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Your ref: Docket No. 52-006  
Our ref: DCP\_NRC\_002833

March 23, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 17)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 17. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response 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 RAI(s):

RAI-SRP17.4-SPLA-05 R1

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  
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/Enclosure

1. Response to Request for Additional Information on SRP Section 17

D063  
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 17

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

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OI Response Number: RAI-SRP17.4-SPLA-05  
Revision: 1

### **Question:**

The staff reviewed Appendix E of DCD Chapter 19, Revision 17, where the applicant describes the safety-related chemical and volume control system (CVS) letdown isolation function during shutdown. During shutdown, the safety-related CVS containment isolation valves must automatically isolate on low hot leg level. This signal is generated by the safety-related protection and monitoring system (PMS). The failure of these CVS valves contributes significantly to the frequency of over-draining the reactor coolant system while attempting to achieve mid-loop conditions (IEV-RCSOD). This initiating event has a risk achievement worth (RAW) on the order of one thousand.

Similarly, when the reactor coolant system is pressurized, the inadvertent opening of a valve in the normal residual heat removal system can result in a LOCA during safe/cold shutdown (IEV-LOCA24ND). The RAW value for this initiating event is also on the order of one thousand. Both of these valves were listed in the DCD Table 17.4, "Design Reliability Assurance Program"; however, only the function of closure on manual actuation of containment isolation using the diverse actuation system was identified as the basis for their inclusion. According to the SRP, all reasons for including components in the D-RAP should be documented in Table 17.4. It appears that component failures used to calculate initiating event frequencies with high RAW values were not evaluated as a reason for the inclusion of SSCs within the scope of D-RAP. Based on these findings, the staff requests the following actions:

1. Update Table 17.4 of the DCD to include the closure of the safety-related CVS containment isolation valves by PMS to support the safety-related shutdown letdown isolation function.
2. Review all initiating events with frequencies that were calculated on the basis of component failure data (other than those explicitly addressed in the at-power model). Address both core damage frequency and large release frequency, in all MODES. (Initiating events of low RAW may be screened.) Please evaluate the associated components for inclusion within the scope of the D-RAP. Document the rationale for their inclusion (in RAP) in Table 17.4 of the AP1000 DCD and the associated tables in Tier 1 Section 3.7.

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

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### **Westinghouse Response: (Revision 0)**

Westinghouse has reviewed the staff's comments associated with the scope of the D-RAP as documented in AP1000 DCD Table 17.4-1.

Westinghouse would like to clarify that the selection of the CVS containment isolation valves for actuation by DAS was performed based on the risk significance of these valves using PRA screening criteria. Therefore, these valves are not considered risk-significant and within the scope of D-RAP due to their DAS isolation function; rather the DAS actuation of the CVS letdown isolation valves was a function of the significance of these valves. This, in turn, is the primary reason these valves were included in the D-RAP scope in DCD Table 17.4-1.

Westinghouse does recognize however that the documentation pertaining to the D-RAP scope of these valves in DCD Table 17.4-1 can be misleading and appear to credit the DAS isolation function of these valves. Additionally, as requested in the staff's inquiry, a review of the AP1000 PRA was performed to verify the content of DCD Table 17.4-1.

Mark-ups of DCD Tier 2 Table 17.4-1 and Tier 1 Table 3.7-1 are attached to this response to address the staff's concerns.

### **Westinghouse Revised Response: (Revision 1)**

A revised response is made to correct two errors found in the Revision 0 DCD markup. These corrections are to the Containment Air Filtration System (VFS) and Liquid Radwaste System (WLS) entries in Table 17.4-1.

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

**Design Control Document (DCD) Revision:**

**Tier 1**

<b>TABLE 3.7-1 RISK-SIGNIFICANT COMPONENTS</b>	
<b>Equipment Name</b>	<b>Tag No.</b>
<b>Component Cooling Water System (CCS)</b>	
Component Cooling Water Pumps	CCS-MP-01A/B
<b>Containment System (CNS)</b>	
Containment Vessel	CNS-MV-01
Hydrogen Igniters	VLS-EH-1 through -64
<b>Chemical and Volume Control System (CVS)</b>	
Makeup Pumps	CVS-MP-01A/B
Makeup Pump Suction and Discharge Check Valves	CVS-PL-V113 CVS-PL-V160A/B
Letdown Discharge Isolation Valves	CVS-PL-V045 CVS-PL-V047
<b>Diverse Actuation System (DAS)</b>	
DAS Processor Cabinets and Control Panel (used to provide automatic and manual actuation)	DAS-JD-001 DAS-JD-002 DAS-JD-003 DAS-JD-004 OCS-JC-020
Annex Building UPS Distribution Panels (provide power to DAS)	EDS1-EA-1, EDS1-EA-14, EDS2-EA-1, EDS2-EA-14
Rod Drive MG Sets (Field Breakers)	PLS-MG-01A/B
Containment Isolation Valves Controlled by DAS	Refer to Table 2.2.1-1
<b>Main ac Power System (ECS)</b>	
Reactor Coolant Pump Switchgear	ECS-ES-31, -32, -41, -42, -51, -52, -61, -62
Ancillary Diesel Generators	ECS-MS-01, -02

