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Your ref: Docket No. 52-006
Our ref: DCP/NRC2233

August 21, 2008

Subject: AP1000 Response to Request for Additional Information (SRP19.0)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 19.0. 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-SRP19.0-SPLA-03, -06 through -11, -12 and -13, and -14 through -16 as sent in emails from Mike Miernicki to Sam Adams dated April 29, May 30, June 4, and June 9, 2008 respectively. This response completes fifteen of sixteen requests received to date for SRP Section 19.0. A response for RAI-SRP19.0-SPLA-01, -02 and -04 was submitted under letter DCP/NRC2211 dated August 21, 2008.

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 SRP Section 19.0

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 19.0

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-03
Revision: 0

Question:

The design-specific risk analyses and other information provided in AP1000 DCD Section 19.58, "Winds, Floods, and Other External Events," are based on assumptions that are expected to envelope conditions at sites selected for a nuclear plant referencing the AP1000 design. Although site-specific information at currently proposed sites was considered in performing this analysis, each COL applicant must document relevant site conditions and demonstrate that the analyses in Section 19.58 of the AP1000 DCD are applicable to their site.
The following items represent the staff's understanding of information provided in TR101 and associated RAI responses. Please confirm these items and provide explicit COL information items in the DCD to ensure that the requested site-specific information will be provided by each COL applicant referencing the AP1000 design.

a) It is assumed that winds exceeding 300 mph are extremely rare, with event frequency less than 1E-7/year. For this reason they are screened from the risk analysis. This assumption must be verified by the COL applicant.

b) Risk evaluations that were performed used conservatively chosen initiating event frequencies for six tornado event categories defined in DCD Table 19.58-1, "Description of the Enhanced Fujita Scale (Tornados)," and for five hurricane event categories defined in DCD Table 19.58-2, "Description of Saffir-Simpson Scale (Hurricanes)." Extra-tropical cyclones were considered as another category of high winds, defined as storms and thunderstorms with winds expected to remain below the operating basis of 145 mph. The frequency of extra-tropical cyclones was assumed in the analysis to be 3E-2/year. COL applicants must verify that at the proposed site, the frequency of winds in each of these twelve high-wind categories is no more than the frequency assumed in Section 19.58 of the AP1000 DCD.

c) The passive containment cooling system (PCS) air flow path is designed to protect from blockage or plugging by ice, snow, or debris. It is assumed that the probability of blockage sufficient to compromise containment cooling is less than 1E-7/year. For this reason it was screened from analysis. The COL applicant must use site-specific information to verify the validity of assumptions relied upon in the analyses performed to support design certification. For example, if the maximum fraction of screen area that can be blocked without compromising containment cooling by air flow has been calculated, the applicant must confirm that the assumptions of that analysis remain conservative in light of conditions at the site.

d) The COL applicant must use site-specific information to verify the validity of assumptions made in the external floods risk evaluation documented in DCD Section 19.58.2.2. Per Section 2.2 of the AP1000 DCD, a COL applicant must identify design changes in its safety analysis report if it is found that the occurrence of a safety hazard is 1E-6 per year or greater. If it is found that the frequency of external floods (including floods due to dam failure and flash flooding) with the potential to reach safety-related SSCs (exceed the 100' elevation of the certified design) is 1E-7 or higher, the COL applicant must perform additional site-specific risk assessments.

e) The assumed "limiting event frequency" of 1.2E-6/year for small aircraft and 1E-7/year for commercial-size aircraft will be demonstrated by the COL applicant for the selected site.

f) The COL applicant will demonstrate that the RG 1.91 criterion of an overpressure event in excess of 1 psi at a frequency less than 1E-6/year is met for the selected site. This criterion is used to screen explosions associated with transportation- and pipeline-related accidents from detailed risk evaluation.

g) For the proposed site, the COL applicant will demonstrate that the frequency criterion of 1E-7/year is met for pipeline as well as for railroad and truck accidents. The frequency of pipeline accidents will be evaluated using the approach discussed in DCD Section 19.58.2.3.3 or another approach acceptable to the staff.

h) The COL applicant should re-evaluate the qualitative screening of external fires based on site-specific information. A risk evaluation should be performed if it cannot be demonstrated that the frequency of external fires is less than 1E-7/year. If any site-specific susceptibilities are found, the site-specific PRA performed to address COL Information Item 19.59.10-2 should include external fires.

i) DCD Section 2.2.1, "Combined License Information for Identification of Site-Specific Potential Hazards," requires evaluation of potential accidents at each proposed site. If any additional external events or hazards, beyond those discussed in DCD Section 19.58, are identified then the COL applicant must assess their frequency. Unless they meet the frequency criterion for screening from further evaluation (i.e., <1E-7 per year) the applicant should evaluate the risk associated with such hazards.

