

## AP1000DCDFileNPEm Resource

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**From:** Loza, Paul G. [lozapg@westinghouse.com]  
**Sent:** Friday, July 24, 2009 9:48 AM  
**To:** Donnelly, Patrick  
**Cc:** Buckberg, Perry; Butler, Rhonda; Seelman, Robert J.  
**Subject:** Acknowledgement of RAI-SRP18-COLP-22 thru -37  
**Attachments:** ISV RAI 22-37 Table -.doc

Patrick,

I acknowledge receipt for Westinghouse of RAI-SRP18-COLP-22 thru -37.

Thanks,

Paul

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**From:** Donnelly, Patrick [mailto:Patrick.Donnelly@nrc.gov]  
**Sent:** Thursday, July 23, 2009 10:22 AM  
**To:** Loza, Paul G.; Seelman, Robert J.  
**Cc:** Butler, Rhonda; McKenna, Eileen; Pieringer, Paul; Hebbar, Sudha  
**Subject:** AP1000 - New Draft RAIs - RAI-SRP18-COLP-22 thru -37

Bob & Paul,

Attached are 16 new draft RAIs on SRP18. Please let me know whether these are accepted or whether a conference call is desired.

Be advised, these are only the first round of RAI's. As the full review of ISV-320 is completed, more RAI's will likely be generated.

Regards-

Patrick

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### RAI-SRP18-COLP-22 - ISV Implementation Plan versus Programmatic Level Description

The ISV plan did not address all of the commitments for ISV made in the *Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan* (WCAP-15860, Rev 2) dated Oct 2003. In some cases the ISV Plan takes exceptions to these commitments. Some examples follow:

1. Technical Support Center (TSC): WCAP-15860 calls for the V&V scope to include the TSC, but it is out of scope per the ISV.
2. Risk Important Human Actions (RIHAs): WCAP-15860, Sec. 4.4 calls for ISV of risk-important tasks. The RIHAs and tasks are identified in TR-59/WCAP-16555. Section 3.2 identifies 22 post-accident RIHAs in Table 3.2-2. The ISV includes essentially all of these 22 RI HAs in scenarios. However, it is not clear why the HA #19 was excluded.
3. Risk Important Maintenance, Test, and Inspection Human Actions (RIMTIS Has): WCAP-15860, Section 4.5 calls for risk-important MTIS tasks. Section 3.3 of TR-59/WCAP-16555 is titled Risk Important Human Actions for MTIS and has two tables that identify many RI MTIS activities. However, the ISV plan does not appear address these. It seems like they could all be addressed by one ISV

scenario where the plant is at a normal full power operating status and the operators validate each of the RI MTIS interfaces while maintaining a normal operating status.

4. Validation of All EOPs: WCAP-15860, Sec. 4 states that the validation of EOPs is explicitly included in ISV. The ISV plan does include many EOPs in the scenarios, but it states in Sec. 5.1.2 “Not all EOPs will be individually exercised in ISV scenarios.” If that is the case, then how will these missing EOPs be validated?
5. Beyond Design Basis Scenarios: WCAP-15860, Sec. 4.4 states that ISV will include beyond design-basis-accident scenarios. At least one scenario that goes to core damage should be included, so that actions leading up to core damage to prevent core damage can be more fully evaluated. Additionally, the capability to support post-CD actions can be assessed.
6. Reactor Trip Scenario: WCAP-15860 indicates that a reactor trip transient (as opposed to an accident scenario) event will be included, but the ISV plan does not appear to include one.
7. Validation of HRA Assumptions: WCAP-15860, Sec. 4.6 states that ISV will include validation of key HRA modeling assumptions for RIHAs. Section 30 of the PRA describes the modeling of RIHAs, which includes the ‘time window’ ‘estimated actual time’ and ‘slack time.’ There is no discussion in the ISV about how HRA modeling assumptions are addressed. The ISV does appropriately verify that the RIHAs can be performed within the time window. However, documentation of actual times during the scenarios and then feeding that information back to the HRA to see that assumptions were correct and that recovery and HEPs were appropriately treated seems to be missing.
8. Participant Experience: WCAP-15860, Sec. 4.9, Subjects, states that “steps will be taken to identify and select test subjects from crews with less experience or unexceptional performance.” This does not appear to be addressed in the ISV.
9. Adequacy of Staffing: WCAP-15860, Sec. 4.3 and 4.4 calls for evaluation of the adequacy of staffing. It is not clear from the ISV how this will be done.
10. Selection of Crews: Section 4 of the ISV Plan indicates that crews will come from at least three different utilities. The utilities will assign “typical crews” based on availability and that crews will not be selected based on individual characteristics. However, no information is provided to address how utilities will select crews or what instruction Westinghouse will provide to utilities to prevent sample bias.