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

TABLE 3.7-1 RISK-SIGNIFICANT COMPONENTS	
Equipment Name	Tag No.
6900 Vac Buses	ECS-ES-1, -2
Main and Startup Feedwater System (FWS)	
Startup Feedwater Pumps	FWS-MP-03A/B
General I&C	
IRWST Level Sensors	PXS-045, -046, -047, -048
RCS Hot Leg Level Sensors	RCS-160A/B
Pressurizer Pressure Sensors	RCS-191A/B/C/D
Pressurizer Level Sensors	RCS-195A/B/C/D
Steam Generator Narrow-Range Level Sensors	SGS-001, -002, -003, -004, -005, -006, -007, -008
Steam Generator Wide-Range Level Sensors	SGS-011, -012, -013, -014, -015, -016, -017, -018
Main Steam Line Pressure Sensors	SGS-030, -031, -032, -033, -034, -035, -036, -037
Main Feedwater Wide-Range Flow Sensors	<del>FWS-050B/D/F, -051B/D/F</del> <del>SGS-050A/C/E, -051A/C/E</del>
Startup Feedwater Flow Sensors	SGS-055A/B, -056A/B
CMT Level Sensors	PXS-011A/B/C/D, -012A/B/C/D, -013A/B/C/D, -014A/B/C/D
Class 1E dc Power and Uninterruptible Power System (IDS)	
<del>125-250</del> Vdc 24-Hour Batteries	IDSA-DB-1A/B, IDSB-DB-1A/B, IDSC-DB-1A/B, IDSD-DB-1A/B
250 Vdc 24-Hour Buses	IDSA-DS-1, IDSB-DS-1, IDSC-DS-1, IDSD-DS-1
250 Vdc 24-Hour Battery Chargers	IDSA-DC-1, IDSB-DC-1, IDSC-DC-1, IDSD-DC-1

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

<b>TABLE 3.7-1 RISK-SIGNIFICANT COMPONENTS</b>	
<b>Equipment Name</b>	<b>Tag No.</b>
250 Vdc and 120 Vac Distribution Panels	IDSA-DD-1, IDSA-EA-1/-2, IDSB-DD-1, IDSB-EA-1/-2/-3, IDSC-DD-1, IDSC-EA-1/-2/-3, IDSD-DD-1, IDSD-EA-1/-2
Fused Transfer Switch Boxes	IDSA-DF-1, IDSB-DF-1/-2, IDSC-DF-1/-2, IDSD-DF-1
250 Vdc Motor Control Centers	IDSA-DK-1, IDSB-DK-1, IDSC-DK-1, IDSD-DK-1
250 Vdc 24-Hour Inverters	IDSA-DU-1, IDSB-DU-1, IDSC-DU-1, IDSD-DU-1
<b>Passive Containment Cooling System (PCS)</b>	
Recirculation Pumps	PCS-MP-01A/B
PCCWST Drain Isolation Valves	PCS-PL-V001A/B/C
<b>Plant Control System (PLS)</b>	
PLS Actuation Software <del>and Hardware</del> (used to provide control functions)	Refer to Table 3.7-2
PLS Actuation Hardware (used to provide control functions)	Refer to Table 3.7-2
<b>Protection and Monitoring System (PMS)</b>	
PMS Actuation Software (used to provide automatic control functions)	Refer to Tables 2.5.2-2 and 2.5.2-3
PMS Actuation Hardware (used to provide automatic control functions)	Refer to Tables 2.5.2-2 and 2.5.2-3
MCR 1E Displays and System Level Controls	OCS-JC-010, -011
Reactor Trip Switchgear	PMS-JD-RTS A01/02, B01/02, C01/02, D01/02
<b>Passive Core Cooling System (PXS)</b>	
IRWST Vents	PXS-MT-03
IRWST Screens	PXS-MY-Y01A/B/C

