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Your ref: Docket No. 52-006
Our ref: DCP/NRC2218

August 4, 2008

Subject: AP1000 Response to Request for Additional Information (TR66)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on AP1000 Standard Combined License Technical Report (TR) 66, APP-GW-GLR-070, "Development of Severe Accident Management Guidance." This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

A response is provided for RAI-TR66-SPLB-02 as sent in an email from Dave Jaffe to Sam Adams dated September 14, 2007. This response completes all requests received to date for Technical Report 66. A response for RAI-TR66-SPLB-01 was submitted under letter DCP/NRC2053 dated December 7, 2007.

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
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/Enclosure

1. Response to Request for Additional Information on Technical Report 66

DCD NRO

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ENCLOSURE 1

Response to Request for Additional Information on Technical Report 66

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR66-SPLB-02
Revision: 0

Question:

Sections 9 (Validation Concerns List) and 10 (Open Items):

a. Please provide the lists of validation concerns and open items.
b. Which of these concerns and items are for COL applicants to address?
c. For all others, please provide a schedule for addressing each concern or open item.
d. For those concerns and open items that have been closed, please provide the resolution.

Westinghouse Response:

a. "Please provide the list of validation concerns and open items."

The list is provided in Tables 1 and 2. Table 1 lists the open items from Chapter 9 along with information regarding their status and schedule. Table 2 addresses the Recommended Design Modifications from Chapter 10.

b. "Which of these concerns and items are for COL applicants to address?"

Design Modification 12 in Table 2 must be addressed by COL applicants. The nature of Design Modification 12 is part of the COL applicant's administrative program for SAMG training and implementation.

c. "For all others (open items and validation concerns), please provide a schedule for addressing each concern or open item.

APP-GW-GJR-400, the SAMG volumes that were reviewed by the NRC at the Energy Center are Revision A documents that will be updated to Revision 0 as part of design finalization. The open items and validation issues that are documented in Chapters 9 and 10 of APP-GW-GJR-400 are captured to provide a road map for Westinghouse to complete design finalization, not as open items to the COL licensing process. The items that have not been closed will be moved to the AP1000 Open Items Tracking database for tracking until closure during design finalization. The resolution of remaining open items will not change the SAMG approach.

Procedures are not scheduled to be finalized until 2012. Completion dates for systems design that are not final are provided in the schedule for the open items. Open items for systems that have achieved revision 0 or higher are marked as closed.

d. "For those concerns and open items that have been closed, please provide the resolution."

The resolutions for the open items and disposition of the recommended design changes are provided in Tables 1 and 2.

Table 1 - OPEN ITEMS LIST From Chapter 9 of SAMGs Volume 1

The following table consists of a list of open items that should be resolved before the generation of the final AP1000 Severe Accident Management Guidelines (SAMG).