Westinghouse Response:

Items (a), (b), and (d) through (i) accurately represent the information provided in TR101 and associated RAI responses to envelope conditions at sites referencing the AP1000 design. These items need to be addressed by each COL applicant referencing the AP1000 design.

Item (c) was previously addressed in RAI-TR101-SPLA-02. In the response to that RAI it states: "In the event of a snow or ice storm, some fraction of the inlets can become blocked with snow and ice. The results of analysis show that a considerable fraction of the inlet area can be blocked without a significant effect on the peak containment pressure for design basis events. Therefore, loss of air flow due to blockage of the screens is considered to be highly unlikely and is not modeled in the PRA." For design basis accidents, there is little effect of air inlet blockage since the bulk of heat removal is due to the evaporation of the water film (PCS water). TR-101 states, "external events with an initiating event frequency less than 1.0E-07 events/yr can be screened from the evaluation." From the evaluation as presented in RAI-TR101-SPLA-02, an initiating event frequency of less than 1.0E-07 exists for this external event and no further site specific evaluation is required."

No changes are planned to the DCD to include an additional list of the items cited in this RAI. This is addressed by a proposed change to the DCD to include the phrase which follows:

"A site specific review of the generic PRA should be conducted to verify that the assumptions in the PRA bound the site specific conditions for the applicant's site."

Design Control Document (DCD) Revision:

The DCD will be revised to include an additional phrase as follows:

The following sentence is added to the end of DCD section 19.58.3:

A site specific review of the generic PRA should be conducted to verify that the assumptions in the PRA bound the site specific conditions for the applicant's site.

PRA Revision:

None

Technical Report (TR) Revision:

None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-06
Revision: 0

Question:

In APP-GW-GLN-022, Revision 1, Section 3.4, Westinghouse asserts that the proposed activity (addition of a DAS cabinet in a location that is spatially separated from plant north) does not result in an impact to features that mitigate severe accidents. A change to the location of a DAS cabinet has the potential to affect the timing of steps taken to mitigate an ATWS event (positively or negatively) and to reduce risk by providing a spatially diverse actuation station. Please confirm that this impact on the PRA does not result in a significant change to the risk importance of any SSC or human action.

Westinghouse Response:

The addition of the additional DAS cabinet in APP-GW-GLN-022, Revision 0 was judged to have minimal impact on the PRA in TR-134. The DAS system modeled in the PRA originally did not have a remote cabinet, thus, the change documented in Revision 0 added redundancy. As stated in TR-134, "... This DCP is intended to add redundancy to the design. There is no negative PRA impact."

The addition of the remote DAS cabinet reflected in APP-GW-GLN-022, Revision 1 would likewise not result in a significant change to the risk importance of any SSC or human action. Thus, use of this remote panel is not modeled in the AP1000 PRA. The probability of using this remote cabinet is very small as it would require several very unlikely events to occur. It would include a situation where there would be a need to use manual controls coupled with the need to evacuate the control room coupled with a failure or unavailability of the remote PMS panels. There is a very high certainty that a fire or event that would make the control room and the remote PMS panel unavailable for manual operation, would also result in a successful automatic shutdown of the AP1000. In addition, HRAs modeled for the DAS system use values that represent low probability of success high stress situations. This supports the conclusion that APP-GW-GLN-022, Revision 1, Section 3.4 would not result in a significant change to the risk importance of any SSC or human action.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-07
Revision: 0

Question:

At the Westinghouse on-site technical review in May 2008, the staff reviewed the CAFTA fault tree for safety-related recirculation squib valve (V-118) failing to open in manual and automatic (gate identifier IWF0013). On the CAFTA fault tree for squib valve 118 failing to open, common cause failure (CCF) probability of the component interface modules (CIMs) is listed as 2.97E-8. The staff then compared this with the common cause failure data for digital I&C components as documented in Westinghouse Calculation Note APP-PRA-GSC-222, "AP1000 PRA Protection and Safety Monitoring System," dated February 20, 2007. On page 11 of 65 of this calculation note, CCF probability of the CIMs is listed as 1.23E-5. The staff then noted that the RAW value for CCF of the CIMs as listed in the Shutdown PRA is >250. In addition, CCF failure of the CIMs impacts every safety-related valve actuated by the safety-related protection and safety monitoring system (PMS). Given the potential risk significance of this type of discrepancy, please provide the following information:
(a) Confirmation that the CCF failure of digital I&C components as listed on page 11 of Westinghouse Calculation Note APP-PRA-GSC-222, "AP1000 PRA Protection and Safety Monitoring System," dated February 20, 2007, was reviewed and documented in the CAFTA PRA database (AP1000.rr).
(b) Updated DCD information, including (i) the results of re-solving and re-quantifying the baseline and RTNSS full power PRA, the shutdown PRA, and the external events PRA, (ii) any new risk insights identified during re-quantification of the previously mentioned PRAs, and (iii) the results of the revised importance analyses.

