

AP1000 DCD SER Open Item REVIEW

Open Item Resolution

OI Response Number: OI-SRP19.0-SPLA-12-01
Revision: 0

Question:

The staff is looking for more information related to Westinghouse's response to RAI-SRP19.0-SPLA-12.

Confirm that an acceptable seismic margin is maintained for HRHF sites.

(Email Chris Procter to Thom Ray, 2/5/09, "Preliminary draft list of Chapter 19 Open Items")

In RAI-SRP19.0-SPLA-21 the staff stated, Section 19.55.2, Table 19.55-1 – As part of its design amendment, Westinghouse changed the method of construction for the shield building from a conventionally reinforced concrete structure to a proposed design that uses steel-plated, concrete-filled modules. Provide the basis for the HCLPF values for the shield building, explicitly considering the design changes from the reinforced concrete to modular construction.

In RAI-SRP19.0-SPLA-22 the staff stated, the effects of soil-structure interaction (SSI) are now addressed in the DCD, while the previous revision did not consider SSI because it was a fixed-base model for hard-rock site. The proposed design addresses sites from soil to hard rock. When considering the current estimates of seismic hazard for the central and eastern United States, peak ground acceleration values may be higher than those previously considered. When peak ground acceleration is coupled with SSI effects there can be increased seismic demands on structures such as the shield building, in terms of bending and horizontal shear response. Describe how SSI effects are taken into account in the HCLPF values provided in Table 19.55-1.

Westinghouse Response:

The response to this OI is in two parts. Part 2 pertaining to equipment seismic qualification demonstrating that sufficient margin needed for the review level earthquake (i.e., HCLPF value $\geq 0.5g$) is obtained in the seismic qualification tests has been addressed (transmitted to the NRC January 14, 2010 via Westinghouse letter DCP_NRC_002739).

This is the Part 1 response that addresses the NRC request that the HCLPF values presented in Chapter 19 (Table 19.55-1) be revised to address the concerns in RAI-SRP19.0-SPLA-21 and RAI-SRP19.0-SPLA-22. Table 19.55-1 has been revised from DCD Rev. 17 and is given below under Design Control Document (DCD) Revision. The electrical equipment is not listed as previously provided in DCD Rev. 17, but identified in a new table 19.55-2. The HCLPF values given in the table reflect the response provided in Part 2 to this OI.

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Also, per OI-SRP19.0-SPLA-12-02 R2 response provided to the NRC on January 14, 2010, via Westinghouse letter DCP_NRC_002739, the equipment in Table 19.55-2 has been provided in this response. This table lists the equipment that is important to PRA-based seismic margin.

Design Control Document (DCD) Revision:

Table 19.55-1 given in Chapter 19 of the DCD (Revision 17) is to be revised as given below. Table 19.55-2 is added to list the equipment important to the Seismic PRA which includes electrical equipment.

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Table 19.55-1 (Sheet 1 of 2) Seismic Margin HCLPF Values				
Description	Median pga ^[1]	Bc	HCLPF Value pga ^[1]	Basis
Buildings/Structures				
Shield Building ⁽⁸⁾	-	-	0.60	[2]
Steel Containment Vessel - Buckling	1.94	0.42	0.73	[4]
Steel Containment Vessel - Overturning	-	-	1.38	[4]
Containment Baffle - Support Failure	-	-	0.91	[2]
Interior Containment Structure & IRWST Tank	-	-	0.71	[2]
Exterior Walls of Auxiliary Building – Wall 1	-	-	0.87	[3]
Exterior Walls of Auxiliary Building – Wall 11	-	-	1.32	[3]
Primary Components				
Reactor Pressure Vessel	-	-	0.56	[2]
Reactor Pressure Vessel Supports	1.58	0.35	0.71	[4]
Reactor Internals and Core Assembly (includes fuel)	1.5	0.51	0.5	[5]
Control Rod Drive Mechanism (CRDM) and Hydraulic Drive Units	2.2	0.51	0.7	[5]
Steam Generator	-	-	0.54	[2]
Steam Generator Support Column Buckling	0.92	0.23	0.54	[4]
Steam Generator Lower Lateral Support	1.23	0.34	0.57	[4]
Steam Generator Intermediate Supports	1.17	0.30	0.59	[4]
Pressurizer Supports ^[9]	-	-	0.58	[2]
Pressurizer Upper Support Weld	1.02	0.31	0.50	[4]
Pressurizer Upper Support Strut	1.11	0.29	0.56	[4]
Pressurizer Lower Support Strut	1.41	0.29	0.72	[4]
Reactor Coolant Pump & Supports	2.2	0.51	0.68	[5]