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
1	General	The NRC SER for AP1000 says that the COL applicant's accident management plan should specifically address all AP1000 PRA insights and COL action items that fall within the scope of accident management, including the following: development of guidance and procedures for actions that are expected to be taken in the longer term (post-72 hours), including: 1) using the ancillary ac diesel generators to power the post-accident monitoring system, MCR lighting, and the PCS recirculation pumps, 2) aligning and using the PCS recirculation pumps to refill the passive containment cooling water storage tank from a mobile water source using power from the ancillary diesel generators, 3) changing the MCR habitability system from air bottles to circulation using diesel-powered ancillary fans, 4) making up water to the spent fuel pool, and 5) containment reflooding a damaged core which is retained in-vessel. Only item 5 is addressed in the SAMG.	6/30/10	The purpose of the SAMG is to achieve a controlled stable condition, which presumably must be accomplished within 72 hours after accident initiation to be considered to be effective. The actions taken post-72 hours that are listed in the open item are essentially no different than post-72 hour actions required for design basis accidents, which are outlined in DCD Chapter 1.9.5.4. The exception is the reflooding of a damaged core retained within the reactor vessel, which is already addressed in the current SAMGs. The other post-72 hour actions will be proceduralized within the applicable plant operating procedures and referenced from within the SAMG. The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
2	General	The NRC SER for AP1000 says that the COL applicant's accident management plan should specifically address all AP1000 PRA insights and COL action items that fall within the scope of accident management, including the following: development of guidance and procedures for actions that may need to be taken during shutdown operations, such as actions to flood the reactor cavity. The SAMG only addresses accidents initiated from at-power conditions that involve the use of the EOPs.	6/30/10	The actions to flood the reactor cavity in shutdown operations is essentially no different from at-power operations, except that, if the water is in the refueling cavity instead of the IRWST, different valves must be opened and more time is available for the operators to perform the action since decay heat is much lower. The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
3	General	With the containment pressurized to a high value, the forces on the containment walls are significant due to its large volume. Add to these pressure stresses the temperature stresses caused by the initiation of PCS water and it appears there may be a possibility of pressurized thermal shock to containment. Is this a potential negative impact of initiating PCS water flow after core damage?	3/31/09	This is an equipment survivability issue, not a SAMG issue. No changes are anticipated to the SAMG due to this issue. The ductility of the containment steel is high. It is not anticipated that PTS is a credible threat to the containment integrity during recovery of PCS water in a severe accident. A PTS analysis for the containment shell is scheduled to be performed and will be completed by 3/31/09.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
4	General	Use of mobile water sources and portable power supplies (e.g. fire trucks and fire tankers) was not included in the guidelines as sources for injection to containment, SG, RCS, or PCS. The hookups into existing systems were not clear (valve alignments to assure flow goes to the intended location). These should be added to the appropriate guidelines based on final design.	Closed	Mobile water supply connections are included in the AP1000 design. There is a connection in the RNS that provides makeup to the RCS and containment. There is a connection in the PCS that provides makeup to the PCS and to the SFS. Information on these hookups are defined in the RNS and PCS P&IDs and the associated pipe routing drawings. The use of mobile water sources can be added to the SAMG.
5	General	Should fan coolers be put into the SAMG even though they only remove less than 1Mw heat -- they do not provide a real benefit and we did not want people worrying about restoring them if there are other important things to do.	Closed	Passive containment cooling is highly reliable and effective in terms of containment heat removal and aerosol fission product scrubbing via enhanced diffusiophoresis and thermophoresis. PCS water and multiple alternate water source connections are provided and SAMGs instruct the operators to restore water to the containment shell if needed. Non-safety fan coolers do not provide significant added benefit.
6	SAMG Framework	The framework document states that the doorways into the loop compartment extend from 107 feet to 112.1 feet. Five feet seem short for a doorway. These elevations should be verified based on final design.	Closed	This is no longer an undefined precursor to completing the SAMGs. General arrangement APP-1030-P2-001, R1, shows that the floor level of concrete at the doorway is at 104.6'. There is a grating stairway up to 107' grating level. The doorway is 112.1' – 104.6' = 7.5'
7	V1, Setpoints and System Alignments	Values of 0% of span or low level alarm were chosen for several setpoints due to lack of information at the time. These setpoints must be revised based on final design.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
8	V1, Setpoints and System Alignments	The setpoints and the system alignments provided must be revised based on the final design.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
9	V2 CA-1.doc; V3 CA-1.doc	Curves for one and two makeup and RNS pumps must be updated base on final flow delivery calculations.	Closed	Pump curves provided in APP-RNS-M3C-001, Rev. 2.
10	V2 CA-3.doc; V3 CA-3.doc	Plots in CA-3 must be adjusted for concrete basemat composition (basaltic/limestone).	6/30/10	Computational aids for both concrete types are provided in the SAMG. Concrete type is a function of local aggregates. The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
11	V2 CA-3.doc; V3 CA-3.doc	Eliminate either dry or wet measurement based on hydrogen monitor chosen in final design.	Closed	The hydrogen monitors specified in APP-VLS-M3C-001, Rev. 0 provide continuous wet measurement of air, hydrogen and steam.
12	V2 CA-3.doc; V3 CA-3.doc	Figure 3-4 must be adjusted based on hydrogen monitor characteristics for detecting carbon monoxide.	6/30/10	Carbon monoxide generation is a function of concrete type. The hydrogen monitors specified in APP-VLS-M3C-001, Rev. 0 provide continuous wet measurements. Computational aids have been provided for both concrete types. The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
13	V2 CA-3.doc; V3 CA-3.doc	Determine whether both the wet and dry plots can be used to estimate hydrogen based on the zirc reaction lines. It seems odd to use the dry plots since the zirc lines are not actually curves on the dry plots, but instead correlate exactly to a hydrogen concentration. If using the dry plots for estimating, choosing a % zirc curve automatically specifies the hydrogen concentration. Can valid hydrogen estimates using the zirc curves only be made if using the wet plots?"	Closed	The hydrogen monitors specified in APP-VLS-M3C-001, Rev. 0 provide continuous wet measurement.
