosure

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

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 18

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-38
Revision: 0

Question:

High level ISV Objectives - Section 4.2 of WCAP-15860 lists high-level objectives of ISV that generally reflect the topics listed in the review criterion. The WCAP indicates that the ISV plan will "specify how the integrated system validation will fulfill these evaluation objectives and that the ISV Plan will include a section to address objectives. The ISV Plan does not include such a section and does not elsewhere specify how the ISV will fulfill the evaluation objectives listed in the WCAP. Please provide this information.

Westinghouse Response:

Section 4.2 of WCAP-15860 (Reference 1) provides a list of topics, including objectives, to be addressed in the Methodology section of the ISV Plan. Six high-level evaluation objectives are then given in Section 4.3. An explanation of how the integrated system validation addresses each of these objectives is provided below.

1. Establish the adequacy of the integrated HSI for achieving HFE program goals – The ISV will demonstrate the capability of the AP1000 HSI to support safe, efficient, and effective operations in a wide range of plant modes and conditions, thereby meeting the goals and objectives of the HFE program plan (Reference 2).
2. Confirm allocation of function and the structure of tasks assigned to personnel – The ISV will evaluate the capability of crews to perform, in real-time, a broad range of important tasks that exercise the full array of manual and automatic AP1000 features.
3. Validate the EOPs and associated HSI – The ISV will exercise a representative cross-section of the AP1000 emergency operating procedures to confirm that the EOPs provide an integrated network of effective and usable directions for event response, ensuring that operators can reliably bring the plant to safe shutdown conditions following abnormal and emergency events.
4. Confirm the dynamic aspects of the HSI for task accomplishment – The ISV will employ a high-fidelity simulator and task environment that provides realistic appearance, behavior, and real-time responses, so that ISV results may be generalized to actual operations.
5. Evaluate and demonstrate error tolerance to human and system failures – The ISV will employ observers and a representative range of plant operating scenarios to confirm that performance of necessary tasks is highly reliable, that task errors are minimized, and that errors or failures are manageable, should they occur.

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6. Establish the adequacy of staffing and of the HSI to support staff to accomplish their tasks –
The ISV will test the sufficiency of AP1000 staffing levels for properly operating the plant in a wide range of conditions, and the sufficiency of control room resources to accommodate these staffing levels and the associated staff activities.

The descriptive information provided above for the six high-level objectives will be added to an appropriate section of the ISV Plan, Rev C. In addition, scenario-specific objectives will be identified in each of the detailed scenario descriptions to be provided in Revision C of the ISV Plan, to be issued by 31st January 2010.

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-GBH-001, Rev. 1, "AP1000 Human Factors Engineering Program Plan," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-39
Revision: 0

Question:

Crew Variability - Section 4.1.2 of the ISV Plan states that a minimum of four crews will participate in the ISV. However, it is not completely clear that the design will account for human variability (per NUREG-0711, Section 11.4.3.2.3, Criterion 2) because of the way crews are assigned to scenarios, i.e., a scenario may be performed by only two crews. Further, little information is provided as to how the participating utilities will select crews (see RAI -22, Part 10). Finally, the ISV plan indicates that counterbalanced assignments will be used. However, the counterbalancing scheme is not presented. Please address these issues.

Westinghouse Response:

Westinghouse will perform three replications of each scenario (see RAI-SRP18-COLP-27). This requires at least three different crews, each to perform all of the ISV scenarios. A new test design will be provided to reflect these changes. In addition, an assignment scheme will be described that demonstrates a balanced trial order, so as to prevent test result bias due to the effects of trial order. This will take into account that some of the scenarios are a sequence of evolutions (e.g., startup and shutdown). These changes will be incorporated in Rev C of the ISV Plan, to be issued by 31st January 31 2010.

The ISV Plan, Rev C, will also include guidance for the utilities to address the selection of the participant personnel. It will be ensured that the participants are representative of the actual plant personnel who will ultimately be operating AP1000; and they will not be engineering personnel. The participants will be selected by the utilities, based on work experience, skills, qualifications and education. However, please note that due to the ongoing development of the utility schedules for operator training (and hence the availability of utility crews), further details can not be provided at this time.

References:

None.

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

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Technical Report (TR) Revision:

None.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-43
Revision: 0

Question:

Crew training - NUREG-0711 criterion 11.4.3.2.6.4(2) calls for crew participants to be trained to near asymptotic performance. However, Section 1.3 of the plan indicates that crew training may be "limited." Please address how stable performance will be achieved with limited training.

Westinghouse Response:

Based on the AP1000 schedule, fully qualified operators trained on AP1000 will not be available at the time of ISV. Therefore, test crews will have less hands-on experience with AP1000 than they will have by the time of final qualification at their respective plants. As a result, test crews are anticipated to have less task performance proficiency than will eventually be the case for the fully qualified AP1000 operators. This is considered to be acceptable for ISV, as the tests will be relatively more demanding as a result. The test subjects are therefore progressing to, but not yet at, near asymptotic performance.

