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Your ref: Project Number 740
Our ref: DCP/NRC2026

October 19, 2007

Subject: AP1000 COL Responses to Requests for Additional Information (TR 101)

In support of Combined License application pre-application activities, Westinghouse is submitting responses to the NRC requests for additional information (RAIs) on AP1000 Standard Combined License Technical Report 101, APP-GW-GLR-101, AP1000 Probabilistic Risk Assessment Site-Specific Considerations. These RAI responses are submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in the responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

Responses are provided for RAI-TR101-SPLA-01 through -08, as transmitted in an email from Mike Miernicki to Sam Adams dated September 7, 2007. These responses complete all requests received to date for Technical Report 101.

Pursuant to 10 CFR 50.30(b), the responses to the requests for additional information on Technical Report 101 are submitted as Enclosure 1 under the attached Oath of Affirmation.

Questions or requests for additional information related to the content and preparation of these responses 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,

A. Sterdis, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

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D079

NRO

/Attachment

1. "Oath of Affirmation," dated October 19, 2007

/Enclosure

1. Responses to Requests for Additional Information on Technical Report No. 101

cc:	D. Jaffe	-	U.S. NRC	1E	1A
	E. McKenna	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	A. Monroe	-	SCANA	1E	1A
	M. Moran	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A
	R. Anderson	-	Westinghouse	1E	1A

ATTACHMENT 1

"Oath of Affirmation"

ATTACHMENT 1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:	)
NuStart Bellefonte COL Project	)
NRC Project Number 740	)

APPLICATION FOR REVIEW OF
"AP1000 GENERAL COMBINED LICENSE INFORMATION"
FOR COL APPLICATION PRE-APPLICATION REVIEW

W. E. Cummins, being duly sworn, states that he is Vice President, Regulatory Affairs & Standardization, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

W. E. Cummins
Vice President
Regulatory Affairs & Standardization

Subscribed and sworn to
before me this 19th day
of October 2007.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Patricia S. Aston, Notary Public
Murrysville Boro, Westmoreland County
My Commission Expires July 11, 2011
Member, Pennsylvania Association of Notaries

Patricia S. Aston
Notary Public

ENCLOSURE 1

Responses to Requests for Additional Information on Technical Report No. 101

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR101-SPLA-01
Revision: 0

Question:

On page 4, the following statement is made:

"Additional work is required by the Combined Operating License Applicant to address the aspects of the Combined License information requested in this subsection as delineated in the following paragraph:

The Combined Operating License Applicant will confirm that the High Winds, Floods, and Other External Events analysis documented in this report is applicable to the COL site. Further evaluation will be required if any unbounded site-specific susceptibilities are found."

It is not clear how this statement will be implemented by each COL applicant. It is stated that Westinghouse gathered site-specific external events information from utilities interested in the AP1000 design and performed bounding analyses using the most limiting site parameters. However, there is no clear definition of all the Abounding@ parameters used in the analysis against which COL applicants, who A*...evaluated each external event for applicability to their proposed site(s)...,*@ will confirm that the analysis is applicable to their site. It is not clear whether the statement "*The highest initiating event frequency was selected to Abound@ each event,"* provides adequate information about the site parameters used in some analyses, such as the external flooding risk analysis. If the submitted analysis is intended to be of a Ageneric@ nature in some aspects, please provide clearly stated site-specific assumptions that COL applicants must show to be valid at their site. Please refer to DCD Chapter 2 and Table 2-1, as necessary.

Westinghouse Response:

The TR-101 methodology is based on the concept of a standard AP1000 design. With a standard AP1000 design, the plant response to an external event will be identical, regardless of the site location. Only the event itself will differ from site-to-site. Therefore, each AP1000 COL applicant must verify the applicability of the events (and severity of events) discussed in TR-101 to the proposed site. Furthermore, the AP1000 COL applicant must verify the site-specific external initiating event frequency is bounded by the values documented in TR-101. This applicability evaluation should be documented in the FSAR Chapter 19. The intent of TR-101 is to evaluate the risk of an external event given a bounding initiating event frequency. The COL applicant should calculate their own site-specific external event frequency in accordance with their own procedures or standard practices. TR-101 only assumes that the external event frequency has been calculated using an acceptable approach and bounds the external events evaluation based on initiating event frequency. TR-101 is not intended to define the methodology for quantifying external event frequencies.

