Westinghouse

Westinghouse Electric Company
Nuclear Power Plants
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-6206
Direct fax: 412-374-5005
e-mail: sisk1rb@westinghouse.com

Your ref: Docket No. 52-006
Our ref: DCP/NRC2211

July 22, 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-01, -02 and -04 as sent in an email from Mike Miernicki to Sam Adams dated April 29, 2008. This response completes three of sixteen requests received to date for SRP Section 19.0.

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,

for/ John T. DeBlasio

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 19.0

D063
NRO

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

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-01
Revision: 0

Question:

The following items represent important PRA-based insights that ensure the assumptions made in the PRA will remain valid for the as-built, as-operated plant. Please address each of them in AP1000 DCD Table 19.59-18, "AP1000 PRA-Based risk Insights" (Table 19.59-18).

(a) The DAS manual actuation cables are located within the nuclear island and therefore are protected from external hazards, such as high winds.

(b) Screens and louvers cover 29 large vertical openings located all around the containment, each 9 ft high by 12 ft long, into an enclosed volume where the air inlet ducts are located. The screens are designed to prevent foreign objects or debris from entering the air flow path. In the event of snow or ice storm, some fraction of these air inlets can become blocked with snow or ice. The results of analysis, made available to the staff during the design certification of the AP1000, 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.

(c) 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.

(d) 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. The presence of a positive air flow during normal operation prevents ice and snow from entering the chimney.

(e) There is a surveillance requirement (SR 3.6.6.5) to verify every 24 months that the air flow path is unobstructed.

(f) The AP1000 is protected against floods up to the 100 ft level, which corresponds to the ground level at each plant. From this point the ground is graded so that water naturally flows away from the plant structures.

(g) The seismic Category I SSCs below grade are protected against flooding by a water barrier comprising waterstops and a waterproofing system.

Westinghouse Response:

It is agreed that the items presented represent important PRA based insights that ensure the assumptions made in the PRA will remain valid for the as built, as operated plant. The items are each addressed in the proposed change to AP1000 DCD Table 19.59 18, "AP1000 PRA Based risk Insights" (Table 19.59 18).

Design Control Document (DCD) Revision:

DCD mark-ups are provided on pages 3 and 4 of this response. Revise DCD section 19.59.by adding items 83 through 85 to Table 19.59-18 after item 82 and revising item 3 as shown. The first paragraph shown below for Item 85 is added in response to RAI-SRP-19.0-SPLA-02 and is not marked as a change in this RAI but is shown here for completeness.

PRA Revision:
None

Technical Report (TR) Revision:
None

DCD Mark-ups:

Insight	Disposition
83. The passive cooling system louvers and screens cover 29 large vertical openings located all around the containment, each 9 ft high by 12 ft long, into an enclosed volume where the air inlet ducts are located. The screens are designed to help prevent foreign objects or debris from entering the air flow path. In the event of snow or ice storm, some fraction of these air inlets can become blocked with snow or ice. The results of analysis, made available to the staff during the design certification of the AP1000, 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. 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. 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. The presence of a positive air flow during normal operation helps prevents ice and snow from entering the chimney. There is a surveillance requirement (SR 3.6.6.5) to verify every 24 months that the air flow path is unobstructed.	6.2.2.2.4 3.6.6
84. The AP1000 is protected against external floods up to the 100 ft level, which corresponds to the ground level at each plant. From this point the ground is graded so that water naturally flows away from the plant structures.	
85. The plant is designed such that the 100' level is slightly above grade and the level of anticipated external flooding. Below grade is protected against flooding by a water barrier consisting of waterstops and a waterproofing system. Seismic Category I SSCs below grade are designed to withstand hydrostatic pressures. The seismic Category I SSCs below grade are protected against external flooding by a water barrier comprising waterstops and a waterproofing system.	3.4.1.1.1

	Insight	Disposition
3.	The diverse actuation system (DAS) provides a nonsafety-related means of performing the following functions:	Tier 1 Information
	- Initiates automatic and manual reactor trip	
	- Automatic and manual actuation of selected engineered safety features.	
	Diversity is assumed in the PRA that eliminates the potential for common cause failures between PMS and DAS.	
	- The DAS automatic actuation signals are generated in a diverse manner from the PMS signals. Diversity between DAS and PMS is achieved by the use of different architecture, different hardware implementations, and different software.	Tier 1 Information
	DAS provides control room displays and fixed position controls to allow the operators to take manual actions.	7.7.1
	DAS actuates using 2-out-of-2 logic. Actuation signals are output to the loads in the form of normally de-energized, energize-to-actuate signals. The normally de-energized output state, along with the dual 2-out-of-2 redundancy, reduces the probability of inadvertent actuation.	7.7.1.11
	The actuation devices of DAS and PMS are capable of independent operation that is not affected by the operation of the other. The DAS is designed to actuate components only in a manner that initiates the safety function.	7.7.1.11
	The DAS reactor trip function is to trip the control rods by deenergizing the motor-generator set.	7.7.1.11
	In the PRA it is assumed the following eliminates the potential for common cause failures between automatic and manual DAS functions.	
	- DAS manual initiation functions are implemented in a manner that bypasses the signal processing equipment of the DAS automatic logic.	Tier 1 Information
	The DAS, including the M-G set field breakers, is included in the D-RAP.	17.4
	<u>The DAS manual actuation cables are located within the nuclear island and therefore are protected from external hazards, such as high winds.</u>	

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP19.0-SPLA-02
Revision: 0

Question:

The evaluation of external floods states, "All seismic Category I structures, systems and components (SSCs) are designed to withstand the effects of flooding." The staff requests a clarification of this statement. Specifically, do seismic Category I SSCs withstand immersion in water or they are just able to withstand expected hydrodynamic and hydrostatic pressures? Please clarify and include a statement to this effect in Table 19.59 18.