Westinghouse Response:

(a) In response to the NRC finding at the on-site technical review of the AP1000 PRA, a Westinghouse CAPs (IR 08-129-M008) was issued the day of the finding. It has been verified that the common cause failure probability used for the component interface modules (CIMs) used in the database (AP1000.rr) from Westinghouse Calculation Note APP-PRA-GSC-236 Revision 0, "AP1000 PRA Quantification", Reference 1 and APP-GW-GLR- 102 (TR102), "AP1000 Probabilistic Risk Assessment Update Report", Reference 2 was incorrect and did not match the value used in the database (PMS.rr) used for initial quantification of the PMS fault trees in Westinghouse Calculation Note APP-PRA-GSC-222 Revision 0, "AP1000 PRA Protection and Safety Monitoring System", Reference 3.

(b) As part of the resolution of this issue (discussed above in (a)), the quantification of the fault trees for the AP1000 PMS and PLS systems with the revised failure probabilities has pointed out over-conservatism in the values selected for PMS/ PLS component common cause beta factors. The resulting model has been revised to reflect component specific common cause beta factors for the PMS and PLS system components that are modeled in the PRA. In

addition, other modeling issues have been addressed as a result of top cutset review for the modified model. The changes reflected by the model changes will result in revisions to References 1, 2 and 3. These changes will include (i) the results of re-solving and re-quantifying the baseline and RTNSS full power PRA, the shutdown PRA, and the external events PRA, (ii) any new risk insights identified during re-quantification of the previously mentioned PRAs, and (iii) the results of the revised importance analyses.

It should be noted that the requantification of the at power PRA indicate that the CDF and LRF values and top cutsets closely compare with these items documented in the DCD PRA documented in the AP1000 PRA, APP-GW-GL-022 Revision 8, Reference 4.

References:
1. APP-PRA-GSC-236 Revision 0, "AP1000 PRA Quantification"
2. APP-GW-GLR- 102 (TR102), "AP1000 Probabilistic Risk Assessment Update Report"
3. APP-PRA-GSC-222 Revision 0, "AP1000 PRA Protection and Safety Monitoring System"
4. APP-GW-GL-022, Revision 8, "AP1000 Probabilistic Risk Assessment"

Design Control Document (DCD) Revision:
None

Reference 2 states for the model changes represented by TR102 Revision 0 that "the internal events, evaluations, conclusions, and insights in the AP1000 DCD Chapter 19 remain representative of the AP1000 design and will not be revised." Requantification of the AP1000 PRA model shows that the changes represented by this model revision will be in the same category. The PRA model changes discussed in this RAI will be included in the next revision of TR102. Applicability of the above referenced statement to the model changes represented by TR102, Revision 1, will be evaluated as part of that revision.

PRA Revision:
None

Technical Report (TR) Revision:

The PRA model changes discussed in this RAI will be included in the next revision of TR102.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-08
Revision: 0

Question:

The AP1000 Final Safety Evaluation Report (FSER) included COL **action** items related to fire **and flooding** protection concerns:

a) FSER COL Action Item 19.1.8.1-2: The COL applicant will take appropriate compensatory measures to minimize risk when a fire door, fire barrier penetration, or flood barrier penetration must be open to allow specific maintenance (e.g., during plant shutdown). Appropriate outage management, administrative controls, procedures, and operator knowledge of plant configuration minimize risk during shutdown. In particular, minimizing risk will call for configuration control of fire/flood barriers to ensure the integrity of fire and flood barriers between areas containing equipment performing redundant safe-shutdown functions.
b) FSER COL Action Item 19.1.8.1-3: The design provides fire detection and suppression capability. The design also provides flooding control features and sump level indication. The COL applicant is expected to take compensatory measures to maintain adequate detection and suppression capability during maintenance activities. This is part of COL Action Item 19.1.8.1-3.

COL **information** items 9.5-3 and 9.5-8 are found in subsections 9.5.1.8.3 and 9.5.1.8.8 of the DCD Revision 16 (and are listed in Table 1.8-2). These two COL information items address fire protection but not flooding. Please clarify how concerns about flooding detection, barrier integrity, and control will be addressed.

