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Your ref: Docket No. 52-006  
Our ref: DCP\_NRC\_002804

March 3, 2010

Subject: AP1000 Response to Proposed Open Item (Chapter 3)

Westinghouse is submitting the following responses to the NRC open item (OI) on Chapter 3. These proposed open item responses are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in these responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following proposed Open Item(s):

OI-SRP3.2.1-EMB2-01  
OI-SRP3.2.1-EMB2-02

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,

A handwritten signature in black ink, appearing to read 'Robert Sisk'.

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

/Enclosure

1. Response to Proposed Open Item (Chapter 3)

DD63  
NRD

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ENCLOSURE 1

AP1000 Response to Proposed Open Item (Chapter 3)

# AP1000 DESIGN CERTIFICATION REVIEW

## Response to SER Open Item (RAI)

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RAI Response Number: OI-SRP3.2.1-EMB2-01  
Revision: 0

### **Question:**

With regard to additional seismic requirements that may apply to certain Class D systems and components, it is still not clear what those additional requirements are. DCD Subsection 3.2.2.6 states that, with regard to Class D, the systems and components are not designed for seismic loads. For example, other than anchorage, the seismic requirements for the ancillary diesel generators and other equipment to ensure their functionality following a seismic event is not defined. The staff guidance in a memorandum dated July 18, 1994, pertaining to AP600 identified a proposed review approach for equipment designated as important by the RTNSS process. Although a dynamic qualification test may not be necessary for this equipment, the staff memorandum identified an approach where a dynamic analysis or qualification of electrical and mechanical equipment by experience may be used on a case by case basis. The Staff is concerned that seismic anchorage alone does not ensure functionality of electrical and mechanical equipment following an SSE, unless it is supported by an analysis or experience.

### **Westinghouse Response:**

Westinghouse has reviewed the staff's comment pertaining to the application of seismic requirements to Regulatory Treatment of Non-Safety Systems (RTNSS) SSCs. Westinghouse would like to clarify the staff guidance applicable to the design certification review of the AP1000; both the AP600 and AP1000 design certifications were completed in accordance with staff guidance documented in SECY 96-128, dated June 12, 1996, as approved in staff requirements memorandum dated January 15, 1997. Therefore, it is Westinghouse's position that the staff guidance in the memorandum dated July 18, 1994 is not applicable to the AP1000 design certification review.

It should also be noted that the amendment to the AP1000 design certification under review does not contain any changes to the application of seismic design requirements to RTNSS SSCs. The application of the RTNSS process and the associated seismic requirements, which was originated during the AP600 design review process, was reviewed and approved by the staff as documented in NUREG-1512 and NUREG-1793.

Per NUREG-1512, Subsection 22.5.3:

"Westinghouse responded to the staff's comments in a letter dated October 10, 1997 [*Letter Number NSD-NRC-97-5367*], incorporating design changes related to post-72-hour actions and responses to staff concerns regarding issues such as protection from natural phenomena, long-term main control room habitability, and spent fuel pool cooling. Westinghouse has also developed RTNSS controls for the post-72-hour, non-safety-related systems that are consistent with those

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## Response to SER Open Item (RAI)

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developed for other risk-significant, non-safety-related SSCs in accordance with the staff's position as stated in its letter to Westinghouse dated July 7, 1997.

The staff finds that Westinghouse's actions, with regard to post-72-hour actions, are acceptable and comply with the staff's approved positions as stated in SECY-94-084 and SECY-96-128. All required equipment is onsite and protected consistent with GDC 2, with consumable supplies sufficient to last at least 7 days."

As documented in NUREG-1793, Subsection 22.5.6:

"The staff evaluation of post-72-hour actions is based on the position developed during the AP600 review and described in SECY-96-128, "Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standardized Passive Reactor Design," dated June 12, 1996, which was approved by the Commission in a memorandum dated January 15, 1997 ... Section 10.3 of WCAP-15985, Revision 2, specifies the short-term availability controls for this equipment, and also states that the long-term shutdown equipment should be available following seismic and high wind events that may make procurement of offsite equipment more difficult ... Since all equipment required for post-72-hour actions is onsite, the equipment meets the requirements of Appendix A to 10 CFR Part 50, GDC 2 with respect to protection against natural phenomena, and consumable supplies are sufficient to last at least 7 days, the staff concludes that the post-72-hour actions for AP1000 comply with the staff-approved positions, as stated in SECY-96-128, and are therefore acceptable."