The same rationale applies to external floods. Specifically, if the COL applicant determines that the external flood has potential consequences serious enough to affect the safety of the plant (severity of the event), and the annual frequency of occurrence (initiating event frequency) is less than 1.0E-07 events per year then the COL applicant can conclude that external floods are already addressed by the TR101 PRA. Inherent in determining the severity of the external flooding events is the consideration of the plant elevation.

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-TR101-SPLA-02
Revision: 0

Question:

Screens prevent clogging of the drain openings in the containment cooling system (PCS) located in the side wall of the shield building. Was the potential blocking of the PCS air baffle, due to clogging of the drains by debris, considered in the site specific external events analyses? Please discuss.

Westinghouse Response:

Blockage or plugging of the air flow paths is not modeled in the PRA because of the following considerations (Chapter 13 of Reference 1):

1. The air inlets consist of 384 ducts that are 16 in wide by 15 in high, arranged in three rows evenly spaced around the top of the concrete shield building. Outside of these ducts is an enclosed volume extending around the circumference. There are 29 openings into the enclosed volume. The openings are 9 ft high by 12 ft long. The openings are covered by louvers and screens. These screens are designed to prevent foreign objects or debris from entering the air flow path. 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.

2. Louvers are arranged within the air inlets to minimize the entrance of debris into the inlets. These louvers are fixed and, therefore, will not block the air flow path. Hence, loss of air flow due to failure of the louvers is not modeled in the PRA.

3. The chimney outlet is designed to produce the necessary air flow in the event of an accident.. The outlet contains two heavy grates to guard against missiles, and is fully screened to prevent foreign objects from entering the containment annulus area. During reactor operation, there is a positive flow of air out of the chimney that will help prevent ice and snow from entering. Therefore, loss of air flow due to blockage of the chimney outlet is considered to be highly unlikely and is not modeled in the PRA.

In addition to the above considerations, there is an AP1000 Surveillance Requirement (SR) to verify the air flow path is unobstructed. AP1000 SR 3.6.6.5 states that the operator will "Verify the air flow path from the shield building annulus inlet to the exit is unobstructed and, that all air baffle sections are in place". This surveillance is to occur at a frequency of 24 months (Chapter 16.1 of Reference 2).

In conclusion, not only is the probability of a flow blockage low, but surveillances tests are to be performed periodically to verify that obstructions have not occurred.

References:

1. APP-GW-GL-022, "AP1000 Probabilistic Risk Assessment", Revision 5.

2. APP-GW-GL-700, "AP1000 Design Control Document", Revision 16.

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-TR101-SPLA-03
Revision: 0

Question:

The external events considered for evaluation are listed in page 5 of the submitted Technical Report. This list does not include external fires. It is stated that the list was based on guidelines provided in NUREG-1407, AProcedures and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities,@ June 1991 (Reference 5). However, NUREG-1407 states that "*...the [potential]... effects of external fires, other than loss of offsite power, have been evaluated during operating license (OL) review against sufficiently conservative criteria...*" Please verify that such a review is applicable to all sites interested in the AP1000 design and list the AP1000 design-specific features and site characteristics that make the risk from external fires to be insignificant.