Westinghouse Response:

Presently no compensatory measures for flooding or fire barriers, including flooding detection, barrier integrity, and control, are planned, beyond those required by existing regulation such as the NFPA 806 and the maintenance rule.

A quantitative internal flooding PRA of AP1000 design to estimate plant CDF and LRF for at-power and during low-power and shutdown events is included in chapter 56 of the AP1000 PRA. The results show that the CDF contribution from internal flooding is minimal. The results of the analysis are shown below with the corresponding values from the internal events PRA for comparison.

	Internal Events	Internal Flooding
CDF		
At Power CDF (events/year)	2.41E-07	8.82E-10
Shutdown CDF (events/year)	1.23E-07	3.22E-09
LRF		
At Power LRF (events/year)	1.95E-08	7.14E-11
Shutdown LRF(events/year)	9.95E-09	5.37E-10

The minimization of potential flooding sources in the safety-related areas, in addition to the physical separation of redundant safety-related components and systems from each other and from nonsafety-related components, reduces the consequences of internal flooding. The core damage and large release frequencies arising from flooding events during shutdown operations are not appreciable contributors to overall AP1000 risk.
It is stated in DCD Chapter 19, Table 19.59-18, AP1000 PRA-Based Insights, "Structural barriers which function as flood barriers are watertight below the maximum flood level" and "There are no watertight doors used for flood protection in the AP1000 design." Flood barriers are permanent fixtures that are not opened or altered by normal plant activities such as obtaining access to a room.

As part of the COL process a checklist is provided for the COL applicant's use when evaluating the applicability of the AP1000 Design PRA to a selected site. Item one of that checklist focuses on as-to-be-built design differences that could impact the PRA insights from DCD table 19.59-18. A section of that checklist is shown blow:

Item	Concern	Impact	COL Applicant Disposition
1	Are there any differences in the as-to-be-built, or as-built design that impact Table 19.59-18 (See Attached)?	If yes, a PRA evaluation1 must be performed.	

Sections of DCD table 19.59-18 discuss features of the AP1000 design that minimize the risk from potential floods. These items provide the rationale to ensure that the specific considerations listed below will be included in Phase 3 procedure development, as described in APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures."

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-09
Revision: 0

Question:

In AP1000 DCD Table 1.8-2, FSER COL Action Item 19.1.8.16-3 corresponds to DCD COL information item 18.7-1. This action item states the following:

"Since inadvertent opening of RNS valve V024 results in a draindown of RCS inventory to the IRWST and requires gravity injection from the IRWST, the COL applicant will have administrative controls to ensure that inadvertent opening of this valve is unlikely. **The control room design will take into account this error.**"

Please explain what features of the control room design will ensure that inadvertent opening of valve V024 is unlikely.

Westinghouse Response:

Features are in place to ensure that inadvertent opening of valve, V024, is unlikely. During shutdown, electrical power to the valve is blocked (breakers open and manually locked out) when RNS is in operation. This prevents inadvertent operation which could potentially blow down the RCS inventory. This could potentially happen since the RCS would be depressurized when ADS valves are opened during shutdown conditions in accordance with Technical Specification 3.4.13.

A permissive signal (V001A/B and V002A/B are fully closed and V023 is open) is required to permit manual opening of this valve. DCD Figure 7.2-1 (Sheet 18 of 20) shows the corresponding interlock portion for opening of the RNS hot leg suction isolation valves, which is prevented if the IRWST cross-connects to the RNS (V023, V024) are not fully closed.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-10
Revision: 0

Question:

Section 13.5 of the AP1000 Design Control Document (DCD), Revision 16, no longer refers to the combined license (COL) applicant in the discussion of plant-specific guidelines for freeze seals. Please clarify whether the development of freeze seal guidelines is the responsibility of the COL applicant (as one of the "operational and maintenance programmatic issues" referred to in COL information item 13.5-1), is included in the procedure development described in APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures" (TR70), or is controlled in some other way. Please confirm that guidelines for use of freeze seals are specifically included in the COL information item 13.5-1 or describe how they will be developed.

Westinghouse Response:

The guidelines for use of freeze seals are specifically included in the COL information item 13.5-1 as described in Reference 1 section 5.1.

The last three paragraphs from Reference 1, section 5.1 are shown below.

The Combined Operating License Applicant will address Operational and Maintenance Programmatic issues, as well as training in the AP1000 COL licensing process.

The following words represent the original Combined Operating License Information Item commitment.