Westinghouse Response:

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 plant is designed such that the 100' level is slightly above grade and the level of anticipated external flooding. Below grade is protected against flooding by a water barrier consisting of waterstops and a waterproofing system. Seismic Category I SSCs below grade are designed to withstand hydrostatic pressures.

References:

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

Design Control Document (DCD) Revision:

Revise DCD section 19.59 by adding the following to item 85 of Table 19.59-18. The second paragraph shown below for Item 85 is added in response to RAI-SRP-19.0-SPLA-01 and is not marked as a change in this RAI but is shown here for completeness.

Insight	Disposition
85. The plant is designed such that the 100' level is slightly above grade and the level of anticipated external flooding. Below grade is protected against flooding by a water barrier consisting of waterstops and a waterproofing system. Seismic Category I SSCs below grade are designed to withstand hydrostatic pressures.	
The seismic Category I SSCs below grade are protected against flooding by a water barrier comprising waterstops and a waterproofing system.	3.4.1.1.1

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-04
Revision: 0

Question:

The AP1000 DCD, Revision 16, (Section 6.3.2.2.7 and Appendix 19E) presents two changes that appear to be relevant to the shutdown risk assessment: (1) actuation of IRWST injection by a fourth stage automatic depressurization system signal rather than by a low hot leg level signal and (2) large interconnected screens without separate trash racks or coarse and fine screens. Please discuss the impact of these changes on the results and insights of the shutdown risk assessment.

Westinghouse Response:

(1) Actuation of IRWST injection by a hotstage automatic depressurization system signal rather than by a low hot leg level signal

The AP1000 DCD, Revision 16, documents a change to the description for fourth stage automatic depressurization system logic. This change is reflected DCD Revision 16 Appendix 19E as follows:

- Actuation of fourth-stage ADS valves on low (empty) hot leg level on a two-out-of-two basis (RCS hot leg level channel basis)
- Actuation of fourth-stage ADS causes actuation of IRWST injection

The description of the logic in the AP1000 DCD, Revision 15 Appendix 19E is as follows:

- Actuation of IRWST injection on low (empty) hot leg level on a two-out-of-two basis (RCS hot leg level channel basis)
- Actuation of fourth-stage ADS valves on low (empty) hot leg level on a two-out-of-two basis (RCS hot leg level channel basis)

The change in description does not reflect a change in the logic. The logic described in DCD Revision 15 has not been changed. The description of the logic has been changed in DCD Revision 16 to more clearly represent the existing logic. The PRA model and shutdown risk assessment are based upon this logic configuration. The change in wording for the logic for actuation of IRWST injection has no impact on the results and insights of the shutdown risk assessment.

(2) Large interconnected screens without separate trash racks or coarse and fine screens. Please discuss the impact of these changes on the results and insights of the shutdown risk assessment.

AP1000 DCD revision 16 reflects the use of large interconnected recirculation screens for recirculation flow. The PXS system has two banks of interconnected screens that are used to provide recirculation flow. These screens were assessed to the Requirements of Regulatory Guide 1.82, Revision 3 in Reference 1. The screens are constructed of perforated stainless steel plate that is used to form pockets. The structural integrity of this configuration is well in excess of screen-like material that was typically used in PWR sump screens prior to actions taken to close Generic Safety Issue GSI-191 and respond to Generic Letter GL 2004-02. As is the case with current operating plants, the structural integrity of the API000 screens precludes the need for trash racks. Reference 2 provides additional discussion of the design of the AP1000 screens.

The AP 1000 design precludes the generation of missiles inside containment as discussed in DCD section 3.5.1.2. The screen testing demonstrated that they will not see a significant head loss while operating within design basis flow/debris conditions (Reference 3). In addition, the screens will be designed to withstand a significant head loss.

The changes in the screen design were qualitatively judged to have no negative impact to the PRA, thus the DCD PRA was not changed to reflect the screen changes. Instead, these changes are judged to have a positive impact to the PRA resulting from a lower failure probability of the screens due to the enhanced design and increased flow area. This change in failure probability was not credited in the DCD PRA; therefore, no change has been made to the shutdown risk assessment as a result of change in screen design.

References:

1. Westinghouse letter DCPINRC2116, Regulatory Guide 1.82, Revision 3 Assessment, Docket No. 52-006, April 6, 2008, Attachment A - AP1000 Regulatory Guide 1.82, Revision 3, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident" Assessment Matrix.

2. APP-GW-GLN-147, Revision 1, Technical Report 147, "APIOOO CR and IRWST Screen Design", February 2008.

3. WCAP-16914-P, Revision 0, "Evaluation of Debris Loading Head Loss Tests for API000 Recirculation Screens and In-containment Refueling Water Storage Tank Screens," March 2008

Design Control Document (DCD) Revision: None

PRA Revision: None

Technical Report (TR) Revision: None