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

<b>TABLE 3.7-1 RISK-SIGNIFICANT COMPONENTS</b>	
<b>Equipment Name</b>	<b>Tag No.</b>
Containment Recirculation Screens	PXS-MY-Y02A/B
CMT Discharge Isolation Valves	PXS-PL-V014A/B, -V015A/B
CMT Discharge Check Valves	PXS-PL-V016A/B, -V017A/B
Accumulator Discharge Check Valves	PXS-PL-V028A/B, -V029A/B
PRHR HX Control Valves	PXS-PL-V108A/B
Containment Recirculation Squib Valves	PXS-PL-V118A/B, -V120A/B
IRWST Injection Check Valves	PXS-PL-V122A/B, -V124A/B
IRWST Injection Squib Valves	PXS-PL-V123A/B, -V125A/B
IRWST Gutter Bypass Isolation Valves	PXS-PL-V130A/B
<b>Reactor Coolant System (RCS)</b>	
ADS Stage 1/2/3 Valves (MOVs)	RCS-PL-V001A/B, -V011A/B RCS-PL-V002A/B, -V012A/B RCS-PL-V003A/B, -V013A/B
ADS Stage 4 Valves (Squibs)	RCS-PL-V004A/B/C/D
Pressurizer Safety Valves	RCS-PL-V005A/B
Reactor Vessel Insulation Water Inlet and Steam Vent Devices	RCS-MN-01
Reactor Cavity Doorway Damper	-
Fuel Assemblies	157 assemblies with tag numbers beginning with RXS-FA
<b>Normal Residual Heat Removal System (RNS)</b>	
Residual Heat Removal Pumps	RNS-MP-01A/B
RNS Motor-Operated Valves	RNS-PL-V011, -V022, -V023, -V055
RNS Stop Check Valves RNS Check Valves	RNS-PL-V015A/B RNS-PL-V017A/B
RNS Check Valves	RNS-PL-V007A/B, -V013, -V056
<b>Spent Fuel Cooling System (SFS)</b>	

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

<b>TABLE 3.7-1 RISK-SIGNIFICANT COMPONENTS</b>	
<b>Equipment Name</b>	<b>Tag No.</b>
Spent Fuel Cooling Pumps	SFS-MP-01A/B
<b>Steam Generator System (SGS)</b>	
Main Steam Safety Valves	SGS-PL-V030A/B, -V031A/B, -V032A/B, -V033A/B, -V034A/B, -V035A/B
Main Steam Line Isolation Valves	SGS-PL-V040A/B
Main Feedwater Isolation Valves	SGS-PL-V057A/B
<b>Service Water System (SWS)</b>	
Service Water Cooling Tower Fans	SWS-MA-01A/B
Service Water Pumps	SWS-MP-01A/B
<b>Nuclear Island Nonradioactive Ventilation System (VBS)</b>	
MCR Ancillary Fans	VBS-MA-10A/B
I&C Room B/C Ancillary Fans	VBS-MA-11, -12
<b>Containment Air Filtration System (VFS)</b>	
Containment Purge Isolation Valves	VFS-PL-V003 VFS-PL-V004 VFS-PL-V009 VFS-PL-V010
<b>Chilled Water System (VWS)</b>	
Air Cooled Chiller Pumps	VWS-MP-02, -03
Air Cooled Chillers	VWS-MS-02, -03
<b>Liquid Radwaste System (WLS)</b>	
Sump Containment Isolation Valves	WLS-PL-V055 WLS-PL-V057
<b>Onsite Standby Power System (ZOS)</b>	
Engine Room Exhaust Fans	VZS-MY-V01A/B, -V02A/B
Onsite Diesel Generators	ZOS-MS-05A/B

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

### Tier 2

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
System: Component Cooling Water (CCS)		
Component Cooling Water Pumps (CCS-MP-01A/B)	EP	These pumps provide cooling of the normal residual heat removal system (RNS) and the spent fuel pool heat exchanger. Cooling the RNS heat exchanger is important to investment protection during shutdown reduced-inventory conditions. CCS valve realignment is not required for reduced-inventory conditions.
System: Containment System (CNS)		
Containment Vessel (CNS-MV-01)	EP, L2	The containment vessel provides a barrier to steam and radioactivity released to the atmosphere following accidents.
Hydrogen Igniters (VLS-EH-1 through -64)	RAW/CCF <del>EP</del> , L2, Regulations	The hydrogen igniters provide a means to control H2 concentration in the containment atmosphere, consistent with the hydrogen control requirements of 10 CFR 50.34f.
System: Chemical and Volume Control System (CVS)		
Makeup Pumps (CVS-MP-01A/B)	EP	These pumps provide makeup to the RCS to accommodate leaks and to provide negative reactivity for shutdowns, steam line breaks, and ATWS.
Makeup Pump Suction and Discharge Check Valves (CVS-PL-V113, -V160A/B)	EP	These CVS check valves are normally closed and have to open to allow makeup pump operation.
Letdown Isolation Valves (CVS-PL-V045, -V047)	RAW	The CVS letdown isolation valves automatically close to prevent excessive reactor coolant letdown and provide containment isolation. These containment isolation valves are important in limiting offsite releases following core melt accidents.
System: Diverse Actuation System (DAS)		