"Combined License applicants referencing the AP1000 certified design will address plant procedures including the following:

- Normal operation
- Abnormal operation
- Emergency operation
- Refueling and outage planning
- Alarm response
- Maintenance, inspection, test and surveillance
- Administrative
- Operation of post-72 hour equipment"

References

1. APP-GW-GLR-040, Revision 1, Plant Operations, Surveillance, and Maintenance Procedures.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-11
Revision: 0

Question:

The AP1000 Final Safety Evaluation Report (FSER) included several specific COL action items related to shutdown procedures. These action items correspond to COL information item 13.5 1 in the AP1000 DCD. Please clarify how Westinghouse will ensure that the specific considerations listed below will be included in Phase 3 procedure development, as described in APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures" (TR70):

a) FSER COL Action Item 19.1.8.1-4: The COL applicant will implement the maintenance guidelines as described in the "Shutdown Evaluation Report" (WCAP-14837).
b) FSER COL Action Item 19.1.8.3-1: The COL applicant is responsible for developing procedures...to close containment hatches and penetrations following an accident during Modes 5 and 6, before steam is released into the containment.
c) FSER COL Action Item 19.1.8.16-1: The COL applicant will have policies that maximize the availability of normal residual heat removal (RNS) valve V-023 and procedures to open this valve during cold shutdown and refueling operations when the RCS is open and the passive residual heat removal system (PRHR) cannot be used for core cooling.
d) FSER COL Action Item 19.1.8.16-2: The COL applicant will develop administrative controls to ensure that inadvertent opening of RNS valve V-024 is unlikely since inadvertent opening results in a draindown of the RCS inventory to the in-containment refueling water storage tank (IRWST) and requires gravity injection from the IRWST.
e) FSER COL Action Item 19.1.8.16-4: The COL applicant will maintain procedures to respond to low hot-leg level alarms.
f) FSER COL Action Item 19.3.7-1: The COL applicant will develop an outage planning and control program and will appropriately address the factors that improve low-power and shutdown operations consistent with DCD Tier 2, Revision 16, Chapter 19E, Shutdown Evaluation Report and NUMARC 91-06
g) FSER COL Action Item 19.1.8.7-1: The COL applicant will have procedures and policies to have the non-safety related wide range pressurizer level indication during cold shutdown.

Westinghouse Response:

As part of the COL process a checklist is provided for the COL applicant's use when evaluating the applicability of the AP1000 Design PRA to a selected site. Item one of that checklist focuses

on as-to-be-built design differences that could impact the PRA insights from DCD table 19.59-18. A section of that checklist is shown below:

Item	Concern	Impact	COL Applicant Disposition
1	Are there any differences in the as-to-be-built, or as-built design that impact Table 19.59-18 (See Attached)?	If yes, a PRA evaluation1 must be performed.	

Sections of DCD table 19.59-18 that are applicable to each of the questions asked are shown below as the rationale to ensure that the specific considerations listed below will be included in Phase 3 procedure development, as described in APP-GW-GLR-040, "Plant Operations, Surveillance, and Maintenance Procedures"

a) FSER COL Information Item 19.1.8.1-4: The COL applicant will implement the maintenance guidelines as described in the "Shutdown Evaluation Report" (WCAP-14837).

This item is addressed in Table 19.59-18 as follows:

47.	The maintenance guidelines as described in the Shutdown Evaluation Report (WCAP-14837) should be considered when developing the plant specific operations procedures.	13.5.1

b) FSER COL Information Item 19.1.8.3-1: The COL applicant is responsible for developing procedures...to close containment hatches and penetrations following an accident during Modes 5 and 6, before steam is released into the containment.

This item is addressed in Table 19.59-18 as follows:

65.	The ability to close containment hatches and penetrations during Modes 5 & 6 prior to steaming to containment is important. Procedures and training must be developed to encompass this item.	13.5 & 16.1

c) FSER COL Information Item 19.1.8.16-1: The COL applicant will have policies that maximize the availability of normal residual heat removal (RNS) valve V-023 and procedures to open this valve during cold shutdown and refueling operations when the RCS is open and the passive residual heat removal system (PRHR) cannot be used for core cooling.

This item is addressed in Table 19.59-18 as follows:

76.	An alternative gravity injection path is provided through RNS V-023 during cold shutdown and refueling conditions with the RCS open. Administrative controls to maximize the likelihood that RNS valve V-023 will be able to open if needed during Mode 5 when the RCS is open, and PRHR cannot be used for core cooling are established.	Emergency Response Guidelines 13.5

d) FSER COL Information Item 19.1.8.16-2: The COL applicant will develop administrative controls to ensure that inadvertent opening of RNS valve V-024 is unlikely since inadvertent opening results in a draindown of the RCS inventory to the in-containment refueling water storage tank (IRWST) and requires gravity injection from the IRWST.