Westinghouse Response:

As stated in the introduction, the purpose of TR-101 is to resolve COL Item 19.59.10-2, as documented in Chapter 19 of Reference 1. This COL item states: "Based on site-specific information, the COL should also reevaluate the qualitative screening of external events (PRA Section 58.1). If any site-specific susceptibilities are found, the PRA should be updated to include the applicable external event." AP1000 Chapter 58.1 of Reference 2 provides a list of five external events that are included for AP1000 analysis:

- High winds and tornadoes
- External floods
- Transportation and nearby facility accidents
- Seismic events
- Internal fires

The first three external events, High Winds and Tornados, External Floods, and Transportation and Nearby Facility Accidents, are addressed in TR-101. Seismic events are addressed in Chapter 55 of Reference 2, and internal fires are addressed in Chapter 57 of Reference 2. External fires are not included in the analysis. Furthermore, there is no COL item written to evaluate any external events other than the above listed external events. Consequently, this issue was not addressed in TR-101. The TR-101 analysis will be modified to address the effects of external fires.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

References:

1. APP-GW-GL-700, "AP1000 Design Control Document", Revision 16.

2. APP-GW-GL-022, "AP1000 Probabilistic Risk Assessment", Revision 5.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:

The following words will be added to the end of section 2.0 on page 6 in the TR revision. The added paragraph is now the last paragraph in section 2.0.

Per Chapter 58 of the NRC approved AP1000 PRA and DCD Chapter 19, external fires are not required to be evaluated in the AP1000 PRA. External fires are those occurring outside the plant site boundary. Potential effects on the plant could be loss of offsite power and forced isolation of the plant ventilation and possible control room evacuation. Usually, external fires are unable to spread onsite because of site clearing during the construction phase. NUREG-1407 notes that because the loss-of-offsite power is addressed in the Individual Plant Examination (IPE), it does not need to be reevaluated for Individual Plant Examination of External Events (IPEEE). As it relates to the AP1000 design, loss-of-offsite power was evaluated in the AP1000 internal events PRA. Loss-of-offsite power contributes less than 1% to the AP1000 plant core damage frequency. External fires do not need to be evaluated further as their contribution to core damage frequency is expected to be less than 1% of the total AP1000 plant CDF.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR101-SPLA-04
Revision: 0

Question:

On page 5, two criteria for screening out external events from the evaluation are stated. These criteria are used to screen out from quantitative evaluation (1) events of frequency greater than 1E-7 per year, and (2) events for which the resulting core damage frequency (CDF) can be shown (e.g., by qualitative or bounding analysis) to be less than 1E-8 per year. The staff finds these criteria to be appropriate. However, event frequency and CDF estimates used in the analysis may not have been based on robust information about the site and uncertainties (associated with both the design and the site) may not have been considered. In addition, design features, site characteristics and associated parameters and operational requirements, if any, which contribute to the low event frequency or CDF, should be explicitly identified and discussed. Please provide this information.

The following additional specific information is also needed:

(a) Explain the basis for replacing the second criterion (CDF less than 1E-8/year) with a more flexible one (CDF less than 10% of total CDF) which may also include significant uncertainties. It is stated that external event accident sequences with CDF less than 5.08E-8 (10% of total CDF) are not considered important to risk. However, such a frequency is as high as the frequency of the dominant accident sequences reported in the AP1000 PRA. In addition, there is uncertainty in the baseline PRA accident sequence frequencies, as discussed in the design certification FSER, which has not been considered. Please discuss.

(b) The conditional core damage probability (CCDP) given a hurricane event at the site for Case 3, which assumes loss of offsite power (LOSP) and unavailability of all non-safety systems for all events, appears to be underestimated. This CCDP is not in agreement with Sensitivity Case 36 (Focused PRA), documented in the AP1000 design certification PRA (APP-GW-GL-022), which assumes unavailability of all non-safety systems. In the focused PRA, the CCDP given LOSP is about 2E-5 while in the submitted evaluation is about two orders of magnitude lower. This discrepancy would be even higher had uncertainties, such as those associated with probabilities used in the PRA for common mode software failures, been considered. Please explain by referring to the focused PRA cut sets and assumptions.

Westinghouse Response:

(a) Westinghouse will consider the original criterion of 1.0E-08 events per year for the analysis. TR-101 will be updated to eliminate this discrepancy.