14	V2 CA-4.doc; V3 CA-4.doc	Equipment elevations must be revised based on final design elevations. CA-4 is currently based on the elevation of the floor in the room that the equipment is located and not the actual equipment elevation.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
15	V2 CA-4.doc; V3 CA-4.doc	If in containment hydrogen monitors are chosen in the final design, their elevation must be included in Table 4-1.	Closed	Hydrogen monitor elevations are defined in CPP-VLS-M3-001, Rev. 0.
16	V2 CA-4.doc; V3 CA-4.doc	Determine if squib valves can fire if underwater.	Closed	Squib valves are designed to fire, but not formally qualified, to operate under water.
17	V2 CA-4.doc; V3 CA-4.doc	Several pieces of equipment do not have elevations or room locations and are listed as TBD. This information must be revised based on the final design.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
18	V2 DFC.doc; V3 DCD.doc	The setpoint for RCS pressure should be reviewed when the EOPs are finalized to assure consistency between FR-C.1 note prior to Step 12 and the value of 140 psig used herein.	Closed	The functional restoration guidelines are complete.
19	V2 DFC.doc; V3 DFC.doc	Check FR-S.1 to determine if there is a transition to the SAMG.	Closed	The functional restoration guidelines are complete.
20	V2 SACRG-1.doc; V3 SACRG-1.doc	Check FR-S.1 to determine if there is a transition to the SAMG.	Closed	The functional restoration guidelines are complete.
21	V2 SACRG-1.doc; V3 SACRG-1.doc	The value of the shutoff head of the RNS pumps was taken to be 140 psig based on the max/min head curves in the DCD. This value should be adjusted based on the pump characteristics of the RNS pump included in the final design.	Closed	Pump curves provided in APP-RNS-M3C-001, Rev. 2.
22	V2 SACRG-1.doc; V3 SACRG-1.doc	The time that the RNS pump can be run in a dead-head mode was taken to be 90 minutes based on the DCD. This value should be adjusted based on the pump characteristics of the RNS pump included in the final design.	Closed	There is no need to run the RNS pumps dead headed since the have automatic open miniflow paths.
23	V2 SACRG-1.doc; V3 SACRG-1.doc	The time that the RNS pump can be run in a dead-head mode may be changed to an RNS pump temperature limit if such indication is available in the final design.	Closed	There is no need to run the RNS pumps dead headed since the have automatic open miniflow paths.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
24	V2 SACRG-1.doc; V3 SACRG-1.doc	Valves between the MSIV and turbine stop valves, steam traps upstream of the MSIVs and any small secondary side drain lines must be identified based on final design.	10/30/08	Isometrics are scheduled for 10/30/08. The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization. Isometrics are scheduled for 10/08.
25	V2 SACRG-1.doc; V3 SACRG-1.doc	Step 3 can be eliminated if the hydrogen monitor design chosen does not require an operator action to turn them on. Determine if this step can be eliminated based on final design.	Closed	Monitors are specified as wet, continuous output design.
26	V2 SACRG-2.doc; V3 SACRG-2.doc	The figure in Attachment A must be modified to be consistent with CA-3 based on the characteristics of the hydrogen monitor chosen in the final design.	Closed	Monitors are specified as wet, continuous output design.
27	V2 SAG-1.doc; V3 SAG-1.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
28	V2 SAG-1.doc; V3 SAG-1.doc	The Equipment Survivability Assessment section of the PRA on page D-10 states that condensate, fire water or service water can be used to inject into the secondary side if SG pressure is sufficiently low. However, the P&IDs do not show these pathways.	Closed	Fire water and service water have been removed from the discussion of secondary side injection in the markups to the equipment survivability documentation in TR-069.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
29	V2 SAG-1.doc; V3 SAG-1.doc	The viability of the valve lineup from the spent fuel pool via the CVS makeup pumps depends on the dynamics of the CVS-V115 valve. The CVS-V115 valve will either be aligned to the BAT or to the demin water piping. If it is aligned to either of these sources with the CVS-V130 also open, I'm not sure from where the makeup pump will actually draw water. The CVS-V115 can not be isolated. It would be possible to align it to the demin supply and close the CVS-136A and CVS-136B valves; however, notes 8 and 14 on print APP-CVS-M6-002 state that CVS-V115 aligns to the BAT on a number of signals, including low pump suction pressure. Further research to determine what, if anything, is needed to ensure the viability of the SFS suction source for this intended purpose.	Closed	The boric acid tank and the demineralized water supply line can be isolated by valves in these lines. Therefore, the SFS can supply dedicated water to the makeup pumps.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
30	V2 SAG-1.doc; V3 SAG-1.doc	The lineup described in worksheet #31 (valve lineup from PCCAWST via RNS) will work as long as a recirculation pump is available. It might be possible, however, to gravity feed the RNS pumps from the PCCAWST depending on the elevation differences between the RNS pumps and the PCCAWST. I think such a gravity drain alignment should work since the RNS pumps must be one of the lowest pumps in the plant in order to take suction on the RCS during shutdown cooling operations. If gravity feed is possible, valves PCS-V037, PCS-V040 and PCS-V035A/035B can be replaced by opening only two valves: PCS-V033 and PCS-V044.	Closed	The hypothesis, defined in the open item, is confirmed.
31	V2 SAG-2.doc; V3 SAG-2.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
32	V2 SAG-2.doc; V3 SAG-2.doc	The minimum water level for use of the PRHR HX is assumed to be the top of the HX tubes. This assumption must be updated to reflect the minimum water level that will still allow decay heat removal based on final design.	Closed	The use of the top of the tubes as the minimum water level for the PRHR HX is conservative and appropriate.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
33	V2 SAG-3.doc; V3 SAG-3.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
34	V2 SAG-4.doc; V3 SAG-4.doc	If CCI is occurring, the core is ex-vessel. With the core ex-vessel, how can RCS temperature exceed 350°F? If RCS temperature can not exceed 350°F, how can we enter SAG-4? This question needs to be addressed.	Closed	To get to vessel failure and CCI, the operators would have already passed through SAG-4 (inject to RCS) following core uncovery. The purpose for SAG-4 after vessel failure would be to inject water into the containment via RNS or CVS. These systems are already accounted for in SAG-1 to inject water into the containment. Therefore, this is not an open item.
35	V2 SAG-4.doc; V3 SAG-4.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