This item is addressed in Table 19.59-18 as part of item 67 as follows:

Inadvertent opening of RNS valve V024 results in a draindown of RCS inventory to the IRWST and requires gravity injection from the IRWST. Administrative controls to ensure that inadvertent opening of this valve is unlikely must be developed.	13.5

e) FSER COL Information Item 19.1.8.16-4: The COL applicant will maintain procedures to respond to low hot-leg level alarms.

This item is addressed in Table 19.59-18 as follows:

71.	Procedures will be prepared to respond to low hot leg level alarms.	Emergency Response Guidelines

f) FSER COL Information Item 19.3.7-1: The COL applicant will develop an outage planning and control program and will appropriately address the factors that improve low-power and shutdown operations consistent with DCD Tier 2, Revision 16, Chapter 19E, Shutdown Evaluation Report and NUMARC 91-06.

This item is addressed in Table 19.59-18 as follows:

47.	The maintenance guidelines as described in the Shutdown Evaluation Report (WCAP-14837) should be considered when developing the plant specific operations procedures.	13.5.1

Item 47 above cites WCAP-14837 (Reference 2) which is the basis of DCD Tier 2, Revision 16, Chapter 19E, Shutdown Evaluation Report. Section 3 of Reference 2 specifically cites NUMARC 91-06 as a source of insights based on the past experience of operating PWRs. Section 3.0 states, "While ultimately the responsibility of shutdown maintenance and shutdown risk management is the responsibility of the combined operating license (COL) applicant, this section summarizes the major shutdown maintenance guidelines and procedures that have been identified in the various submittals..."

In addition, section 3 of reference 2 states that Shutdown procedures are also addressed by the submittal of the AP600 Emergency Response Guidelines (ERGS) (Reference 4), which include shutdown emergency procedures. Use of the ERGs from Reference 4 is also cited in APP-GW-GLR-040, Reference 1

g) FSER COL Information Item 19.1.8.7-1: The COL applicant will have procedures and policies to have the non-safety related wide range pressurizer level indication during cold shutdown.

This item is addressed in Table 19.59-18 as follows:

	It is important to maximize the availability of the nonsafety-related wide range pressurizer level indication during RCS draining operations during cold shutdown. Procedures and training must be developed to encompass this item.	13.5

References:

1. APP-GW-GLR-040, Revision 1, Plant Operations, Surveillance, and Maintenance Procedures.
2. 14837
3. NUMARC 91-04, "Guidelines for Industry Actions to Assess Shutdown Management," December 1991.
4. Letter, Westinghouse to NRC, DCP/NRC0702, Submittal of AP600 Emergency Response Guidelines, Revision 2, January 10, 1997.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-12
Revision: 0

Question:

The interim staff guidance on Seismic Issues Associated with High Frequency Ground Motion defines ground motion response spectra (GMRS) as site-specific. For this reason, the generic hard-rock high-frequency (HRHF) ground motion spectra provided in Figures 5.0-3 and 5.0-4 (added to DCD Revision 16, Tier 1) are considered design basis spectra for hard rock sites. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," states:

> PRA insights will be used to support a margins-type assessment of seismic events. A PRA-based seismic margins analysis will consider sequence-level HCLPFs and fragilities for all sequences leading to core damage or containment failures up to approximately twice the magnitude of the SSE.

Please clarify the basis proposed for the seismic margins analysis of plants at hard rock sites given that the SSE is now taken as the HRHF GMRS (defined at the foundation level for 5% damping) as shown in Figure 5.0-3 and Figure 5.0-4 of the DCD (Tier 1). If other sections of the DCD are affected, please revise them.

Please clarify the COL information items either by amending COL information item 19.59.10-1 or by adding an item to make it clear that each COL **applicant** should identify the GMRS for each proposed site. The applicant should confirm that the GMRS to which the plant may be subjected is bounded by the appropriate generic GRMS from the DCD (Tier 1, Chapter 5) or otherwise demonstrate that the plant has adequate margin with respect to the site-specific GMRS. It will remain for each COL holder to confirm that the as-built plant conforms to the both the seismic design and the seismic margins analysis described in DCD Section 19.55.

