September 18, 1997

APPLICANT: Westinghouse Electric Corporation

PROJECT: AP600

SUBJECT: DOCUMENTATION OF AP600 TELEPHONE CONFERENCE (TELECON) TO DISCUSS SEVERE ACCIDENT AND PROBABILISTIC RISK ASSESSMENT (PRA) ISSUES

On July 17, 1997, August 5, 1997, September 5, 1997, and September 11, 1997, telecons were held between Westinghouse and members of the staff to discuss severe accident and PRA issues. Attachment 1 contains a list of the telecon participants, and Attachment 2 contains the topics for the discussions. Attachment 3 contains the disposition for the topics from Attachment 2. The staff requests that Westinghouse enter the items from Attachment 2 into the Open Item Tracking System.

There have been subsequent discussions with Westinghouse concerning the PRA. Attachment 4 contains informal questions that were asked of Westinghouse and Attachment 5 contains Westinghouse's response. Westinghouse does not have to enter this information into the Open Item Tracking System, because Westinghouse's response, documented in attachment 5, resolves the issue. In addition, Attachments 6, 7, and 8 contain information concerning the shutdown PRA (see item 4 of Attachment 2 and 3).

A draft of this telecon summary was provided to Westinghouse to allow them the opportunity to comment on the summary prior to issuance.

original signed by:

Joseph M. Sebrosky, Project Manager
Standardization Project Directorate
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Office of Nuclear Reactor Regulation

Docket No. 52-003

Atts: As stated

cc w/atts: See next page



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|---|---|
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| BOB LUTZ | WESTINGHOUSE |
| JIM SCOBEL | WESTINGHOUSE |
| SELIM SANCAKTAR | WESTINGHOUSE |
| BOB PALLA | NRR/DSSA/SCSB |
| MIKE SNODDERLY | NRR/DSSA/SCSB |
| JOE SEBROSKY | NRR/DRPM/PDST |

AP600 PHONE CALL PARTICIPANTS CONCERNING EQUIPMENT SURVIVABILITY AUGUST 5, 1997

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|---|---|
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| DICK MILLER | WESTINGHOUSE |
| JIM SCOBEL | WESTINGHOUSE |
| DAN MCDERMOTT | WESTINGHOUSE |
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AP600 PHONE CALL PARTICIPANTS CONCERNING SAMDAS AUGUST 5, 1997

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| TERRY SCHULZ | WESTINGHOUSE |
| JIM SCOBEL | WESTINGHOUSE |
| BOB PALLA | NRR/DSSA/SCSB |
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AP600 PHONE CALL PARTICIPANTS CONCERNING SHUTDOWN PRA SEPTEMBER 5, 1997

| NAME | ORGANIZATION |
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| ISAAC WALLACE | WESTINGHOUSE |
| SUE FANTO | WESTINGHOUSE |
| JIM FREELAND | WESTINGHOUSE |
| BOB PALLA | NRR/DSSA/SCSB |
| MARIE POHIDA | NRR/DSSA/SPSB |
| JOE SEBROSKY | NRR/DRPM/PDST |

Attachment 1

AP600 PHONE CALL PARTICIPANTS CONCERNING SHUTDOWN PRA SEPTEMBER 11, 1997

| NAME | ORGANIZATION |
|---|---|
| SELIM SANCAKTAR | WESTINGHOUSE |
| ISAAC WALLACE | WESTINGHOUSE |
| CINDY HAAG | WESTINGHOUSE |
| JIM FREELAND | WESTINGHOUSE |
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| JOE SEBROSKY | NRR/DRPM/PDST |

## Discussion Topics for Meeting/Telecon with Westinghouse

1. PRA Insights: (1) the completeness of insights, (2) the level to which related system features are described, and (3) the need to tie the insights to specific ITAAC, COL action items, SSAR sections (rather than PRA chapters that may disappear). Examples of weaknesses: (1) insights writeup for RPV insulation design and referenced PRA section does not mention key features of the system (redundant/diverse cavity flood lines and valves, ball in cage check valves, buoyant dampers, flow areas and gaps/clearances) or provisions to assure that the system/components will function as designed (e.g., ITAAC, SSAR figures, tech specs), and only refers to Chapter 39, which may not become part of DCD, (2) insights writeup doesn't discuss relationship between PCCS and containment integrity and identify mechanisms/commitments for assuring that drain plugging will not occur, (3) items that will be dispositioned to severe accident management should refer to COL action item rather than the SAMG framework.