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Table 19.55-1 (Sheet 2 of 2) Seismic Margin HCLPF Values				
Description	Median pga ^[1]	β_c	HCLPF Value pga ^[1]	Basis
Mechanical Equipment				
Polar Crane	-	-	0.81	[2]
Piping - Support Controlled	3.3	0.61	0.81	[5]
Cable trays - Support Controlled	2.2	0.61	0.54	[5]
Accumulator Tank	2.2	0.46	0.76	[5]
Core Make Up Tank	-	-	0.87	[2]
Heat Exchanger (PRHR)	-	-	1.11	[2]
Valves				
Higher than El. 100'	3.3	0.61	0.81	[5]
Equal to or Lower than El. 100'	-	-	1.02	[2]
Passive Containment Cooling System	-	-	0.63	[3]
Electrical Equipment (See Table 19.55-2)				
Non-Sensitive to High Frequency Excitation or Non-Screened Out Sensitive to High Frequency Excitation	-	-	0.52	[6]
Screened Out Sensitive to High Frequency Excitation	-	-	0.6	[6]
Ceramic Insulators ^[10]	0.2	0.35	0.09	[7]

Notes:

- [1] pga is the free field peak ground acceleration level for the seismic event
- [2] HCLPF based on deterministic approach
- [3] HCLPF based on conservative deterministic failure margin approach
- [4] HCLPF based on probabilistic fragility analysis
- [5] HCLPF based on URD recommended generic fragility data
- [6] HCLPF based on design margin, code requirements and test margins inherent to the seismic qualification Testing.
- [7] HCLPF based on recognized generic fragility data
- [8] The HCLPF value listed is for the Reinforced Concrete (RC) shield building. For the new design of the enhanced shield building, the HCLPF value is higher.
- [9] The pressurizer support columns are not the critical section due to their high design margin. The HCLPF value of the pressurizer supports is controlled by the lateral support loads.
- [10] The capacity of the ceramic insulators is less than the review level earthquake of 0.5g. The failure of the ceramic insulators is considered in the PRA analysis.