The subjects available for ISV will have completed the Westinghouse AP1000 Senior Reactor Operator (SRO) Instructor Certification Program. The purpose of this 24 week program is to train utility instructors such that they can support the utilities licensed operator training schedules. The training program will provide previously SRO certified instructors, or aspiring instructor candidates, with detailed system and plant knowledge in order to meet the technical requirements for instructing operations and other plant personnel. The training content is derived from a review of the AP1000 Initial License Training Program, and the program will be presented using a combination of classroom instruction, self-study, classroom mockups, procedure walk through, computer and exercises using the Training Development Simulator (TDS) located at the Westinghouse Cranberry Woods facility. The topics covered include the design and operation of the nuclear island systems, turbine island systems, electrical systems, instrumentation and control systems, rod control, plant protection and monitoring, engineered safety features and passive systems. Successful training completion will be evaluated using written examinations, job performance measures and simulator dynamic examinations.

This information will be added to Revision C of the ISV Plan, to be issued by 31st January 2010. However, please note that due to the ongoing development of the utility schedules for operator training (and hence the availability of utility crews), further details can not be provided at this time.

References:

None.

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Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-46
Revision: 0

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.

References:

None.

Design Control Document (DCD) Revision:

None.

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PRA Revision:

None.

Technical Report (TR) Revision:

None.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-51
Revision: 0

Question:

Inclusion of important tasks - WCAP-15860 section 4.4 states that important tasks from the Task Analysis will be included in ISV. The ISV plan does not mention this area. Were these considered for ISV? Were any selected?

Westinghouse Response:

It can be confirmed that the important tasks identified in the OSA-2 task analysis (APP-OCS-J1R-220, Reference 1) will be included in ISV, as follows:

- 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. Also, see the Response to RAI-SRP18-COLP-32.

References:

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1. 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.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-52
Revision: 0

Question:

Simulation of RSW - There is a scenario (E.7) for remote shutdown after a fire in the MCR. However it is not clear what will be the testbed simulation for the remote shutdown workstation (RSW). The descriptions of the simulated RSW in the ISV Sections 1.3, 2.1 and E.7 are not fully descriptive or consistent. Please clarify.

Westinghouse Response:

The ISV Plan, Rev C (to be issued by 31st January 2010), will include a clear description of the simulated Remote Shutdown Workstation (RSW) facility and the means to represent the evacuation of the MCR and the relocation of the operators to the Remote Shutdown Room. In the ISV Plan, Rev B, the associated scenario description states that, "A fire will be simulated in the MCR, which will require the evacuation of the MCR. The operators expected to trip the reactor and transfer control to the remote shutdown panel. A plant shutdown and cooldown will then be performed using the remote shutdown panel [i.e., workstation]."

To the extent practical, the RSW capabilities will be represented and validated utilizing the Facility. The MCR includes all features and capabilities of the RSW, and the RSW will be represented by using the subset of MCR resources that comprise the RSW resources. This will be achieved by utilizing a section of the RO console comprising two non-safety dual-headed monitor workstations, a mock-up of the RSW panel switches and representative communication facilities.

The Wall Panel Information System, safety displays, access to the switches that are not provided at the RSW, and the DAS panel will not be available. The ISV facility equipment in excess of the RSW complement will be made clearly unavailable during remote shutdown activities, for example, by deenergizing display monitors, and by physically covering panels and switches. The changeover to this temporary configuration will be performed while the crew is 'evacuating' the MCR, transferring control to the RSW, and 'relocating' to the Remote Shutdown Room. The transfer-of-control switches outside the simulated MCR will be represented by a static mockup.

References:

None.

Design Control Document (DCD) Revision:

None.

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PRA Revision:

None.

Technical Report (TR) Revision:

None.

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Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP18-COLP-53
Revision: 0

Question:

Simulation of local actions - Section 1.3, Scope, of the ISV states in part that "The use of local control stations may be represented in ISV scenarios, but local control stations are outside the scope of the ISV." Reasons for this are given in the proprietary portion of Section 1.3. However, the staff notes that the list of AP1000 RI HAs in Table 3.2-2 of APP-GW-GL-011, WCAP-16555 (NP) includes a local action to close the equipment hatch and personnel airlocks during shutdown. Please address.

Westinghouse Response:

The risk-important task involving the local control action to close the equipment hatch and personnel airlocks during shutdown (as detailed in APP-GW-GL-011, Reference 1) will be included in the ISV Plan, Rev C, to be issued by 31st January 2010. (Note, this was also included in the Response to RAI-SRP18-COLP-32).

The activities associated with closing the containment involve closing the equipment hatch, personnel hatches and any temporary penetrations. The time required to physically close the hatches under optimal conditions is perhaps five minutes, versus a time window of 30 minutes. The uncertainty in such situations includes the extent to which temporary penetrations and work practices and procedures will add to the time to complete these activities. With respect to the ISV scenario, the time required to physically close local containment hatches and temporary penetrations can not be validated utilizing the ISV facility. However, the assurance of prompt local containment closure will be addressed via an assessment of the local plant design against relevant HFE guidelines, a review of the applicable administrative procedures and controls, the performance of task walkthroughs on installed equipment, and as part of the HFE design verification at plant startup (Reference 2). This information will be added in Revision C of the ISV Plan, to be issued by 31st January 2010.

References:

1. APP-GW-GL-011 (WCAP-16555), Rev. 0, "AP1000 Identification of Critical Human Actions and Risk Important Tasks," Westinghouse Electric Company LLC.
2. APP-OCS-GEH-520, "AP1000 Plant Startup Human Factors Engineering Design Verification Plan," Westinghouse Electric Company LLC.

Design Control Document (DCD) Revision:

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Response to Request For Additional Information (RAI)

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.