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
DAS Processor Cabinets and Control Panel (used to provide automatic and manual actuation) (DAS-JD-001, -002, -003, -004, OCS-JC-020)	RAW	The DAS is diverse from the PMS and provides automatic and manual actuation of selected plant features including control rod insertion, turbine trip, passive residual heat removal (PRHR) heat exchanger actuation, core makeup tank actuation, isolation of critical containment lines, and passive containment cooling system (PCS) actuation.
Annex Building UPS Distribution Panels (EDS1-EA-1, EDS1-EA-14, EDS2-EA-1, EDS2-EA-14)	RAW	These panels distribute power to the DAS equipment.
Rod Drive MG Sets (Field Breakers) (PLS-MG-01A/B)	RAW	These breakers open on a DAS reactor trip signal demand to de-energize the control rod MG sets and allow the rods to drop.
<del>Containment Isolation Valves Controlled by DAS (Note 5)</del>	<del>RAW</del>	<del>These containment isolation valves are important in limiting offsite releases following core melt accidents.</del>
System: Main ac Power System (ECS)		
Reactor Coolant Pump Switchgear (ECS-ES-31, -32, -41, -42, -51, -52, -61, -62)	RAW/CCF <del>EP</del>	These breakers open automatically to allow core makeup tank operation.
Ancillary Diesel Generators (ECS-MS-01, -02)	EP	For post-72 hour actions, these generators are available to provide power for Class 1E monitoring, MCR lighting and for refilling the PCS water storage tank and spent fuel pool.
6900 Vac Buses (ECS-ES-1, -2)	RAW	These are ac power buses fed by the onsite DGs and offsite power.
System: Main and Startup Feedwater System (FWS)		
Startup Feedwater Pumps (FWS-MP-03A/B)	EP	The startup feedwater system pumps provide feedwater to the steam generator. This capability provides an alternate core cooling mechanism to the PRHR heat exchangers for non-loss-of-coolant-accidents or steam generator tube ruptures.
System: General I&C(4)		

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
Low Pressure/DP Sensors - IRWST level sensors (PXS-045, -046, -047, -048)	RAW/CCF	The in-containment refueling water storage tank (IRWST) level sensors support PMS functions. They are used in automatic actuation, and they provide indications to the operator. IRWST level supports IRWST recirculation actions.
High Pressure/DP Sensors - RCS Hot Leg Level (RCS-160A/B) - Pressurizer Pressure (RCS-191A/B/C/D) - Pressurizer Level (RCS-195A/B/C/D) - SG Narrow-Range Level (SGS-001, -002, -003, -004, -005, -006, -007, -008) - SG Wide-Range Level (SGS-011, -012, -013, -014, -015, -016, -017, -018)	RAW/CCF/EP	The following sensors are included in this group. These sensors support PMS and PLS functions. They are used in reactor trip and ESF functions, and provide indications to the operator. Main feedwater flow sensors support startup feedwater actuation and startup feedwater flow sensors support PRHR actuation. The hot leg level sensors automatically actuate the IRWST injection and automatic depressurization system (ADS) valves during shutdown conditions.
- Main Steamline Pressure (SGS-030, -031, -032, -033, -034, -035, -036, -037) - Main Feedwater Wide-Range Flow (FWS-050B/D/F, -051B/D/F) ( <del>SGS-050A/C/E, -051A/C/E</del> ) - Startup Feedwater Flow (SGS-055A/B, -056A/B)		
CMT Level Sensors (PXS-011A/B/C/D, -012A/B/C/D, -013A/B/C/D, -014A/B/C/D)	RAW/CCF	These level sensors provide input for automatic actuation of the ADS. They also provide indications to the operator.
System: Class 1E DC Power and Uninterruptible Power System (IDS)		

