AP1000DCDFileNPEm Resource

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Sent: Friday, July 23, 2010 3:08 PM
To: Donnelly, Patrick
Cc: Pieringer, Paul; Loza, Paul G.; Brehm, Jason A.; Reed, Julie I.; Melton, Michael A
Subject: Draft of RAI-SRP18-COLP-46 R2A - Draft.doc
Attachments: RAI-SRP18-COLP-46 Rev 2A Draft.doc

Patrick,

Please review the attached response to RAI#46. To support the review schedule, I am submitting it as a draft for NRC evaluation of acceptability.

I will submit formally upon completion of NRC evaluation.

We are available next week to discuss this and any other open issue related to the closing the review of Chapter 18.

Thanks.
Bob

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AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

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

Question:

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

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

Please discuss and justify.

Westinghouse Response:

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

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

Question Rev 1:

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

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

Westinghouse Response Rev 1:

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

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

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

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

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

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

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

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

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

Westinghouse Response Rev 2:

Each of the above questions are discussed below:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

References:

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

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

Design Control Document (DCD) Revision:

None.

PRA Revision:

None.

Technical Report (TR) Revision:

None.

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