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<p>Table 19.55-2 Equipment important to Seismic PRA</p>	
Equipment	AP1000 Tag Number
Fourth Stage ADS Squib Valve	RCS-PL-V004A [1]
Fourth Stage ADS Squib Valve	RCS-PL-V004B [1]
Fourth Stage ADS Squib Valve	RCS-PL-V004C [1]
Fourth Stage ADS Squib Valve	RCS-PL-V004D [1]
Containment Recirculation A Squib Valve	PXS-PL-V118A [1]
Containment Recirculation B Squib Valve	PXS-PL-V118B [1]
Containment Recirculation A Squib Valve	PXS-PL-V120A [1]
Containment Recirculation B Squib Valve	PXS-PL-V120B [1]
IRWST Injection A Squib Valve	PXS-PL-V123A [1]
IRWST Injection B Squib Valve	PXS-PL-V123B [1]
IRWST Injection A Squib Valve	PXS-PL-V125A [1]
IRWST Injection B Squib Valve	PXS-PL-V125B [1]
Containment Recirculation A Check Valve	PXS-PL-V119A [2]
Containment Recirculation B Check Valve	PXS-PL-V119B [2]
IRWST Injection A Check Valve	PXS-PL-V122A [2]
IRWST Injection B Check Valve	PXS-PL-V122B [2]
IRWST Injection A Check Valve	PXS-PL-V124A [2]
IRWST Injection B Check Valve	PXS-PL-V124B [2]
IRWST Screen A	PXS-MY-Y01A [3]
IRWST Screen B	PXS-MY-Y01B [3]
IRWST Screen C	PXS-MY-Y01C [3]
Containment Recirculation Screen A	PXS-MY-Y02A [3]
Containment Recirculation Screen B	PXS-MY-Y02B [3]
Core Makeup Tank A	PXS-MT-02A [2]
Core Makeup Tank B	PXS-MT-02B [2]
CMT A Discharge Check Valve	PXS-PL-V016A [2]
CMT B Discharge Check Valve	PXS-PL-V016B [2]
CMT A Discharge Check Valve	PXS-PL-V017A [2]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
CMT B Discharge Check Valve	PXS-PL-V017B [2]
CMT A Discharge Isolation Valve	PXS-PL-V014A [4]
CMT B Discharge Isolation Valve	PXS-PL-V014B [4]
CMT A Discharge Isolation Valve	PXS-PL-V015A [4]
CMT B Discharge Isolation Valve	PXS-PL-V015B [4]
Batteries	
IDSA 125V 60 Cell Battery 1A	IDSA-DB-1A [5]
IDSA 125V 60 Cell Battery 1B	IDSA-DB-1B [5]
IDSB 125V 60 Cell Battery 1A	IDSB-DB-1A [5]
IDSB 125V 60 Cell Battery 1B	IDSB-DB-1B [5]
IDSB 125V 60 Cell Battery 2A	IDSB-DB-2A [5]
IDSB 125V 60 Cell Battery 2B	IDSB-DB-2B [5]
IDSC 125V 60 Cell Battery 1A	IDSC-DB-1A [5]
IDSC 125V 60 Cell Battery 1B	IDSC-DB-1B [5]
IDSC 125V 60 Cell Battery 2A	IDSC-DB-2A [5]
IDSC 125V 60 Cell Battery 2B	IDSC-DB-2B [5]
IDSD 125V 60 Cell Battery 1A	IDSD-DB-1A [5]
IDSD 125V 60 Cell Battery 1B	IDSD-DB-1B [5]
Inverters	
IDSA Inverter	IDSA-DU-1 [5]
IDSB Inverter 1	IDSB-DU-1 [5]
IDSB Inverter 2	IDSB-DU-2 [5]
IDSC Inverter 1	IDSC-DU-1 [5]
IDSC Inverter 2	IDSC-DU-2 [5]
IDSD Inverter	IDSD-DU-1 [5]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
Switchgear	
RCP 1A 6900V Switchgear 31	ECS-ES-31 [5]
RCP 1A 6900V Switchgear 32	ECS-ES-32 [5]
RCP 2A 6900V Switchgear 51	ECS-ES-51 [5]
RCP 2A 6900V Switchgear 52	ECS-ES-52 [5]
RCP 1B 6900V Switchgear 41	ECS-ES-41 [5]
RCP 1B 6900V Switchgear 42	ECS-ES-42 [5]
RCP 2B 6900V Switchgear 61	ECS-ES-61 [5]
RCP 2B 6900V Switchgear 62	ECS-ES-62 [5]
Reactor Trip Switchgear	PMS-JD-RTSA01 [5]
Reactor Trip Switchgear	PMS-JD-RTSA02 [5]
Reactor Trip Switchgear	PMS-JD-RTSB01 [5]
Reactor Trip Switchgear	PMS-JD-RTSB02 [5]
Reactor Trip Switchgear	PMS-JD-RTSC01 [5]
Reactor Trip Switchgear	PMS-JD-RTSC02 [5]
Reactor Trip Switchgear	PMS-JD-RTSD01 [5]
Reactor Trip Switchgear	PMS-JD-RTSD02 [5]
Motor Control Centers	
IDSA 250 Vdc MCC	IDSA-DK-1 [5]
IDSB 250 Vdc MCC	IDSB-DK-1 [5]
IDSC 250 Vdc MCC	IDSC-DK-1 [5]
IDSD 250 Vdc MCC	IDSD-DK-1 [5]
Transformers	
IDSA Regulating Transformer 1	IDSA-DT-1 [5]
IDSB Regulating Transformer 1	IDSB-DT-1 [5]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
IDSC Regulating Transformer 1	IDSC-DT-1 [5]
IDSD Regulating Transformer 1	IDSD-DT-1 [5]
Transfer Switches	
IDSA Fused Transfer Switch Box 1	IDSA-DF-1 [5]
IDSB Fused Transfer Switch Box 1	IDSB-DF-1 [5]
IDSB Fused Transfer Switch Box 2	IDSB-DF-2 [5]
IDSC Fused Transfer Switch Box 1	IDSC-DF-1 [5]
IDSC Fused Transfer Switch Box 2	IDSC-DF-2 [5]
IDSD Fused Transfer Switch Box 1	IDSD-DF-1 [5]
IDSS Fused Transfer Switch Box 1	IDSS-DF-1 [5]