Westinghouse believes that the seismic design requirements imposed on components identified as important by the RTNSS process, as defined in the AP1000 Design Control Document (DCD) in Table 3.2-3 and WCAP-15985 Revision 2, provides an appropriate level of seismic protection. The seismic requirements applied to the RTNSS SSCs that support the post-72 hour operation of the passive safety features will provide reasonable assurance that these SSCs will be available in the desired time frame (after 72 hours).

Note that the AP1000 provides an alternative way of supporting the long-term operation of the passive features using offsite supplied equipment that is independent of these RTNSS SSCs. Furthermore, these alternate methods represent the design basis of the AP1000 safety analysis for post-72 hour operation. As a result, continued operation of the passive safety features is not dependent on these RTNSS features.

Therefore, there is no need to raise the level of seismic design requirement for these RTNSS SSCs to Seismic Category I. This action would be required to "... ensure the functionality of electrical and mechanical equipment following an SSE ..." as described in the staff's comment above. As discussed in Subsection 3.2.1 of the DCD, Seismic Category I design requirements

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are generally applicable to safety-related SSCs, as these components represent equipment that is required for design basis shutdown and accident response.

Implementation of protection against natural phenomena, as documented in the AP1000 DCD, includes:

- Post-72 hour RTNSS equipment is designed using seismic Category II supports and/or anchorages as documented in DCD Table 3.2-3. This equipment includes the ancillary diesel generator, passive containment cooling system recirculation pump, main control room ancillary fans, and instrumentation room ancillary fans. Additionally, with regard to the post-72 hour containment cooling function, all manual valves representing the required flow paths are identified as equipment with seismic Category II anchorages.

Westinghouse has identified three (3) manual valves that are not included in the scope of DCD Table 3.2-3. These valves were not included as they were recently added to the AP1000 as the result of an approved design change. DCD Table 3.2-3 has been revised and included with revisions attached to the response to OI-SRP3.2.1-EMB2-02.

- For post-72 hour RTNSS equipment that is not of an inherently rugged design, application of seismic Category II design requirements have been applied to the SSCs as documented in DCD Table 3.2-3. This equipment includes the ancillary diesel generator fuel tank and the passive containment cooling ancillary water storage tank.
- The passive containment cooling ancillary water storage tank is designated as a seismic Category II component in DCD Table 3.2-3. Also, as stated in DCD Section 6.2, "The tank is analyzed, designed and constructed using the method and criteria for Seismic Category II building structures defined in subsections 3.2.1 and 3.7.2. The tank is designed and analyzed for Category 5 hurricanes including the effects of sustained winds, maximum gusts, and associated wind-borne missiles."
- DCD Subsection 6.2.2.3 states: "The portions of the passive containment cooling system which provide for long term (post 72-hour) water supply for containment wetting are located in Seismic Category I or Seismic Category II structures excluding the passive containment ancillary water storage tank and associated valves located outside of the auxiliary building. The water storage tank and the anchorage for the associated valves are Seismic Category II. The features of these structures which protect this function are analyzed and designed for Category 5 hurricanes including the effects of sustained winds, maximum gusts, and associated wind-borne missiles."
- Pertaining to the ancillary diesel generators, DCD Subsection 8.3.1.1.3 states: "These generators are located in the portion of the Annex Building that is a Seismic Category II structure. Features of this structure which protect the function of the ancillary generators

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are analyzed and designed for Category 5 hurricanes, including the effects of sustained winds, maximum gusts, and associated wind-borne missiles.”

It should also be noted, as documented in NUREG-1793, “The staff has reviewed functional interactions, human commission interactions, and spatial interactions described in WCAP-15992, Revision 1 [*AP1000 Adverse System Interactions Evaluation Report*], and concluded that there are no ASIs (Adverse System Interactions) that have not been properly addressed in the design process and therefore require RTNSS controls.”