36	V2 SAG-4.doc; V3 SAG-4.doc	Per Note 13 on print APP-RNS-M6-001, post-accident containment makeup water is added through either of the RNS HX channel head drains. This print doesn't show what the water source is and it is not clear how viable it would be for SAMG purposes. The basis for this note should be clarified. Also, this is not currently an option in the EOPs, although it may eventually be included in the EOPs under long term considerations.	Closed	This connection provides long term makeup to the containment following LOCAs. It is intended to be used after 30 days to accommodate containment leakage. The source of water after 30 days is not critical.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
37	V2 SAG-4.doc; V3 SAG-4.doc	The CVS-V136 valves will probably be aligned opposite to what is directed in Worksheet 3e because they automatically align to the BAT on a P-4 reactor trip signal. To realign them, the boron dilution signal will need to be reset (see print APP-PMS-J1-103). This comment also applies to worksheets that open the CVS-136 valves in other SAGs.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but a detail that must be updated for design finalization.
38	V2 SAG-4.doc; V3 SAG-4.doc	The accuracy of the hot leg water level is questionable for post-accident conditions. There are questions regarding limitations that impact its usability in EOPs and the same would carry over into SAMG.	Closed	The HL level instruments are provided for use during normal shutdown operation. Even if its post-accident accuracy is questionable and assumed to be equivalent to the pressurizer level (20%), it can still be used as an indication of whether there is water in the hot leg.
39	V2 SAG-4.doc; V3 SAG-4.doc	A solid pressurizer is a concern in EOPs and in SAMGs for existing plants but is it really a SAMG concern for the AP1000? It seems like this is a no-never-mind if any ADS stage 1-3 valves are open. Besides, the AP1000 is designed to circulate full recirculation flow via the ADS stage 1-3 valves to the IRWST and back to the RCS via the RNS pumps.	Closed	The hypothesis is confirmed. If ADS 1,2,3 (or 4) are open then there is no concern about a full Pressurizer.
40	V2 SAG-5.doc; V3 SAG-5.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
41	V2 SAG-5.doc; V3 SAG-5.doc	Will AP1000 containment penetration seals be more susceptible to degradation due to high temperature than the existing plant containment penetration seals since the thru wall containment temperature in the AP1000 design will be higher than in existing concrete containments.	Closed	This is an equipment survivability issue. Containment penetration seal integrity is captured under the Equipment Survivability Program (APP-GW-GLR-069). There is no need to identify them here as well.
42	V2 SAG-6.doc; V3 SAG-6.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
43	V2 SAG-6.doc; V3 SAG-6.doc	A shutoff head for the demin transfer pumps is unknown. It has been assumed that it is sufficient to deliver PCS flow directly. This value must be updated based on the final design.	10/30/09	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
44	V2 SAG-6.doc; V3 SAG-6.doc	The DCD states that the fire dampers close on loss of electrical power. The SAMG was developed assuming that they close on loss of AC power. This needs to be verified based on final design.	Closed	Fire dampers close on smoke and heat. The open item should read "isolation dampers" instead of "fire dampers." It is confirmed that the isolation dampers close on the loss of AC power.
45	V2 SAG-6.doc; V3 SAG-6.doc	Fire pumps may not be able to provide containment spray flow if containment is near the containment failure pressure. This needs to be verified based on final design as to whether this is a limitation of the containment spray.	Closed	Addressed in Design Issue # 6.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
46	V2 SAG-6.doc; V3 SAG-6.doc	The framework document states that the doorways into the loop compartment extend from 107 feet to 112.1 feet. Five feet seem short for a doorway. These elevations should be verified based on final design.	Closed	Addressed in Open Item # 6.
47	V2 SAG-6.doc; V3 SAG-6.doc	The standpipe in the PCCWST on APP-PCS-M6-001 shows the top very close to the normal water level. This is used as a reserve for fire protection and other functions but the water may be limited depending on how high the standpipe is. Elevations should be verified in final design.	Closed	Elevations are known now. The design provides 18,000 gal of fire water which is sufficient to provide 75 gpm for two hours. Note that an additional volume is available from the Ancillary Water Storage Tank.
48	V2 SAG-7.doc; V3 SAG-7.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
49	V2 SCG-1.doc; V3 SCG-1.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
50	V2 SCG-2.doc; V3 SCG-2.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
51	V2 SCG-2.doc; V3 SCG-2.doc	A shutoff head for the demin transfer pumps is unknown. It has been assumed that it is sufficient to deliver PCS flow directly. This value must be updated based on the final design.	10/30/09	Addressed in Open Item # 43.
52	V2 SCG-2.doc; V3 SCG-2.doc	The DCD states that the fire dampers close on loss of electrical power. The SAMG was developed assuming that they close on loss of AC power. This needs to be verified based on final design.	Closed	Addressed in Open Item # 44.
53	V2 SCG-2.doc; V3 SCG-2.doc	Fire pumps may not be able to provide containment spray flow if containment is near the containment failure pressure. This needs to be verified based on final design as to whether this is a limitation of the containment spray.	Closed	Addressed in Open Item # 45.
54	V2 SCG-2.doc; V3 SCG-2.doc	The framework document states that the doorways into the loop compartment extend from 107 feet to 112.1 feet. Five feet seem short for a doorway. These elevations should be verified based on final design.	Closed	Addressed in Open Item # 6.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
55	V2 SCG-2.doc; V3 SCG-2.doc	The standpipe in the PCCWST on APP-PCS-M6-001 shows the top very close to the normal water level. This is used as a reserve for fire protection and other functions but the water may be limited depending on how high the standpipe is. Elevations should be verified in final design.	Closed	Addressed in Open Item # 47.
56	V2 SCG-3.doc; V3 SCG-3.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but details that must be updated for design finalization.
57	V2 SCG-3.doc; V3 SCG-3.doc	The DCD states that the fire dampers close on loss of electrical power. The SAMG was developed assuming that they close on loss of AC power. This needs to be verified based on final design.	Closed	Addressed in Open Item # 44.
58	V2 SCG-4.doc; V3 SCG-4.doc	Numerical values and system alignments in this guide were generated from various sources, some of which were still in draft form at the time this guide was developed. All values must be verified against the final design before this guide can be finalized.	6/30/10	The revision described does not represent a fundamental change to the SAMG as reviewed, but a detail that must be updated for design finalization.
59	V3 SAG-7.doc	The discussion of the PARs in Step 1 of the background document must be updated based on the final design (which of the 3 vendors is selected).	6/30/09	The revision described does not represent a fundamental change to the SAMG as reviewed, but a detail that must be updated for design finalization.