2. Cost beneficial SAMDAs: additional information is needed regarding the system description, costs, and risk reduction estimates for two SAMDAs: (1) diverse IRWST valves, and (2) self-actuating valves. The first of these appears cost-beneficial when averted on-site costs are considered. Justification for not implementing this SAMDA is needed.

3. Requantification of Level 2 sensitivity and importance analyses for internal events at power assuming that events with diffusion flames near the containment shell will result in containment failure.

4. Justification for basing Level 2 portion of shutdown PRA on earlier (Revision 3) event trees on which the staff had many questions. These questions were resolved by going to a significantly modified approach for the at-power PRA, but are still relevant to the shutdown PRA.

5. Capability/pathway/procedures for venting as an accident management strategy needs to be addressed. Although venting is not expected to be necessary in most sequences, it may be needed in the event of reactor vessel failure (since deterministic calculations indicate that early containment failure from steam explosion is not likely).

6. The accident management COL action item, and what specific issues are flagged for inclusion (e.g., should include use of post-72h SSCs).

Attachment 2

7. Appendix D of the PRA contains Westinghouse's equipment survivability assessment. The staff would like to talk about this assessment in general and at this time has four specific concerns which are as follows:

   a) The staff is having difficulty correlating the time frames given in the assessment to the environmental conditions that are expected during the time frames.

   b) It appears that Westinghouse is qualifying entire systems instead of specific components. The staff feels that another level of detail is needed to assure proper procurement of specific components. Westinghouse should refer to Section 19.11.4.4 of the ABB-CE System 80+ design control document as an example of the level of detail the staff has found acceptable in the past.

   c) The staff believes that the Global hydrogen assessment maybe appropriate, however, Westinghouse does not address local hydrogen burning.

   d) The staff would like to further discuss where certain systems/components are addressed in Appendix D for example: cavity flooding system valves, the equipment used to address TMI issue (NUREG-0737) Item II.F.2, post accident sampling system (SSAR 9.3.3.1.2.2 states this function is performed by the primary sampling system for the AP600), containment vent, and containment sprays.

## Disposition of Items from Attachment 2

1. Westinghouse will consider revising the insights from the level 2 and 3 PRA to address the staff's concern.

2. Westinghouse will provide the staff with further information on the diverse IRWST valves SAMDA.

3. Westinghouse will provide a sensitivity and importance analysis to address the staff's concern. Subsequently provided by Westinghouse in an August 29, 1997, letter (NSD-NRC-97-5304).

4. This item was discussed during the conversation on September 5, 1997, and September 11, 1997. Although these conversations focussed on level 1 PRA, the level 2 PRA was also discussed. Concerning the level 2 PRA Westinghouse agreed to evaluate requantyfing the level 2 analysis, or to provide justification for not redoing the analysis.

   Concerning the level 1 PRA, the staff discussed an August 21, 1997, letter (NSD-NRC-97-5285) pertaining to the AP600 shutdown PRA and surge line flooding (RAI 720.303). The staff was concerned that Westinghouse response was based on an old revision to the PRA that did not model the squib valves in the IRWST injection line. In addition, the staff was concerned that the results of the letter reflected a success criteria change in the shutdown PRA. Westinghouse informed the staff that they would not requantify the shutdown PRA. Attachment 6 contains the actions that the staff expected Westinghouse to take to resolve the issue. The information in Attachment 6 was faxed to Westinghouse. Please note for item 5 of Attachment 6 the beginning of the sentence should read as follows: "For cases 1 and 4 above...".

   In addition, Attachment 7 contains information that was faxed to Westinghouse prior to the telecon on September 5, 1997. Attachment 8 contains Westinghouse's response to the questions. Attachment 7 and 8 are included for information only, because Attachment 6 contains the Westinghouse action items.

5. Westinghouse will provide a discussion that addresses the requirements of 10 CFR 50.34(f)(3)(iv). Westinghouse will also look at how the issue was resolved in the General Electric final safety evaluation report (Section 20.5.44) for guidance.