Conformance to WCAP-15860 is part of COL item and ITAAC commitments. Please address the general issue of conformance to WCAP-15860, as well as the specific issues noted above.

#### **RAI-SRP18-COLP-23 - ITAAC closure**

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.

#### **RAI-SRP18-COLP-24 - Simulator verification**

The ISV Plan does not address simulator verification beyond software testing identified in Section 2.3. Please add this information to the ISV Plan.

#### **RAI-SRP18-COLP-25 - Validation crew training**

Section 4 of the ISV Plan states that participants will be qualified commercial PWR operators being trained on AP1000 operations. Their training includes both classroom and hands-on components. However, Section 1.3 of the plan indicates that crew training may be “limited.” WCAP-15860 indicates that one week of training will be needed, but the ISV Plan does not address this.

Please provide specific information as to how much training the crews will have prior to ISV, and what criteria will be used to determine whether the crews have had sufficient training to be representative AP1000 operators.

#### **RAI-SRP18-COLP-26 - Validation crew staffing level**

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.

#### **RAI-SRP18-COLP-27 - Number of scenario replications**

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.

#### **RAI-SRP18-COLP-28 - Scenario success criteria**

According to the ISV plan, if a failure on Pass/Fail criteria is encountered on one (of the two) replication, then another (a 3<sup>rd</sup>) trial is run “to avoid an ambiguous result.” If the added scenario trial is successful, the final outcome is not clearly specified in the plan. Is the design considered validated for that scenario? If so, the design may be validated with two out of three successful trials, e.g., if a risk-important human action can be accomplished two out of three times, it’s acceptable. This is an unacceptably weak standard of acceptance. Please clarify actions when a scenario fails and how that scenario is eventually validated as successful.

#### **RAI-SRP18-COLP-29 - Design modifications during testing**

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.

#### **RAI-SRP18-COLP-30 - Testbed completeness**

Regarding the testbed, Section 2.1 of the ISV plan states that the completeness of the Facility HSI Design relative to the reference HSI Design may be limited to those items required by the scenario test set. This statement may be at variance with the Review Criterion 1 in NUREG-0711 Section 11.4.3.2.2, which states:

“Interface Completeness—The testbed should completely represent the integrated system. This should include HSIs and procedures not specifically [provided for] in the test scenarios. For example, adjacent controls and displays may affect the ways in which personnel use those that are addressed by a particular validation scenario)”

Please address this concern by justification or modification of the Plan.

#### **RAI-SRP18-COLP-31 - Level of detail in Plan**

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.

#### **RAI-SRP18-COLP-32 - Performance measures – range of measures**

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?

#### **RAI-SRP18-COLP-33 - Performance measures – RIHAs**

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.

**RAI-SRP18-COLP-34 - Performance measures – scenario specific measures**

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.

**RAI-SRP18-COLP-35 - Performance measures – measurement characteristics**

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.

**RAI-SRP18-COLP-36 - Acceptance criteria**

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.

**RAI-SRP18-COLP-37 - Training of test personnel**

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.

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**Patrick Donnelly**

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**RAIs based on the Initial Review of  
Westinghouse Document APP-OCS-GEH-320,  
AP1000 Human Factors Engineering Integrated System Validation Plan (ISV)**  
July 23, 2009

The purpose of this initial review was to determine whether Westinghouse's ISV plan is sufficiently detailed to support the staff's implementation plan level review. The initial review identified a number of RAIs listed here. The overall conclusion is the ISV Plan can support such an implementation plan level review, but considerable additional detail will be required. This review is preliminary and does not constitute a complete ISV Plan evaluation. The full review of the ISV Plan will likely raise more issues/RAIs.