(b) The TR-101 CCDP for loss of offsite power with failure of the non-safety systems is analogous to Case 37, Focused PRA with manual DAS credited. The CCDP information for Case 37 was not presented in the AP1000 design certification PRA (Chapter 50 of Reference 1); however, preliminary calculations indicate that the CCDP defined above is comparable to the CCDP used in the TR-101 high winds analysis. The DAS manual actuation cables are located within the nuclear island and therefore are protected against high winds. The manual DAS reliability goal is set at 1.0E-02 /year. This reliability accounts for the two orders of magnitude difference seen between Sensitivity Case 36 and Sensitivity Case 37.

References:

1. APP-GW-GL-022, "AP1000 Probabilistic Risk Assessment", Revision 5.

Design Control Document (DCD) Revision: None

PRA Revision: None

Technical Report (TR) Revision:

Revise fourth paragraph of Section 3.0.

Where CDF is annual Core Damage Frequency, IEF is the Initiating Event Frequency and CCDP is the Conditional Core Damage Probability. If this evaluation indicates an acceptably small contribution to risk (e.g. CDF less than 1.0E-08 events/yr), then the progressive screening is complete and no detailed PRA will be necessary.

Revise thirteenth paragraph of Section 3.0.

In this high winds analysis, events are considered of low risk importance if their initiating event frequency is less than 10^{-7} or if their estimated CDF is less than 1.0E-08 events/yr.

Revise fifteenth paragraph of Section 3.0.

In the above table, none of the limiting initiating event frequencies were sufficiently low to be removed from further consideration. Therefore, the CDF calculation was performed. In each case, the resultant CDF is less than 1.0E-08 events/yr. The Category 4 and Category 5 Hurricane frequency is considered to be extremely conservative at 1.00E-02 events/yr. Yet, even with that initiating event frequency, and the worst case sensitivity study (Case 3), the resultant CDF is still less than the CDF criterion of 1.0E-08 events/yr. Case 2 is considered to be the representative model for High Winds, with Case 1 and Case 3 being treated as sensitivity studies on the baseline. Therefore, while the total Case 3 CDF does fall above the 1.0E-08 events/year CDF screening criteria, the results are considered very conservative. Therefore, no further detailed PRA is necessary for the AP1000 High Winds and Tornados analysis.

Revise Item #1 of Section 7.0

1. High Winds and Tornados were quantitatively evaluated to be of low risk to the AP1000 design for each of the participating sites. A bounding assessment is provided to show that the expected CDF due to any one of these events does not exceed 1.0E-08 events/yr. The same is true for the aggregate results. Sensitivity studies were performed to ensure low risk for more limiting scenarios. No further analysis is suggested.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR101-SPLA-05
Revision: 0

Question:

Tables 2.0-1 and 2.0-2 describe the Enhanced Fujita (EF) scale for tornados and the Saffir-Simpson scale for hurricanes, respectively. It is stated that three categories of tornados (EF3, EF4 and EF5) and two categories of hurricanes (Categories 4 and 5) may challenge the non-safety structures of an AP1000 plant because these events exceed the 145 mph operating basis wind speed used in the design of non-safety structures. However, the 145 mph operating basis wind speed is based on a three second gust. Although the wind speeds associated with each EF scale (Table 2.0-1 for tornados) are based on three second gust, the wind speeds associated with the Saffir-Simpson scale (Table 2.0-2) are one-minute average wind speeds. According to the Hurricane Research Division of the National Oceanic and Atmospheric Administration's (NOAA) Atlantic Oceanographic and Meteorological Laboratory, the value of the maximum three-second gust in a hurricane environment is approximately 30 percent higher than the one-minute average speed winds. This implies that Category 3 hurricanes, in addition to Category 4 and 5, may have 3-second gust wind speeds that exceed the AP1000 operating basis wind speed of 145 mph for non-safety structures. Please discuss.

Westinghouse Response:

Westinghouse will consider in TR-101 that Category 3 hurricanes may have 3-second gust wind speeds that exceed the AP1000 operating basis wind speed of 145 mph for non-safety structures. This consideration impacts the High Winds sensitivity case 2, and results in an increase in case 2 CDF from 3.44E-09 events per year to 4.52E-09 events per year. While this does represent an increase in CDF, the resultant CDF still remains below the screening criterion of 1.0E-08 events per year. The conclusions remain the same that no further detailed PRA is necessary for the AP1000 High Winds and Tornados analysis.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Technical Report (TR) Revision:

Revise ninth paragraph of Section 3.0.