6. The NRC will look at the revision to the severe accident management guidance that Westinghouse provided in Revision 1 to WCAP-13914. In SSAR Revision 15, Westinghouse provided a change to Section 13.3.1 to add how the post-72 hour actions are to be treated.

7. The staff requested Westinghouse to read the requests for additional information that were sent to Westinghouse on the subject (RAIs 470.34, 470.35, 470.36, and 470.37). The staff was also concerned that RAI 470.36 was not addressed in Appendix D to the PRA. The staff agreed to review the Appendix and to reconvene the conversation with Westinghouse concerning the issue at a later date. (Subsequent to the telecon the staff issued RAIs to Westinghouse on the subject in a letter dated September 11, 1997. Therefore the phone call was deferred and this item is superseded by the September 11, 1997, RAIs.)

## Informal questions sent to Westinghouse concerning the PRA

The sensitivity case for containment isolation (50.6.2.2) appears to represent the effect of increasing the isolation failure probability by about a factor of 5 for all accident classes except "6". For "6" it looks like the failure probability is increased by about a factor of 60. (I am basing this on the split fractions shown in Figures 43-3 through -11). Can you confirm the following:

1. Why the IS split fractions for accident classes 1A and 3D/1D are an order of magnitude higher than for the other accident classes that are also quantified based on the CIC fault tree.

2. Why the IS split fraction for accident class 3C (based on OTH-CNB+CID) is not greater than the split fraction for accident class 3A (based on CID).

3. Why accident class 6 has been treated differently in the sensitivity study.

4. Why the IS split fractions are so much lower in the focussed PRA than in the baseline PRA for accident classes 1A (a factor of 15 lower) and 3D (a factor of 23 lower).

Attachment 4

From: "Scobel, James H." <scobeljh@westinghouse.com>
To: Robert Palla[SMTP:RLP3@nrc.gov]
Date: Wed, 10 Sep 1997 09:50:56 -0400

To: Bob Palla

Subject: Responses to your questions in your e-mail

9/10/1997

Bob

Here are the responses to your questions related to containment isolation sensitivity node (IS node) in the AP600 PRA containment event tree.

1. In the accident classes 1A and 3D, the Boolean multiplication of accident sequence CDF cutsets and the IS failure cutsets share more I&C related failures than those cutsets that are in the low pressure RCS accident sequences. For that reason, the I&C failures that dominate CDF for 1A or 3D also fail the containment isolation signal. I briefly looked at the top cutsets for (1A and CIC failure), and also (3A and CIC failure) cutsets and observed that top cutsets contain failures like common cause software; loss of ESF cabinets, etc., which support the above statement.

2. The CID fault tree used in 3A has a failure probability of 1.64 E-03, whereas the XCID ( CID + OTH-CNB) fault tree used for 3C has a failure probability of 2.64 E-03, as expected. When the Boolean multiplication is performed on the product of accident class CDF cutsets and the IS node system failure cutsets, the IS node split fractions for 3A and 3C turn out to be 2.62 E-03 and 2.65 E-03, respectively. The difference is due to the following:

Since the CDF cutsets for 3C only involve RV rupture, they are independent from the IS node cutsets; thus the IS split fraction is the same ( or about the same) as the XCID fault tree result. On the other hand, there are some common actuation or component failures between the cutsets of 3A and CID to make their product to come out higher than a scalar probability multiplication; thus the split fraction for 3A IS node goes up somewhat from the fault tree value of 1.64 E-03 to the calculated value of 2.62 E-03.

3. The IS split fractions accident classes 1A and 3D have higher failure probabilities (at the order of 0.01) than the rest of the accident classes (at the order of 0.001). The intention of the IS sensitivity case was to raise the IS split fractions of those accident classes with 10-2 IS failure to 0.1 and raise the remaining split fractions to 0.01. Accident class 6 was inadvertently included in the first group, despite its IS split fraction originally being in the order of 0.001.

I have set the accident class 6 IS node split fraction to 0.01 in the same sensitivity analysis and observed that the result is the same as the one in the subsequent case with IS = 0.1 within two significant figures. Sorry for the confusion it created!