No.	Applicable Guideline / Background	SAMG Open Item	Status/Schedule	Disposition
60	V2 SAEG-2.doc	Add direction to align RNS in the sump recirc mode prior to exiting SAMGs in order to prevent creating a containment vacuum after leaving SAMGs if RNS is aligned later. It is better to create a vacuum while in SAMGs since this is addressed by SCG-4.	6/30/10	The open item described does not represent a fundamental change to the SAMG as reviewed, but a detail that must be updated for design finalization.

Table 2 – Recommended Design Changes from Chapter 10 of SAMG Volume 1

No.	System or Program	SAMG Design Issue	Disposition
1	RNS system	**Consider raising the elevation of the RNS containment isolation valves.** One of the strategies in the SAMGs is to vent containment to reduce pressure and/or hydrogen concentration. The proposed venting path is through the RNS hot leg suction valves and into the spent fuel pool. This action is likely to be taken well into the severe accident at a time when it is likely the containment would already be flooded. However, the RNS hot leg suction valves (RNS-V001A, RNS-V001B, RNS-V002A, RNS-V002B) are located at the 84.5 ft elevation. Unless these valves are in a sealed compartment that can not be flooded, these motor operated valves will likely be under more than 20 ft of water during a severe accident. SAMGs may not be able to credit this containment vent path if these valves can not be opened due to being underwater.	This change is not recommended based on the following discussion. Raising the elevation of the RNS suction / containment isolation valves would have a significant negative impact on RNS operations. The RNS pump suction line is designed to slope continuously downward from the HL to the pumps. This routing was selected based on lessons learned from operating plants to avoid the loss of RNS pump suction due to accumulation of gas during standby operation or as a result of steam formation coming from loss of RCS cooling. Raising the line high enough to have the motor above the flood level would create a large high point gas trap which would significantly increase the probability of the loss of RNS pumping. The need for the recommended change is based upon an incorrect assumption that the valves could be flooded on demand for containment venting. The RNS valves are located in a PXS room that will not normally flood during a LOCA unless there is a loss of coolant from the PXS piping in the room. The PXS piping in these rooms is qualified for leak before break. If there is a LOCA in the room and the room floods, the water will flood back into the RCS and refill the reactor vessel. The LOCA will also fill the reactor cavity and the core debris and the reactor vessel will be cooled with water and the vessel integrity will not be challenged. Containment venting is not required in cases in which IVR works. So flooding the compartment and the need for containment venting are mutually exclusive.