In summary of the design against high winds, the plant is designed against 300 miles per hour (mph) winds. The operating basis of the plant is winds up to 145 mph. This means that the safety structures are protected against winds up to 300 mph and non-safety system structures are protected against winds up to 145 mph. Per the Enhanced Fujita Scale for Tornados (Table 2.0-1), no tornados are expected to exceed 300 mph; however, EF3, EF4, and EF5 tornados do exceed the operating basis of the AP1000. Per the Saffir-Simpson Scale for Hurricanes (Table 2.0-2), no hurricanes are expected to reach 300 mph winds; however, Category 3, Category 4 and Category 5 Hurricane winds may exceed the operating basis of the AP1000.

Revise eleventh paragraph of Section 3.0.

As stated above, the EF3, EF4, and EF5 Tornados and Category 3, Category 4 and Category 5 Hurricanes may challenge the non-safety related structures in the AP1000. Therefore, these events will be evaluated with the loss of additional SSCs. The Case 2 study is created by modifying the Case 1 analysis for the EF3, EF4, and EF5 tornados, and Category 3, Category 4 and Category 5 hurricanes to have a LOSP with additional failures of non-safety systems. A CCDP was developed for this scenario, which may be multiplied by the high wind event frequency. The CCDP was calculated as 5.85E-08.

Revise Table 3.0-1

Table 3.0-1: High Winds and Tornados Results					
Category	**Event**	**Limiting Initiating Event Freq. (events/yr)**	**CDF (events/yr)**		
			LOSP (Case 1) (events/yr)	**LOSP with non-safety systems unavailable for select events (Case 2) (events/yr)**	**LOSP with non-safety systems unavailable for all events (Case 3) (events/yr)**
High Winds	EF0 Tornado	8.00E-05	7.85E-13	7.85E-13[1]	4.68E-12
	EF1 Tornado	8.00E-05	7.85E-13	7.85E-13[1]	4.68E-12
	EF2 Tornado	1.60E-04	1.57E-12	1.57E-12[1]	9.36E-12
	EF3 Tornado	8.00E-05	7.85E-13	4.68E-12	4.68E-12
	EF4 Tornado	8.00E-05	7.85E-13	4.68E-12	4.68E-12
	EF5 Tornado	8.00E-05	7.85E-13	4.68E-12	4.68E-12
	Cat. 1 Hurricane	1.00E-01	9.81E-10	9.81E-10[1]	5.85E-09
	Cat. 2 Hurricane	5.00E-02	2.94E-10	2.94E-10[1]	2.93E-09
	Cat. 3 Hurricane	3.00E-02	2.94E-10	1.76E-09	1.76E-09
	Cat. 4 Hurricane	1.00E-02	9.81E-11	5.85E-10	5.85E-10
	Cat. 5 Hurricane	1.00E-02	9.81E-11	5.85E-10	5.85E-10
	Extratropical Cyclones	3.00E-02	2.94E-10	2.94E-10[1]	1.76E-09
Totals			2.07E-09	4.52E-09	1.35E-08

[1]CDF values from Case 1 were used to illustrate the winds from these events will not challenge additional plant SSCs.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR101-SPLA-06
Revision: 0

Question:

It is stated (pages 11 and 23) that engineering judgment was used to establish that the frequency of generating a storm surge of 18 feet is less than 1E-7 per year. Please explain the basis for this estimate. Also, please define and explain the relationship between the various heights (100, 45 and 18 feet) listed in the submittal and how were they used in the analysis to show that the flooding frequency is less than 1E-7 per year (refer to parameters in DCD Chapter 2 , as necessary).

Westinghouse Response:

Of the surveyed sites, only one site indicated susceptibility to external floods. This site indicated potential susceptibility to hurricane storm surges. Note that it is the responsibility of the COL applicant to defend their own event applicability evaluation.

