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Your ref: Docket No. 52-006
Our ref: DCP_NRC_002654

October 15, 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-23
RAI-SRP18-COLP-26
RAI-SRP18-COLP-27

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

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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-23
Revision: 0

***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-16769-P 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.

**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).


**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-26
Revision: 0

***Question:***

WCAP-15860, Sec. 4.9, Subjects, states that "validation crews will consist of currently qualified operating crews, as adjusted in number to man the AP1000 control room for conditions of minimum and maximum staffing." TR-52, AP1000 MCR Staff Roles and Responsibilities, defines the minimal and maximum crews, but the crew size in the ISV does not fully agree with that of TR-52. TR-52 states the minimal crew size will be 1 RO, 2 SROs, and 2 AOs. Also it notes that the STA role will be filled by one of the available SROs, not by a dedicated individual. TR-52 also defines two other staffing levels, one with an added unit supervisor and a maximum staff level. Most of the ISV scenarios (1 to 19) will be done with a staff of 2 ROs, 1 SRO, and 1 STA, while other scenarios (20 to 29) will be done with 2 ROs and 1 SRO. The ISV does not address at all the maximum crew as defined in TR-52. Please address the apparent conflicts in staffing levels between the various Westinghouse documents.

**Westinghouse Response:**

It is noted that most ISV scenarios are performed with a MCR staffing complement that is representative of utilities' expected minimum complements. This comprises two Reactor Operators, one Senior Reactor Operator, with one Shift Technical Advisor (for selected scenarios). It is also assumed that there are two Auxiliary Operators elsewhere in the plant. The number of Auxiliary Operator on shift does not impact the MCR design; therefore test staff (rather than test subjects) will fulfill the Auxiliary Operators' responsibilities in ISV by scripted role play. It is recognized that this expected minimum MCR staffing complement differs from the information provided in Reference 1, Section 4.1.2. However it was considered to be appropriate (and more realistic) to implement ISV with the crew size that the utilities are planning to adopt than use an alternative minimum crew size.

Reference 1 Section 5.3 specifies the operating staff for a large complement of staff and visitors in the MCR. This equates to the maximum capacity of the emergency habitability system for the MCR, and comprises the following:

**In the access controlled area within the MCA section of the MCR:**

One MCA RO (licensed RO)
One MCR Supervisor (licensed SRO)
First additional licensed RO (normally non-designated elsewhere in the MCR)
Second additional licensed RO (normally elsewhere in the plant)
One Unit Supervisor (licensed SRO)
One STA

**Elsewhere in the MCA section of the MCR**
One Shift Manager (licensed SRO)
One Communicator (for communications external to the MCR)
One NRC Observer
One Plant Management Observer
One additional member of the operations staff

WEC confirms that ISV will address the maximum staffing levels in the MCR. This will be addressed by means of scripted complications in one or more scenarios. The completed detailed scenario descriptions will be included in Revision C of the ISV Plan to be issued by January 31, 2010. Due to the ongoing development of the detailed scenario descriptions, further information can not be provided at this time. WEC would welcome a discussion with the NRC to address any concerns.

**References:**


1. APP-GW-GLR-010, Rev. 2, "AP1000 Main Control Room Staff Roles and Responsibilities," 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-27
Revision: 0

***Question:***

Per the ISV Plan, a given scenario is run a minimum of two times by two different crews. If acceptable performance on Pass/Fail criteria is achieved on both of the two trials, then the scenario is not run again. Thus for example, if the scenario involves a risk-important human action, then it is validated if the action is completed twice within the PRA-specified time window and no tech specs were violated (typically, risk-important human actions appear in only one scenario). Section 4.10 of WCAP-15860 specified "a minimum of 3 runs on each scenario in the test set." The staff concurred with this number and determined it was reasonable to account for human variability within the context of ISV where the design is mature, the design is well evaluated and verified prior to ISV, and the crews are well trained. However, the ISV Plan has reduced the minimum number of crews per scenario to two, provided acceptable performance is obtained.

Some justification for the reduction in replications is provided in the ISV Plan; i.e., the number of replications has been reduced to two because the crew size has been increased from two to three. The plan states:

> This number was chosen to ensure that enough different subjects (n=6) would be involved for each scenario to offer a reasonable tradeoff between the amount of testing and the declining value of each added replication.

This logic is unclear and does not appear to provide a basis for an exception to the WCAP. Crew size not directly related to the number of times each scenario is replicated. The unit of analysis for key measures is *crews,* not individual operators. That is, the Pass/Fail measures used to evaluate the scenario are based on actions of the crew, e.g., plant measurement involving tech specs and the accomplishment of risk-important human actions. Thus for one scenario, the N is two not six. And, contrary to the statement above, there is not a declining value with each replication, particularly when the numbers are so small to begin with. Instead, there is increased confidence that the results are valid and generalizable with each added successful scenario by another crew.

The ISV Plan statement about the number of subjects quoted above is tied to Section 4.9 of the WCAP:

> A key question is the number of subjects to be used in each test (that is, sample size = n). Several authors have examined the mathematical models that underlie descriptive usability evaluations. Plotting the proportion of usability problems detected as a function of number of test participants, the relation can be modeled as a simple Poisson process. In essence, each successive test subject tends to reveal fewer findings. Reference [13] continues in this vein to suggest that five test subjects are typically enough to detect 70 to 90 percent of major usability

> problems in a prototype. Thus, a minimum of n = 6 subjects (3 crews) is proposed as sufficient for validation tests.

This statement equates ISV to a usability test model designed to uncover usability problems. Thus the more subjects run the fewer new problems are uncovered. While uncovering problems is one possible outcome of ISV, its main purpose is to "validate the integrated system design (i.e., hardware, software, and personnel elements) will acceptably supports safe operation of the plant." Thus the usability model suggested above (and in the Virzi paper, reference 13 cited above) does not meet the intent of ISV.

Please revise the numbers of replications to match the commitment in WCAP-15860.

**Westinghouse Response:**

WEC has reviewed the required number of repetitions per scenario, and has determined that each scenario will be run three times. This will match the commitment stated in WCAP-15860 (Reference 1).

This information will be updated in the ISV Plan Revision C, to be issued by January 31, 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.

**Design Control Document (DCD) Revision:**

None.

**PRA Revision:**

None.

**Technical Report (TR) Revision:**

None.