Westinghouse Response:

The seismic margin analysis for the AP1000 has been developed using the AP1000 Certified Seismic Design Response Spectra (CSDRS) that is described in AP1000 DCD Section 3.7.1.1 (Tier 2). The HRHF GMRS do not envelop the AP1000 CSDRS. Westinghouse performed an evaluation for HRHF GMRS that envelop the site specific GMRS for this site. The HRHF GMRS evaluated are given in Westinghouse Technical Report 144 (TR144) that document AP1000 DCD changes to Tier 1 Figures 5.03 and 5.04 as well as Figures 3I.1-1 and 3I.1-2. From this evaluation performed (documented in Westinghouse Technical Report 115 (TR115)) it was concluded that the HRHF GMRS input is not damaging to equipment and structures qualified by analysis for AP1000 CSDRS, and that the normal design practices result in an AP1000 design that is safer and more conservative than that which would result if designed for the high

frequency input. Therefore, since the seismic demand obtained from the AP1000 CSDRS is higher than that from the AP1000 HRHF, it can be stated that the seismic margin obtained using AP1000 CSDRS input will be conservative compared to the seismic margins associated with the AP1000 HRHF. Therefore, the PRA insights are based on conservative seismic margins.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-13
Revision: 0

Question:

The staff compared the results of the shutdown PRA as seen in the current model with the results reported in Revision 16 of the DCD. Many of the results are now significantly different from those reported in Chapter 19 of the DCD Section 19.59.5.1, "Summary of Shutdown Level 1 Results."

For example, in Section 19.59.5.1 the dominant sequences and key contributors to risk are discussed. The staff compared this documentation with the top 15 cutsets and the top 20 component basic events ranked by risk achievement worth (RAW) from the CAFTA results. Loss of component cooling (CWS) or service water (SWS) during drained conditions contributes at least 73% to the CDF as seen in the CAFTA results versus 64% as reported in the DCD. Loss of the RNS initiating event during drained conditions contributes at least 10% to the CDF as compared to 6% reported in the DCD. Inadvertent draining through V-24 (IEV-LOCA24ND) contributes more to CDF than the risk of RCS overdraining as seen in the CAFTA results. However, this event is not reported in the DCD.

Please update DCD Table 19.59-15, "Summary of AP1000 Results" and provide the following information:

1. a list of cutsets for the AP1000 Shutdown PRA that contribute to 95% of total shutdown CDF and any that contribute as much as 1% of total shutdown CDF.
2. a list of all SSCs in the shutdown PRA with their RAWs (if RAW > 2)
3. a list of all human actions modeled in the shutdown PRA with their RAW
4. a list of all CCFs in the shutdown PRA with their RAW (if RAW > 2) (or confirm that all are described in WCAP-16555)

Also, please confirm that the list of major contributors to risk for each sequence that contributes more than 1% to shutdown CDF remains consistent with the cutset results.

Finally, please revise the DCD as necessary to ensure that all such sequences are described.

Westinghouse Response:

The AP1000 PRA model was reviewed as part of the NRC on-site PRA review as documented in TR 102, Reference 1, and APP-PRA-GSC-236 Revision 0, Reference 2. PRA model changes were made as a result of RAI-SRP 19.0-SPLA-7 resulting from the NRA review. Preliminary results from the requantification of the AP1000 Shutdown PRA indicate that the CDF and LRF values and top cutsets closely compare with these items documented in the DCD PRA documented in the AP1000 PRA, APP-GW-GL-022, Revision 8.

The AP1000 PRA models, including the shutdown model are being revised to reflect component specific common cause beta factors for the PMS and PLS system components that are modeled in the PRA and modeling issues found as a result of these changes. The changes reflected by the model changes will be reflected in revisions to References 1, 2 and 3. The revision to APP-PRA-GSC-236, Reference 2 will include items identified as items 1-4 above as well as a confirmation that the list of major contributors to risk for each risk sequence that contributes more than 1% to shutdown CDF remains consistent with the cutset results.

Results of the revised AP1000 shutdown model will be compared to the AP1000 PRA model as documented in AP1000 DCD Revision 16 section 19.59 and APP-GW-GL-022 Revision 8, Reference 4. In addition, the review will include comparison of parameters discussed in paragraph 2 of this RAI. These comparisons will be included in TR 102, Reference 1. Comparisons of the revised model that show minimal changes to the shutdown results will result in no changes to AP1000 DCD Revision 16 section 19.59.