The AP1000 is protected against floods up to the 100' level. The 100' level corresponds to the plant ground level. From this point, the ground is graded away from the structures. Thus, water will naturally flow away from the structures. Additionally, all seismic Category I SSCs are designed to withstand the effects of flooding. The seismic Category I SSCs below grade (below ground level) are protected against flooding by a water barrier consisting of waterstops and a waterproofing system. None of the non-safety SSCs were found to be important based on flooding considerations (Reference 1, Section 3.4.1.1).

The site described in the first paragraph is located at an elevation of 45' above sea level. Therefore, the AP1000 100' level, for this site, corresponds to 45' above sea level. Per DCD Section 3.4.1.1, the ground will be graded away from the structures beginning at the 100' level and sloping downward away from the structures. The Saffir-Simpson hurricane scale notes that Category 5 hurricanes have the ability to generate storm surges in excess of 18 feet. Hurricane Camille (1969) generated a storm surge of 25 feet along the Mississippi Gulf Coast (Reference 2).

Based on the description of a Category 5 hurricane in the Saffir-Simpson hurricane scale, a hurricane storm surge in excess of 18 feet may be classified as an extremely rare event. The ASME has recently approved changes to the ASME PRA Standard to assign a value to an "extremely rare event". That value is defined as 1E-06 / year for currently operating plants. Recognizing that the AP1000 design provides additional levels of safety, TR-101 suggests a value of 1E-07 /year to define an extremely rare event for the AP1000 design.

TR-101 will be revised to clarify the discussion.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

References:

1. APP-GW-GL-700, "AP1000 Design Control Document", Revision 16.

2. National Weather Service, "The Saffir-Simpson Hurricane Scale", June 22, 2006, Available: http://www.nhc.noaa.gov/aboutsshs.shtml.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision: Revision to TR-101

Revise Section 4.0 as follows.

An external flooding analysis was performed to account for any significant contribution to core damage frequency resulting from plant damage caused by storms, dam failure, and flash floods.

The analysis for External Floods begins with an examination of the Design Basis for the plant, which is documented in Section 2.0 of the AP1000 DCD (Reference 1). The AP1000 is protected against floods up to the 100' level. The 100' level corresponds to the plant ground level. From this point, the ground is graded away from the structures. Thus, water will naturally flow away from the structures. Additionally, all seismic Category I SSCs are designed to withstand the effects of flooding. The seismic Category I SSCs below grade (below ground level) are protected against flooding by a water barrier consisting of waterstops and a waterproofing system. None of the non-safety SSCs were found to be important based on flooding considerations (Reference 1).
Only one site indicated susceptibility to external floods, due to hurricane surge water. That site is located at an elevation of 45 feet above sea level. Therefore, the AP1000 100' level, for this site, corresponds to 45' above sea level. Per DCD Chapter 3.4.1.1, the ground will be graded away from the structures beginning at the 100' level and sloping downward away from the structures. The Saffir-Simpson hurricane scale notes that Category 5 hurricanes have the ability to generate storm surges in excess of 18 feet. Hurricane Camille (1969) generated a storm surge of 25 feet along the Mississippi Gulf Coast (Reference 7).

Based on the description of a Category 5 hurricane in the Saffir-Simpson hurricane scale, a hurricane storm surge in excess of 18 feet may be classified as an extremely rare event. The ASME has recently approved changes to the ASME PRA Standard to assign a value to an "extremely rare event". That value is defined as 1E-06 / year for currently operating plants. Recognizing that the AP1000 design provides additional levels of safety, TR-101 suggests a value of 1E-07 /year to define an extremely rare event for the AP1000 design.
As a sensitivity study, the 1.0E-07 events/yr initiating event frequency is taken as the frequency of an event that may challenge the non-safety structures in the plant. This sensitivity study also considers failure of the switchyard due to flooding. A LOSP with failure of the non-safety systems CCDP was developed. Equation 1 was used to determine the resultant CDF.

As expected, the risk due to a flooding event is very low for the AP1000. The resultant CDF of 5.85E-15 events/yr is an insignificant contribution to total plant CDF.