In conclusion, the application of the Seismic Category II anchorages identified in DCD Table 3.2-3 will provide the reasonable assurance that the SSCs identified by the RTNSS process as important for post-72 hour operation are functional in the required time frame for use, even after the most limiting design basis earthquake. Additionally, as described in NUREG-15992, and consistent with the AP1000 seismic design criteria, adverse system interactions that could preclude post 72 hour RTNSS equipment from functioning are addressed in the AP1000 design. Finally, post-72 hour equipment is satisfactorily protected against sustained winds, maximum gusts, and wind-borne missiles. These features provide a design that is compliant with the guidance outlined in SECY-96-128.

### Design Control Document (DCD) Revision:

None

### PRA Revision:

None

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## Response to SER Open Item (RAI)

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RAI Response Number: OI-SRP3.2.1-EMB2-02  
Revision: 0

### **Question:**

During the review of Revision 16, the staff was concerned that the scope of SSCs identified in DCD Subsection 3.2.1 does not appear to be complete and this was identified as an Open Item. In RAI-SRP3.2.1-EMB2-02 the applicant was requested to identify the seismic classification of any non-site-specific SSCs, such as the circulating water system, electrical items and reactor vessel insulation, within scope of the DCD that are not included in the DCD Tables.

The RAI response clarified that the Table 3.2-3 does not include information on electrical, instrumentation or architectural elements and identified that Table 3.2-2 will be revised to include seismic requirements for various structures and that Table 3.2-3 will be revised for the fire protection systems. The response also clarified that, although the design of some of the SSCs is the responsibility of the Combined License (COL) applicant, the seismic categorization is provided as part of the design certification. The response identified the Circulation Water System (CWS) and Raw Water System (RWS) as non-seismic.

The staff reviewed Revision 17 and determined that the changes do not entirely resolve the staff's concerns. Relative to completeness of scope in the application, the applicant included the omitted ancillary diesel generators and the fire protection system components in the DCD and referenced DCD Subsection 3.7.2.8 for seismic requirements applicable to NS structures. However, the seismic classification of the CWS and RWS identified in the RAI response is not included in the revised DCD Tables. Similarly, DCD Revision 17 does not include the seismic classification for the electrical and instrumentation components or other miscellaneous SSCs such as the RPV insulation. DCD Revision 17 does not include the seismic classification for the electrical and instrumentation components or other miscellaneous SSCs such as the RPV insulation.

### **Westinghouse Response:**

1. Classification of the CWS and RWS

Westinghouse has reviewed the staff's comments concerning the documentation of the seismic categorization of the CWS and RWS systems. Westinghouse has concluded that the detail contained within the AP1000 Design Control Document (DCD) is sufficient for design certification.

The CWS and RWS systems are contained in DCD Table 3.2-3 and documented as containing AP1000 Class E SSCs. Westinghouse does recognize that RAI-SRP3.2.1-EMB2-02 identified these as "equipment Class 1" systems. This is considered a typographical error as AP1000 does not utilize an "equipment Class 1" designation. Furthermore, as documented in DCD

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## Response to SER Open Item (RAI)

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Table 3.2-1, Class E SSCs are non-seismic except where analyzed for unacceptable interaction (Seismic II/I).

In summary, Westinghouse has concluded that the AP1000 DCD contains sufficient detail to identify the categorization of the CWS and RWS as non-seismic systems.

### 2. Seismic Classification of Electrical, Instrumentation, and Miscellaneous Components

Westinghouse respectfully does not agree with the staff's comments concerning the inclusion of electrical, instrumentation, and miscellaneous components into DCD Table 3.2-3. Westinghouse has identified the following excerpts from pertinent regulatory references:

#### **(RAI-SRP3.2.1-EMB2-02)**

Table 3.2-3 contains classification for mechanical and fluid system components and equipment. This is consistent with the guidance of the Standard Review Plan Section 3.2.2. The Table does not include information on electrical equipment or instrumentation. The table also does not include information on architectural elements.

#### **(NUREG-0800, Section 3.2.1, Revision 2)**

The staff review of Seismic Category I items includes the following plant features: structures, dams, ponds, cooling towers, reactor internals, fluid systems important to safety that are identified in RG 1.29, safety-related instrument sensing lines that are identified in RG 1.151, ventilation systems, standby diesel generator auxiliary systems, fuel handling systems, and cranes. ... Where portions of structures and fluid systems are Seismic Category I, they also must be clearly identified. For fluid systems important to safety, the classification tables in the SAR should identify system components such as pressure vessels, heat exchangers, storage tanks, pumps, piping, and valves...