Summary:

Open: RAI-SRP18-COLP-22 to 37

Confirmatory:

Closed:

RAI Number	Reviewer	Question Summary	Full Text
RAI-SRP18-COLP-22	P. Pieringer	ISV Implementation Plan versus Programmatic Level Description	<p>The ISV plan did not address all of the commitments for ISV made in the <i>Programmatic Level Description of the AP1000 Human Factors Verification and Validation Plan</i> (WCAP-15860, Rev 2) dated Oct 2003. In some cases the ISV Plan takes exceptions to these commitments. Some examples follow:</p> <ol style="list-style-type: none"> <li>1. <u>Technical Support Center (TSC)</u>: WCAP-15860 calls for the V&amp;V scope to include the TSC, but it is out of scope per the ISV.</li> <li>2. <u>Risk Important Human Actions (RIHAs)</u>: WCAP-15860, Sec. 4.4 calls for ISV of risk-important tasks. The RIHAs and tasks are identified in TR-59/WCAP-16555. Section 3.2 identifies 22 post-accident RIHAs in Table 3.2-2. The ISV includes essentially all of these 22 RI HAs in scenarios. However, it is not clear why the HA #19 was excluded.</li> <li>3. <u>Risk Important Maintenance, Test, and Inspection Human Actions (RIMTIS Has)</u>: WCAP-15860, Section 4.5 calls for risk-important MTIS tasks. Section 3.3 of TR-59/WCAP-16555 is titled Risk Important Human</li> </ol>

RAI Number	Reviewer	Question Summary	Full Text
			<p>Actions for MTIS and has two tables that identify many RI MTIS activities. However, the ISV plan does not appear address these. It seems like they could all be addressed by one ISV scenario where the plant is at a normal full power operating status and the operators validate each of the RI MTIS interfaces while maintaining a normal operating status.</p> <ol style="list-style-type: none"> <li>4. <u>Validation of All EOPs</u>: WCAP-15860, Sec. 4 states that the validation of EOPs is explicitly included in ISV. The ISV plan does include many EOPs in the scenarios, but it states in Sec. 5.1.2 “Not all EOPs will be individually exercised in ISV scenarios.” If that is the case, then how will these missing EOPs be validated?</li> <li>5. <u>Beyond Design Basis Scenarios</u>: WCAP-15860, Sec. 4.4 states that ISV will include beyond design-basis-accident scenarios. At least one scenario that goes to core damage should be included, so that actions leading up to core damage to prevent core damage can be more fully evaluated. Additionally, the capability to support post-CD actions can be assessed.</li> <li>6. <u>Reactor Trip Scenario</u>: WCAP-15860 indicates that a reactor trip <u>transient</u> (as opposed to an accident scenario) event will be included, but the ISV plan does not appear to include one.</li> <li>7. <u>Validation of HRA Assumptions</u>: WCAP-15860, Sec. 4.6 states that ISV will include validation of key HRA modeling assumptions for RIHAs. Section 30 of the PRA describes the modeling of RIHAs, which includes the ‘time window’ ‘estimated actual time’ and ‘slack time.’ There is no discussion in the ISV about how HRA modeling assumptions are addressed. The ISV does appropriately verify that the RIHAs can be performed within the time window. However, documentation of actual times during the scenarios and then feeding that information back to the</li> </ol>

RAI Number	Reviewer	Question Summary	Full Text
			<p>HRA to see that assumptions were correct and that recovery and HEPs were appropriately treated seems to be missing.</p> <p>8. <u>Participant Experience</u>: WCAP-15860, Sec. 4.9, Subjects, states that “steps will be taken to identify and select test subjects from crews with less experience or unexceptional performance.” This does not appear to be addressed in the ISV.</p> <p>9. <u>Adequacy of Staffing</u>: WCAP-15860, Sec. 4.3 and 4.4 calls for evaluation of the adequacy of staffing. It is not clear from the ISV how this will be done.</p> <p>10. <u>Selection of Crews</u>: Section 4 of the ISV Plan indicates that crews will come from at least three different utilities. The utilities will assign “typical crews” based on availability and that crews will not be selected based on individual characteristics. However, no information is provided to address how utilities will select crews or what instruction Westinghouse will provide to utilities to prevent sample bias.</p> <p>Conformance to WCAP-15860 is part of COL item and ITAAC commitments. Please address the general issue of conformance to WCAP-15860, as well as the specific issues noted above.</p>
RAI-SRP18-COLP-23	P. Pieringer	ITAAC closure	<p>DCD Tier I contains V&amp;V ITAAC in Table 3.2-1, #4 and #5. ITAAC #4 states in part: “A report exists and concludes that the HFE V&amp;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.</p>
RAI-SRP18-COLP-	P. Pieringer	Simulator	<p>The ISV Plan does not address simulator verification beyond software testing</p>