Transfer Switches	
IDSA Fused Transfer Switch Box 1	IDSA-DF-1 [5]
IDSB Fused Transfer Switch Box 1	IDSB-DF-1 [5]
IDSB Fused Transfer Switch Box 2	IDSB-DF-2 [5]
IDSC Fused Transfer Switch Box 1	IDSC-DF-1 [5]
IDSC Fused Transfer Switch Box 2	IDSC-DF-2 [5]
IDSD Fused Transfer Switch Box 1	IDSD-DF-1 [5]
IDSS Fused Transfer Switch Box 1	IDSS-DF-1 [5]
IDSS Spare Termination Box	IDSS-DF-2 [5]
IDSS Spare Termination Box	IDSS-DF-3 [5]
IDSS Spare Termination Box	IDSS-DF-4 [5]
IDSS Spare Termination Box	IDSS-DF-5 [5]
IDSS Spare Termination Box	IDSS-DF-6 [5]
Protection and Safety Monitoring System Cabinets	
Nuclear Instrumentation Cabinet (NIC)	N/A [5]
Bistable/Coincidence Logic Cabinet (BCC)	N/A [5]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
Integrated Logic Cabinet (ILC)	N/A [5]
Squib Valve Controller Cabinet (SVC)	N/A [5]
Sequence of Events (SOE) Cabinet	N/A [5]
Qualified Data Processing Cabinet (QPDS)	N/A [5]
Main Control Room	
Operator Workstation A	N/A [5]
Operator Workstation B	N/A [5]
Supervisor Workstation	N/A [5]
Switch Station (Including Switches)	N/A [5]
QDPS MCR Display Unit	PMS-JY-001B [5]
QDPS MCR Display Unit	PMS-JY-001C [5]
Level Switches	
Core Makeup Tank A Narrow Range	PXS-JE-LS011A [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS011B [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS011C [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS011D [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS012A [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS012B [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS012C [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS012D [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS013A [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS013B [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS013C [5]
Core Makeup Tank A Narrow Range	PXS-JE-LS013D [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS014A [5]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
Core Makeup Tank B Narrow Range	PXS-JE-LS014B [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS014C [5]
Core Makeup Tank B Narrow Range	PXS-JE-LS014D [5]
Containment Floodup Level	PXS-JE-LS050 [5]
Containment Floodup Level	PXS-JE-LS051 [5]
Containment Floodup Level	PXS-JE-LS052 [5]
Transmitters	
PCS Water Delivery Flow	PCS-JE-FT001 [5]
PCS Water Delivery Flow	PCS-JE-FT002 [5]
PCS Water Delivery Flow	PCS-JE-FT003 [5]
PCS Water Delivery Flow	PCS-JE-FT004 [5]
PCS Storage Tank Water Level	PCS-JE-LT010 [5]
PCS Storage Tank Water Level	PCS-JE-LT011 [5]
PRHR HX Flow	PXS-JE-FT049A [5]
PRHR HX Flow	PXS-JE-FT049B [5]
RCS Hot Leg 1 Flow	RCS-JE-FT101A [5]
RCS Hot Leg 1 Flow	RCS-JE-FT101B [5]
RCS Hot Leg 1 Flow	RCS-JE-FT101C [5]
RCS Hot Leg 1 Flow	RCS-JE-FT101D [5]
RCS Hot Leg 2 Flow	RCS-JE-FT102A [5]
RCS Hot Leg 2 Flow	RCS-JE-FT102B [5]
RCS Hot Leg 2 Flow	RCS-JE-FT102C [5]
RCS Hot Leg 2 Flow	RCS-JE-FT102D [5]
IRWST Level	PXS-JE-LT045 [5]
IRWST Level	PXS-JE-LT046 [5]

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Table 19.55-2 Equipment important to Seismic PRA	
Equipment	AP1000 Tag Number
IRWST Level	PXS-JE-LT047 [5]
IRWST Level	PXS-JE-LT048 [5]
RCS Hot Leg Water Level	RCS-JE-LT160A [5]
RCS Hot Leg Water Level	RCS-JE-LT160B [5]

Notes:

- [1] Per Table 3I.6-2 and 3I.6-3, the valves are not High Frequency Sensitive but the Limit Switch and Squib Operators are potential high frequency sensitive equipment.
- [2] Per Table 3I.6-2 and 3I.6-3, the components are not high frequency sensitive components.
- [3] Not a component listed in Table 3I.6-2 as potentially sensitive to high frequency.
- [4] Per Table 3I.6-2 and 3I.6-3, the valves are not High Frequency Sensitive but the Limit Switch and solenoid valve are potential high frequency sensitive equipment.
- [5] Per Table 3I.6-2, the components are potentially sensitive to high frequency.

PRA Revision:

None

Technical Report (TR) Revision:

None