4. In the focused PRA model, the loss of offsite power is postulated. This causes loss of air and the air operated containment isolation valves close due to loss of air, without a need for I&C actuation. Thus the I&C failures, which dominated base case for both the accident sequence cutsets for 1A and 3D and also affected IS node failure, are no longer relevant. Then, the IS split fractions for 1A and 3D are dominated by other failures, just like the other accident classes; the IS split fractions are similar to those of the other accident classes.

I hope these explanations respond to your questions.

Regards, Selim



Attachment 5

**Material that the staff is expecting to receive based on September 11, 1997, phone call**

1. Using the truncated cutsets from the last shutdown PRA quantification, Westinghouse will generate a revised CDF, a revised list of dominant cutsets, and revised importance analyses, assuming the AP600 design changes incorporated in Attachment 54A of the shutdown PRA and the new success criteria (incorporation of the 4th stages ADS valves to preclude surge line flooding).

2. Using the truncated cutsets from the last shutdown PRA quantification, Westinghouse will generate a revised "focused PRA" CDF, a revised list of "focused PRA" dominant cutsets, and "focused PRA" importance analyses, assuming the AP600 design changes incorporated in Attachment 54A of the shutdown PRA and the new success criteria (incorporation of the 4th stage ADS valves to preclude surge line flooding).

3. Westinghouse will provide a justification for not re-quantifying the PRA given the new success criteria.

4. For case 1 above, Westinghouse will provide a sensitivity case assuming minimal compliance with AP600 TS during the entire cold shutdown and refueling period (with RCS level less than 23 feet above the reactor vessel flange). This case will assume: 1-out-of-2 IRWST gravity injection paths are inoperable, gravity injection through the RNS pump suction line is inoperable (RNS valve V-023 is inoperable), and 2-out-of-4 4th stage ADS valves inoperable.

5. For cases 1 and 3 above, Westinghouse will perform a sensitivity study changing all human error probabilities to .5. I think that this result will be more meaningful than setting all human error probabilities to 1.0.

**Questions the staff had on August 21, 1997, letter from Westinghouse (NSD-NRC-97-5304)**

I have three comments/questions for Cindy Haag about RAI response 720.303 (OITS Item 3007).

1. The cutsets don't make sense as we discussed last Wednesday.

2. In the revised RAI response, in the fault trees, Westinghouse credits 4 ADS valves being available during reduced inventory conditions. However, TS only require 2 ADS valves to be operable. Westinghouse needs to provide a sensitivity study assuming the COL applicant follows TS. Specifically, Westinghouse needs to determine the CDF assuming only two 4th stage ADS valves are operable and one IRWST injection path is available.

3. Why did Westinghouse not update the PRA to reflect this new success criteria considering that 4 event trees have changed?

1. The surge line analysis was a sensitivity study of the shutdown results reported in Revision 6 of the PRA, which did not model the IRWST squib valves. The Rev. 6 shutdown model used the MOVs in the IRWST injection lines for drained cases.

   In the Rev. 6 shutdown model, the ADS was modeled only for non-drained conditions and with squib valves. Therefore, in the surge line flooding analysis, ADS squib valves were modeled for the drained cases.

   Therefore, the components modeled in the surge line flooding analysis are consistent with the Rev. 6 model; MOVs are modeled in the IRWST and squib valves are modeled in the ADS.

   The shutdown PRA was not updated since revision 6, but an assessment of the impact of design changes subsequent to Rev. 6 was conducted earlier this year. That assessment included the IRWST design changes such as the squib valves and was transmitted to the NRC as Attachment 54 (letter: NSD-NRC-97-5044) dated March 31, 1997.

2. The ADS was modeled consistent with the IRWST with regard to Tech Specs for drained conditions. As was discussed previously with the NRC, the TS allowance for one train of IRWST to be inoperable is not intended for scheduled maintenance. Therefore, both trains of IRWST are expected to be available during drained operations. Similarly, the TS allowance for 2 ADS valves to be inoperable during drained conditions is not meant for scheduled maintenance unavailability. Therefore, the baseline success criteria should not reflect one available train of IRWST injection and 2 available ADS valves

3. As stated in item one above, the intent of the surge line flooding analysis was not to update the shutdown PRA.