No.	System or Program	SAMG Design Issue	Disposition
2	PMS and CVS systems	**Install a reset function into the high-2 containment radiation signal specifically for the CVS containment isolation valves.** Such a reset already exists for the RNS containment isolation valve closure on a high-2 containment radiation signal. CVS makeup provides the only high pressure RCS injection path as well as an important low pressure RCS injection path in the SAMGs. The CVS-V090 and CVS-V091 makeup line containment isolation valves auto close on a high-2 containment radiation signal. It is likely that containment radiation will reach the high-2 setpoint during a severe accident. The high-2 containment radiation signal to these CVS valves can not be blocked or reset. (See prints APP-PMS-J3-324 and APP-PMS-J3-319). This means that the CVS makeup path will probably not be available during a severe accident.	This change is not needed based on the following discussion. The CVS system has limited capacity (low flow) for providing makeup water during a severe accident. Multiple other water sources (RNS, spent fuel cooling system, fire protection system) that provide significantly more flow are already included in the design and have been identified in the SAMGs. Therefore, this design change does not provide significant benefit to the design.
3	SFS and PXS systems	**On print APP-PXS-M6-002 at location H-6, installation of a motor operated valve in the IRWST fill line just after where the RNS and SFS lines connect would allow SFS pumps to feed into the DVI line via the RNS discharge lines if the proposed valve were closed.** Such a lineup would be useful in SAMGs and might also be useful in EOPs because it would allow another pump besides the RNS pumps to pump from the IRWST and inject into the DVI line, however it might take time to perform this lineup for an SFS pump because it will require realignment of the following local valves: SFS-V046 (close), SFS-V042 (close), SFS-V051 or SFS-V052 (open), and SFS-V001A or SFS-V001B (close), SFS-V053 or SFS-V054 (open), and SFS-V023A or SFS-V023B (close). This lineup would also require opening the following motor operated valves: SFS-V034, SFS-V035, and SFS-V038. Note that adding the suggested motor operated valve at the IRWST fill point would also allow the SFS pumps to transfer water from the CLP into the DVI line. PRA results could determine whether the benefit of this design change justifies	This change is not recommended based on the following discussion. The cross ties between the RNS and other systems have been reduced / minimized in the AP1000 in order to reduce the complexity of operation. This design approach also reduces the chance of inadvertently draining the RCS during shutdown operations. This proposed change is not consistent with this design approach. In addition, the SAMDA analysis performed for the AP1000 (refer to DCD Appendix 1B) shows that changes that add measurable cost to the plant are not cost effective even if they significantly reduce LRF. This appendix shows that even if a design change eliminated all of the remaining risk from the AP1000, the maximum cost that could be justified is $21,000. This change would cost much more than this amount and has no measurable LRF benefit; as a result it would not be cost effective.

No.	System or Program	SAMG Design Issue	Disposition
		the modification. Note that this SFS lineup might even be effective in preventing ADS stage 4 after actuation of ADS stages 1-3 if the SFS valves could be realigned prior to CMT level reaching the Lo-2 setpoint. In effect, adding this valve could allow SFS to serve as a backup for RNS for some RNS functions.	
4	RNS and SFS systems	**Add a cross-connect line between the SFS and RNS suction lines from the CLP to provide added diversity to the SFS and RNS systems.** RNS pump suction could be aligned to containment recirc sump A (and SFS pump suction could be aligned to containment recirc sump B) if a cross connect line were added between the SFS and RNS lines taking suction from the CLP. This line would need to include an isolation valve that would normally be closed. The primary advantage of this crosstie would be to allow aligning RNS suction to either IRWST screen. Note that to a certain extent, the benefits of such a line for design basis accident mitigation are reduced by the existing cross connect line between the two recirc sumps.	This change is not recommended based on the following discussion. The RNS pumps already have suction capability from both sets of recirc lines and screens. Although the RNS pumps take suction from the IRWST B line, they also have access from the IRWST A line because during recirc the IRWST does not drain. As a result, the RNS pumps can take water from recirc lines A with the water flowing back into the IRWST, across the bottom of the IRWST and out the IRWST B line to the RNS connection. In addition, the SAMDA analysis performed for the AP1000 (refer to DCD Appendix 1B) shows that changes that add measurable cost to the plant are not cost effective even if they significantly reduce LRF. This appendix shows that even if a design change eliminated all of the remaining risk from the AP1000, the maximum cost that could be justified is $21,000. This change would cost more than this amount and has no measurable LRF benefit; as a result it would not be cost effective.
5	Spent Fuel System	**Install a motor operator on valve SFS-V032 to allow a diverse means of draining the IRWST to the reactor cavity.** On print APP-SFS-M6-001, the line entering from the containment recirc sump at location D-7 has a 'T' connection that goes vertically on the print toward the refuel cavity drain lines, and then connects to a line that drains into SG 2 compartment. In this line lies valve SFS-V032. The print indicates SFS-V032 as normally closed. This valve must be closed during normal operation; otherwise the IRWST	This change is not recommended based on the following discussion. The IRWST drain lines already use diverse valves in that the two squib valves (PXS-V118A/B) in that are used to drain the IRWST are diverse from all other valves in the plant. Note that these two squib valves are actuated by both the PMS and the DAS. As a result, the current design is already very reliable and since its failure is not a large contributor to core damage, the proposed change