#### **(NUREG-0800, Section 3.2.2, Revision 2)**

The specific areas of review are ... [the] applicant's classification system for pressure-retaining components such as pressure vessels, heat exchangers, storage tanks, pumps, piping, and valves in fluid systems important to safety, and the applicant's assignment of quality groups to those portions of systems necessary to perform safety functions. Excluded from this review are: structures; internal parts of mechanical components such as shafts, seals, impellers, packing, and gaskets; fuel, electrical, and instrumentation systems; electrical valve actuation devices; and pump motors.

NUREG-0800 clearly identifies that the scope of Subsection 3.2.2 of the AP1000 DCD, and therefore DCD Table 3.2-3, is pressure retaining components, which are typically mechanical and fluid systems. NUREG-0800 Section 3.2.2 also clearly excludes electrical and

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## Response to SER Open Item (RAI)

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instrumentation systems, while NUREG-0800 Section 3.2.1 allows for the combination of tabular information in the DCD to limit the length of required documentation. Therefore, the AP1000 Design Control Document is in compliance with the NUREG-0800 guidance as documented in the following sections:

- Mechanical and Fluid System Components in accordance with NUREG-0800 Section 3.2.2 are documented in DCD Table 3.2-3.
- Electrical & Instrumentation equipment classified as Seismic Category I are contained in DCD Table 3.11-1 as identified in DCD Subsection 3.10.1.2.
- The seismic categorization of structures, and portions of structures, is contained in DCD Table 3.2-1, in accordance with NUREG-0800 Section 3.2.1.

In general, insulation and miscellaneous SSCs do not perform functions that are considered important to safety. Insulation and applicable miscellaneous SSCs are incorporated into stress analyses to account for the additional mass present during seismic events. Additionally, this equipment is evaluated for seismic interactions in accordance with the process documented in DCD Subsection 3.7.2.8. In the application of the reactor vessel insulation, this assembly provides a specific severe accident function that has been identified as being important to safety for containment performance. Therefore, the classification and seismic categorization of the reactor vessel insulation has been added to DCD Table 3.2-3.

In addition, the following DCD Revision includes:

- Addition of three (3) manual valves in the Passive Containment Cooling System. The addition of these valves was described in the Westinghouse response to OI-SRP3.2.1-EMB2-01.
- Observations internal to Westinghouse have identified that the AP1000 reactor vessel neutron pads, instrumentation grid assembly, secondary core support structure, and flow skirt should be included in Table 3.2-3. These components were added for consistency.
- The staff has commented that a sufficient level of detail concerning the classification of the AP1000 reactor coolant pumps and the associated subcomponents is not available in Table 3.2-3. Additional detail has been added to address these staff concerns.

In summary, upon review of applicable regulatory guidance documents, Westinghouse has concluded that (with the additions identified above) the contents of AP1000 DCD satisfy the requirements for seismic categorization of components in accordance with the Standard Review Plan.

# AP1000 DESIGN CERTIFICATION REVIEW

## Response to SER Open Item (RAI)

Design Control Document (DCD) Revision:

Table 3.2-3 (Sheet 9 of 65)

### AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
<b>Passive Containment Cooling System (Continued)</b>					

PCS-PL-V002A	PCCWST Series Isolation	C	I	ASME III-3	
PCS-PL-V002B	PCCWST Series Isolation	C	I	ASME III-3	
PCS-PL-V002C	PCCWST Series Isolation	C	I	ASME III-3	
<b>PCS-PL-V004</b>	<b>Recirculation Bypass Isolation Valve</b>	<b>D</b>	<b>NS</b>	<b>ANSI B16.34</b>	<b>Equipment anchorage is Seismic Category II</b>
PCS-PL-V005	PCCWST Supply to FPS Isolation	C	I	ASME III-3	

PCS-PL-V015	Water Bucket Makeup Line Drain Valve	C	I	ASME III	
PCS-PL-V016	PCCWST Drain Isolation Valve	C	I	ASME III-3	