For other sites, the AP1000 is designed to site characteristics described in Chapter 2 of the DCD. The site selection criterion provides that, for an accident that has potential consequences serious enough to affect the safety of the plant to the extent that 10 CFR 100 guidelines are exceeded, the annual frequency of occurrence is less than 1.0E-06 per year. As explained in Section 2.0, this criterion should be extended to an annual frequency of occurrence less than 1.0E-07 per year. As none of the surveyed sites indicated susceptibility to floods due to dam failure and/or flash floods, those events should be considered on a site-by-site basis.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-TR101-SPLA-07
Revision: 0

Question:

Verify that the assumed "limiting event" frequencies for total aviation accidents (1.21E-06 events/year) and for commercial size aircraft accidents (1E-7 events/year) will be demonstrated by the COL applicant for each site. In addition, please clarify several statements and the basis of assumptions made in the evaluation of aviation accidents: (a) list the standby non-safety systems that were conservatively assumed failed; (b) explain why a small aircraft accident cannot impact equipment beyond standby non-safety systems, such as electrical and I&C cabinets located outside containment; (c) explain the impact of fires initiated by a small aircraft accident, including the possibility of fire-induced spurious actuation of squib valves.

Westinghouse Response:

The assumed "limiting event" frequencies for total aviation accidents and for commercial size aircraft accidents will be demonstrated by the COL applicant for the applicant's site. It is the COL applicant's responsibility to determine the applicability of the postulated accident and the frequency of the accident.

(a) The standby non-safety systems that were conservatively assumed failed are CVS, RNS, SFW, Diesel Generators and automatic DAS. The hardware for the CVS, SFW, Diesel Generators, and automatic DAS are located outside of the areas assessed for commercial aircraft accidents. The non-safety systems that were conservatively assumed failed are consistent with the RTNSS Sensitivity Study documented in AP1000 PRA Chapter 50, Case 37. The containment building, shield building, and spent fuel pool have been assessed for commercial size aircraft accidents. Therefore, the equipment in these areas is assumed to be protected against commercial and small aircraft accidents.

(b) The AP1000 containment building, shield building, and spent fuel pool are specifically analyzed against commercial size aircraft and military jet accidents. The impact from a small personal aircraft, with an impact angle of 0 to 45 degrees from horizontal is not explicitly analyzed because results are enveloped by other external events such as tornado wind and seismic. The non-1E electrical system may be affected by a small aircraft accident; however, the systems that are dependent on non-1E electrical power are already failed in this evaluation, as described in the response to (a).

(c) Fires initiated by aircraft accidents may occur outside of the areas analyzed for the reasons described in the response to (a) and (b). As such, fires may impact the non-safety SSCs described in the response to (a). The CCDP calculated for the TR-101 aircraft accident evaluation was used and is conservative as a fire is unlikely to affect this wide range of systems.

The PRA does not credit spurious actuation of the Automatic Depressurization System due to fire in sensor cables, because the spurious signals must be in a valid impedance range and several spurious signals are required, first to actuate the CMTs, then the low-level signals and so on. This is also true for a fire in the DAS manual actuation cables for the same reasons as above. Per Chapter 57 of the AP1000 PRA (Reference 1), the probability of this scenario is very small and does not need to be modeled further.

Reference:

1. AP1000 Document APP-GW-GL-022, Chapter 57, "Fire Risk Assessment", Revision 8.

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-TR101-SPLA-08
Revision: 0

Question:

The evaluation of Pipeline Accidents states that *"The expected frequency value is expected to be below the initiating event criterion of 1E-7 events per year."* Does this mean that the COL applicant will demonstrate that the site meets this criterion? Please clarify.

Westinghouse Response:

The intent of TR-101 is to qualitatively illustrate the potential scenarios resulting from gas pipeline accidents. COL applicants should demonstrate that nearby facility accidents, such as pipeline accidents, are:

(a) applicable to their site, and

(b) if so, demonstrate the frequency of the postulated accident is less than the 1.0E-07 events per year criterion.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None