No.	System or Program	SAMG Design Issue	Disposition
		would drain to the refuel cavity and on to the SG compartment. The SFS-V032 valve is shown as being a manual valve, but if instead it was motor operated, the valve could be opened during an accident to provide a method for draining the IRWST to the SG 2 compartment and ultimately on to the reactor cavity. All the lines of interest here are indicated to be 6" diameter. It is conceivable that this lineup could be adequate for draining the IRWST to the sump without the need to blow squib valves in the sump lines, although that would be dependent on the flow rate in the line and how quickly water is transferred from the SG compartment to the reactor cavity. If this lineup turned out to be inadequate for draining the IRWST to the reactor cavity, then at least it would provide a backup, passive reactor cavity fill method, which would be advantageous to PRA results in scenarios that place the plant in Emergency Procedure FR-C.1 and into the Severe Accident Management Guidelines.	would not add much to IRWST drain reliability. It is doubtful that this 6" drain line would drain the IRWST fast enough (the PXS drain lines are 8"). In addition, the SAMDA analysis performed for the AP1000 (refer to DCD Appendix 1B) shows that changes that add measurable cost to the plant are not cost effective even if they significantly reduce LRF. This appendix shows that even if a design change eliminated all of the remaining risk from the AP1000, the maximum cost that could be justified is $21,000. This change would cost more than this amount and has no measurable LRF benefit; as a result it would not be cost effective.
6	Fire Protection System	**Consider increasing the shutoff head of the fire pumps so containment spray will be effective if containment pressure reaches or exceeds the containment design pressure.** The shutoff head of the fire pumps is too low to force water to the containment spray nozzles for severe accidents with very high containment pressures. Table 2.3.4-2 of the Tier 1 material states that the FPS spray headers have 44 nozzles at plant elevation of at least 260 feet and 24 nozzles at plant elevation of 275 feet. The fire pumps are assumed to be located at ~100 feet. This means that the pumps must produce approximately 160 feet of head to get the water to the lowest spray nozzles (not accounting for water elevation in the fire tanks - which reduces the required pump head). According to Table 9.5.1-2 of the Tier 2 DCD, the motor driven and diesel driven fire pumps produce approximately 300 feet of head. This means that these pumps have approximately 140 feet of head available to overcome containment pressure. This translates to about 60 psig	This change is not recommended based on the following discussion. Containment spray is not considered to be an important PRA feature. It is not modeled in the AP1000 PRA and as such does not contribute to the already very low LRF. In addition, the spray is designed to be a one shot system. If the spray is used during a core melt sequence it would be during the time when most activity is released to the containment, which would be during the first couple hours after the accident initiation. At this time the containment pressure will be well less than 96 psig even if there is no PCS water cooling. Note that if the containment pressure is high, it would be as a result of the failure of PCS water cooling on the outside of the containment shell. Establishing water drain on the outside of the containment shell is the preferred long-term action to reduce pressure and scrub fission products via

No.	System or Program	SAMG Design Issue	Disposition
		containment pressure (approximately equal to containment design pressure). Based on this rough calculation, it appears containment spray may not be viable if containment pressure is at 96 psig, the value used in the Severe Challenge Status Tree (SCST). This makes containment spray marginal as a severe accident mitigation strategy for conditions where it would be very beneficial – high containment pressures with high potential for fission product leakage.	enhanced thermophoresis and diffusiophoresis, instead of containment spray, which is a limited, single shot system. In addition, the SAMDA analysis performed for the AP1000 (refer to DCD Appendix 1B) shows that changes that add measurable cost to the plant are not cost effective even if they significantly reduce LRF. This appendix shows that even if a design change eliminated all of the remaining risk from the AP1000, the maximum cost that could be justified is $21,000. This change would cost more than this amount and has no measurable LRF benefit; as a result it would not be cost effective.
7	Containment Instrumentation	**Consider adding an analog, non-safety related, containment floor level indication that can be used as an adjunct and backup to the existing floodup alarm system.** The lack of analog containment water level indication makes it difficult to estimate containment floor water level when adding water from the containment spray system. Operators will only know that the current floor water level is above one of the discreet level setpoints, but it will not be possible to know exactly where the water level resides. This is of particular concern if level is above the Hi-5 setpoint and additional water from containment spray actuation is threatening to flood important equipment or the PXS valve room.	During the final design of the PXS design, specific vendor instruments designs have been reviewed and the type of instrument that has been selected provides an analog like continuous readout.
8	Containment Instrumentation	Consider adding a Hi-7 containment floodup alarm just prior to the level at which the doorways are blocked.	Given that the initial containment water elevation can not be more than 110' (Hi-6 elevation) prior to initiating non-safety sprays, and that the sprays will be injected in a single shot, and that the volume of water in the fire water tanks will not produce a water elevation greater than 110'-5", the flow paths (top elevation of 112'-1") cannot be blocked and the electrical penetrations (elevation 112') cannot be flooded unless the operators refill the fire water tanks and spray additional water. There is no purpose to continue to