# AP1000 DESIGN CERTIFICATION REVIEW

## Response to SER Open Item (RAI)

Table 3.2-3 (Sheet 12 of 65)

### AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
<b>Passive Containment Cooling System (Continued)</b>					
PCS-PL-V044	PCCWST Long-Term Makeup Isolation Valve	C	I	ASME III-3	
PCS-PL-V045	Emergency Makeup to the Spent Fuel Pool Isolation Valve	C	I	ASME III-3	
PCS-PL-V046	PCCWST Recirculation Return Isolation Valve	C	I	ASME III-3	
PCS-PL-V047A/B	PCS Recirculation Pump Discharge Isolation Valve	D	NS	ANSI B16.34	Equipment anchorage is Seismic Category II

Balance of system components are Class E					
<b>Plant Gas Systems (PGS)</b>				Location: Various	
System components are Class E					
<b>Primary Sampling System (PSS)</b>			Location: Containment and Auxiliary Building		
n/a	Grab Sample Unit	D	NS	Manufacturer Std.	
n/a	Sample Cooler, PSS and CCS Side	D	NS	ASME VIII/TEMA	
n/a	Valves Providing PSS AP1000 Equipment Class D Function	D	NS	ANSI 16.34	
PSS-PL-V001A	Hot Leg Sample Isolation	B	I	ASME III-2	
PSS-PL-V001B	Hot Leg Sample Isolation	B	I	ASME III-2	

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Table 3.2-3 (Sheet 21 of 65)					
AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT					
Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments

Reactor Coolant System (RCS)					Location: Containment
RCS-MB-01	Steam Generator 1	A	I	ASME III-1	
RCS-MB-02	Steam Generator 2	A	I	ASME III-1	
RCS-MP-01A/B	SG 1A(B) Reactor Coolant Pump	A	I	ASME III-1	Pump Motor – Class D
n/a	Rotor Shaft	C	I	Manufacturer Std	
n/a	Impeller	C	I	Manufacturer Std	
n/a	Flywheel	C	I	Manufacturer Std	
n/a	RCP Heat Exchanger (Tube Side)	A	I	ASME III-1	Shellside – Class D, ASME VIII, Div. 1
n/a	Pump Motor Cooling Water to HX inlet Connector	A	I	ASME III-1	
n/a	Pump Motor Cooling Water from HX outlet Connector	A	I	ASME III-1	
<del>RCS-MP-01B</del>	<del>SG-1B Reactor Coolant Pump</del>	<del>A</del>	<del>I</del>	<del>ASME III-1</del>	
RCS-MP-02A/B	SG 2A(B) Reactor Coolant Pump	A	I	ASME III-1	Pump Motor – Class D
n/a	Rotor Shaft	C	I	Manufacturer Std	
n/a	Impeller	C	I	Manufacturer Std	
n/a	Flywheel	C	I	Manufacturer Std	
n/a	RCP Heat Exchanger (Tube Side)	A	I	ASME III-1	Shellside – Class D, ASME VIII, Div. 1
n/a	Pump Motor Cooling Water to HX inlet Connector	A	I	ASME III-1	
n/a	Pump Motor Cooling Water from HX outlet Connector	A	I	ASME III-1	

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## Response to SER Open Item (RAI)

RCS-MP-02B	<del>SG 2B Reactor Coolant Pump</del>	A	I	ASME III-1	
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RCS-MY-22	SG 2 Channel Head Divider Plate	B	I	ASME III-1	
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Table 3.2-3 (Sheet 33 of 65)

### AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
<b>Reactor System (Continued)</b>					

RXS-MI-80	Reactor Vessel Flow Skirt	D	II	Manufacturer Standards	
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RXS-MN-01	Reactor Vessel Cavity Reflective Insulation	D	II	Manufacturer Standards	
RXS-MV-10	Reactor Integrated Head Package	C	I	AISC-690	
RXS-MV-10A	Integrated Head Package Shroud	C	I	ASME-NF	
RXS-MV-10B	Integrated Head Package Seismic Support System	C	I	ASME-NF	

n/a	Neutron Pad	D	II	Manufacturer Standards	
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**PRA Revision:**

None