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
24		verification	identified in Section 2.3. Please add this information to the ISV Plan.
RAI-SRP18-COLP-25	P. Pieringer	Validation crew training	Section 4 of the ISV Plan states that participants will be qualified commercial PWR operators being trained on AP1000 operations. Their training includes both classroom and hands-on components. However, Section 1.3 of the plan indicates that crew training may be "limited." WCAP-15860 indicates that one week of training will be needed, but the ISV Plan does not address this. Please provide specific information as to how much training the crews will have prior to ISV, and what criteria will be used to determine whether the crews have had sufficient training to be representative AP1000 operators.
RAI-SRP18-COLP-26	P. Pieringer	Validation crew staffing level	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.
RAI-SRP18-COLP-27	P. Pieringer	Number of scenario replications	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).

RAI Number	Reviewer	Question Summary	Full Text
			<p>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.</p> <p>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:</p> <p style="padding-left: 40px;">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.</p> <p>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 <i>crews</i>, 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.</p> <p>The ISV Plan statement about the number of subjects quoted above is tied to Section 4.9 of the WCAP:</p> <p style="padding-left: 40px;">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</p>

RAI Number	Reviewer	Question Summary	Full Text
			<p>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.</p> <p>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.</p> <p>Please revise the numbers of replications to match the commitment in WCAP-15860.</p>
RAI-SRP18-COLP-28	P. Pieringer	Scenario success criteria	<p>According to the ISV plan, if a failure on Pass/Fail criteria is encountered on one (of the two) replication, then another (a 3<sup>rd</sup>) trial is run “to avoid an ambiguous result.” If the added scenario trial is successful, the final outcome is not clearly specified in the plan. Is the design considered validated for that scenario? If so, the design may be validated with two out of three successful trials, e.g., if a risk-important human action can be accomplished two out of three times, it’s acceptable. This is an unacceptably weak standard of acceptance. Please clarify actions when a scenario fails and how that scenario is eventually validated as successful.</p>
RAI-SRP18-COLP-29	P. Pieringer	Design modifications during testing	<p>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</p>

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			<p>also be considered.” The ISV plan provides guidelines for adjusting the test plan when failures are encountered, including the following statement:</p> <ol style="list-style-type: none"> <li>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.</li> </ol> <p>What exactly does “without implications” mean? Since ISV addresses the integration of the HSI, procedures, and training, how can training be revised without implications?</p> <p>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:</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul> <p>Please provide justification for the approach in the Plan or modify the approach</p>

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			to address the above concerns.
RAI-SRP18-COLP-30	P. Pieringer	Testbed completeness	<p>Regarding the testbed, Section 2.1 of the ISV plan states that the completeness of the Facility HSI Design relative to the reference HSI Design may be limited to those items required by the scenario test set. This statement may be at variance with the Review Criterion 1 in NUREG-0711 Section 11.4.3.2.2, which states:</p> <p>“Interface Completeness—The testbed should completely represent the integrated system. This should include HSIs and procedures not specifically [provided for] in the test scenarios. For example, adjacent controls and displays may affect the ways in which personnel use those that are addressed by a particular validation scenario)”</p> <p>Please address this concern by justification or modification of the Plan.</p>
RAI-SRP18-COLP-31	P. Pieringer	Level of detail in Plan	<p>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.</p>
RAI-SRP18-COLP-32	P. Pieringer	Performance measures – range of measures	<p>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?</p>
RAI-SRP18-COLP-33	P. Pieringer	Performance measures –	<p>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</p>

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		RIHAs	<p>scenario. An example is provided in Appendix F. However, the ISV plan does not address how these behaviors are selected for assessment. Please discuss.</p> <p>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.</p>
RAI-SRP18-COLP-34	P. Pieringer	Performance measures – scenario specific measures	<p>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.</p>
RAI-SRP18-COLP-35	P. Pieringer	Performance measures – measurement characteristics	<p>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.</p>

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RAI-SRP18-COLP-36	P. Pieringer	Acceptance criteria	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.
RAI-SRP18-COLP-37	P. Pieringer	Training of test personnel	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.