No.	System or Program	SAMG Design Issue	Disposition
			add water to the containment if it is known to be filled above the 110' elevation. The sprays do not provide significant heat removal capability and are only provided in the design for fission product scrubbing. They cannot be recirculated. Passive fission product removal due to sedimentation, thermophoresis and diffusiophoresis within the containment is sufficient to mitigate long-term releases from the RCS after the spraying has been completed. The SAMGs should not instruct the operators to refill the fire water tanks or continue to inject more water into the containment if the level is greater than 110'.
9	Fire Protection System	**Bring Fire Protection system prints up to date.** The current FPS prints (AP600 vintage) do not show isolation of the FPS jockey pump from the PCCWST. There is no normally closed valve in the line-up. The AP1000 prints need to identify an isolation device or provide a basis for the lack of isolation.	Valve APP-FPS-V101 was revised for Rev. 0 of APP-FPS-M6-002 to a normally closed configuration to isolate the flow path from the FPS jockey pump to the PCCWST.
10	PCS system	**Install valve PCS-V009 near ground level.** It would be desirable to install the PCS-V009 valve near ground level so operators do not need to climb stairs or ride an elevator to the top of the containment structure to open it during a severe accident. It may be difficult to access valves above the containment structure during a severe accident due to high radiation fields. Judging by the prints, this valve could easily be located at ground level near the PCS-V051 valve.	This change is not recommended based on the following discussion. The PCS water delivery system was redesigned from the AP600 design to the AP1000 design to be very highly reliable by providing 3 way redundancy and 2 way diversity between injection lines. Alternate water source connections are provided at ground level. The suggested improvement is not a practical design change due to environmental requirements (i.e. heating the line to prevent freezing) and it does not add significant benefit to the severe accident performance while creating significant complications.
11	Engineering and Analysis	**Evaluate the potential for PTS of the containment vessel.** Late initiation of PCS after the containment temperature and pressure are elevated into the Severe Challenge region could	This is an equipment survivability issue, not a SAMG issue. No changes are anticipated to the SAMG due to this issue. The ductility of the containment steel is very high. It is not

No.	System or Program	SAMG Design Issue	Disposition
		potentially result in a pressurized thermal shock (PTS) condition on the containment shell. The potential for PTS needs to be evaluated.	anticipated that PTS is a credible threat to the containment integrity during recovery of PCS water in a severe accident. An engineering evaluation of PTS for the containment shell is scheduled to be performed and will be completed by 3/31/09.
12	Admin	**Train the Shift Technical Adviser (STA) to the level of SAMG evaluator** Communication and understanding between the TSC SAMG Decision Makers and control room personnel would be greatly improved if someone on the control room staff were trained to the SAMG evaluator level. The Shift Technical Advisor is the logical choice for this level of training. Furthermore, AP1000 control room Severe Accident Management Guideline SACRG-1 directs control room operators to perform attachments in select Severe Accident Guidelines (SAGs). The SAGs, therefore, need to be placed in the control room. Control room personnel would be familiar with the SAGs if the STA were trained on their function and usage since this is not provided in their implementer training.	This change involves the COL applicant.
13	Hydrogen monitoring	**Consider adding hydrogen monitors inside the CMT rooms.** CMT rooms may contain higher hydrogen concentrations than portions of the containment due to the natural circulation of steam condensation on the inner containment wall. It would be helpful to have the capability to monitor hydrogen in those rooms.	This change is not recommended based on the following discussion. The hydrogen monitors as located in the upper compartment are sufficient to provide the appropriate monitoring capability throughout the accident sequence. The operators are instructed to turn on the hydrogen igniters in the EOPs prior to significant cladding oxidation reaction (before hydrogen is released to containment) so hydrogen releases in the lower compartments will be controlled as hydrogen is generated. However, if the operators fail to turn on the igniters in a timely fashion, the upper compartment monitors will register elevated hydrogen concentrations. In the longer term, the hydrogen concentration in the CMT

No.	System or Program	SAMG Design Issue	Disposition
			room will be well-mixed with the upper compartment and loop compartment volumes. Stratification of steam due to the PCS condensation does not present a significant threat to the containment integrity. Even in dry air, the well-mixed hydrogen concentration is less than 13%. But stratification will not result in dry concentrations in the CMT room, but merely a decreased steam concentration from the upper compartment. The dry air assumption for the CMT room in PRA Chapter 41 Hydrogen Analysis was an analytical conservatism, not a realistic condition.