References:

1. APP-GW-GLR- 102 (TR102), "AP1000 Probabilistic Risk Assessment Update Report"
2. APP-PRA-GSC-236 Revision 0, "AP1000 PRA Quantification"
3. APP-PRA-GSC-222 Revision 0, "AP1000 PRA Protection and Safety Monitoring System"
4. APP-GW-GL-022, Revision 8, "AP1000 Probabilistic Risk Assessment"

Design Control Document (DCD) Revision:
None

Reference 1 states for the model changes represented by TR102 Revision 0 that "the internal events, evaluations, conclusions, and insights in the AP1000 DCD Chapter 19 remain representative of the AP1000 design and will not be revised" Requantification of the AP1000 PRA model shows that the changes represented by this model revision will be in the same category. The PRA model changes discussed in this RAI will be included in the next revision of TR102. Applicability of the above referenced statement to the model changes represented by TR102, Revision 1, will be evaluated as part of that revision.

PRA Revision:
None

Technical Report (TR) Revision:

The PRA model changes discussed in this RAI will be included in the next revision of TR102.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-14
Revision: 0

Question:

SRP 19.0 directs the staff to verify "that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions ...to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

In reviewing the following APP-GW-GLR-069, "Equipment Survivability Assessment," (TR68), the staff noted that the severe accident environmental conditions have been revised. The TR references APP-SSAR-GSC-507, Rev. 3, CN-REA-02-16, Rev. 3 (Proprietary), "AP1000–Equipment Qualification (EQ) and Severe Accident Radiation Dose," and APP-GW-GER-010, Rev. 0, CN-CRA-02-47, Rev. 0 (Proprietary), "Thermal Hydraulic Environments for AP1000 Equipment Survivability Analyses."

The applicant proposes a revision to the DCD to reflect the new conditions, but the supporting calculations are not referenced in the DCD.

Please revise the DCD amendment to provide complete and consistent references to documentation that supports the licensing basis.

Westinghouse Response:

APP-GW-GLR-069, Reference 0, "Equipment Survivability Assessment," (TR68), Reference 1, provides complete and consistent references to documentation that supports the licensing basis.

There is no proposed DCD revision for section 19D.7, Severe Accident Environments, included in TR68, Reference 1.

Reference:
1. APP-GW-GLR-069 (TR68), Reference 0, "Equipment Survivability Assessment."

Design Control Document (DCD) Revision: None

PRA Revision: None

Technical Report (TR) Revision: None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-15
Revision: 0

Question:

In Section 19.59.10.5, the COL applicant is tasked with development and implementation of SAMG using a framework provided in APP-GW-GL-027, "Framework for AP1000 Severe Accident Management Guidance." Please clarify at what point and in what form this will be available for review by the staff. If either of these activities are to be deferred until a license is issued, it may be appropriate to revise this section and associated entries in Table 19.59-18.

Westinghouse Response:

This is available for review by the staff at Westinghouse and is also included as Section 2 of the Executive Volume of AP1000 Severe Accident Management Guidelines (SAMG), APP-GW-GJR-400 Volume 1, Reference 1.

Reference:

1. APP-GW-GJR-400 Volume 1 Revision A, AP1000 Severe Accident Management Guidelines, January 2007.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-16
Revision: 0

Question:

The severe accident management guidelines address actions to introduce water to a dry reactor vessel after core relocation (full or partial) to the bottom head. Concerns over hydrogen generation suggest maximizing the flow rate, while concerns about a degraded RV (overheating and wall thinning at or near the surface of the pool of relocated core material) suggest that flow should be controlled.

Please clarify how guidance will be provided to resolve which of these considerations is more important in a given situation (or otherwise resolve the ambiguity).

Westinghouse Response:

The AP1000 SAMG Guideline (Reference 1) for "Inject into the RCS" will be updated to address the recommended rate of injection into the RCS for situations where injection capability is recovered after significant core damage has occurred. This will be addressed by adding a new item in the evaluation of the potential negative impacts of injecting in to the RCS to note that high injection flow rates would minimize the potential for significant hydrogen generation while lower, controlled flow rates would minimize the potential for failure of the reactor vessel. The evaluation will discuss that hydrogen generation due to low flow rates would only be a concern if there was already significant hydrogen in the containment that would be indicative of a failure of the hydrogen igniters and/or recombiners. On the other hand, the concern about reactor vessel integrity due to high injection flow rates would only be a concern when there was a prolonged period since the onset of high core temperatures and the reactor vessel was being externally cooled by submergence in water. A full discussion of the conditions under which each of the concerns is applicable will also be provided in Attachment B to that the Guideline and in the associated Background Document.

References
1. APP-GW-GJR-400 Volume 2 Revision A, AP1000 Severe Accident Management Guidelines, January 2007.

Design Control Document (DCD) Revision: None

PRA Revision: None

Technical Report (TR) Revision: None