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
250 Vdc 24-hour Buses, Batteries, Inverters, and Chargers (IDSA-DB-1A/B, IDSB-DB-1A/B, IDSC-DB-1A/B, IDSD-DB-1A/B, IDSA-DU-1, IDSB-DU-1, IDSC-DU-1, IDSD-DU-1, IDSA-DC-1, IDSB-DC-1, IDSC-DC-1, IDSD-DC-1, <b>IDSA-DS-1, IDSB-DS-1, IDSC-DS-1, IDSD-DS-1</b> )	RAW/CCF	The batteries provide power for the PMS and safety-related valves. The chargers are the preferred source of power for Class 1E dc loads and are the source of charging for the batteries. The inverters provide uninterruptible ac power to the I&C system. <b>The buses distribute power to the Class 1E dc loads.</b>
250 Vdc and 120 Vac Distribution Panels (IDSA-DD-1, -EA-1/2, IDSB-DD-1, -EA-1/2/3, IDSC-DD-1, -EA-1/2/3, IDSD-DD-1, -EA-1/2)	RAW	These panels distribute power to components in the plant that require 1E power support and for the PMS.
Fused Transfer Switch Boxes (IDSA-DF-1, IDSB-DF-1/-2, IDSC-DF-1/-2, IDSD-DF-1)	RAW	The fused disconnect switches connect the different levels of Class 1E distribution panels.
250 Vdc Motor Control Centers (IDSA-DK-1, IDSB-DK-1, IDSC-DK-1, IDSD-DK-1)	EP	These buses provide power for the PMS and safety-related valve operation.
System: Passive Containment Cooling System (PCS)		
Recirculation Pumps (PCS-MP-01A/B)	EP	These pumps provide the motive force to refill the PCS water storage tank during post-72 hour support actions.
PCCWST Drain Isolation Valves (PCS-PL-V001A/B/C)	EP, L2	These valves (two AOVs and one MOV) open automatically to drain water from a water storage tank onto the outside surface of the containment shell. This water provides evaporative cooling of the containment shell following accidents.
System: Plant Control System (PLS)		

# AP1000 DCD SER Open Item REVIEW

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DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
PLS Actuation Hardware (Control functions listed in Note 5 6)	RAW/CCF	This common cause failure event is assumed to disable all logic outputs from the PLS associated with CVS reactor makeup, RNS reactor injection, spent fuel cooling, component cooling of RNS SFS heat exchangers, service water cooling of CCS heat exchangers, standby diesel generators, and hydrogen igniters.
PLS Actuation Software (Control functions listed in Note 5)	RAW/CCF	This common cause failure event is assumed to disable the software in the PLS associated with CVS reactor makeup, RNS reactor injection, spent fuel cooling, component cooling of RNS SFS heat exchangers, service water cooling of CCS heat exchangers, standby diesel generators, and hydrogen igniters.
System: Protection and Safety Monitoring System (PMS)		
PMS Actuation Software	RAW/CCF	The PMS software provides the automatic reactor trip and ESF actuation functions listed in Tables 7.2-2 and 7.3-1.
PMS Actuation Hardware	RAW/CCF	The PMS hardware provides the automatic reactor trip and ESF actuation functions listed in Tables 7.2-2 and 7.3-1.
Main Control Room (MCR) 1E Displays and System Level Controls (OCS-JC-010, -011)	RAW/CCF	This includes the Class 1E PMS (QDPS) displays and controls. These displays and system level controls provide important plant indications to allow the operator to monitor and control the plant during accidents.
Reactor Trip Switchgear (PMS-JD-RTS A01/02, B01/02, C01/02, D01/02)	RAW/CCF	These breakers open automatically to allow insertion of the control rods.
System: Passive Core Cooling System (PXS)		
IRWST Vents (PXS-MT-03)	RAW/CCF	The IRWST vents provide a pathway to vent steam from the tank into the containment. The IRWST vents also have a severe accident function to prevent the formation of standing hydrogen flames close to the containment walls. This function is accomplished by designing the vents located further from the containment walls to open with less IRWST internal pressure than the other vents.

# AP1000 DCD SER Open Item REVIEW

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DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
IRWST Screens (PXS-MY-Y01A/B/C)	RAW/CCF	The IRWST injection lines provide long-term core cooling following a LOCA. These screens are located inside the IRWST and prevent large particles from being injected into the RCS. They are designed so that they will not become obstructed.
Containment Recirculation Screens (PXS-MY-Y02A/B)	RAW/CCF	The containment recirculation lines provide long-term core cooling following a LOCA. The screens are located in the containment and prevent large particles from being injected into the RCS. They are designed so that they will not become obstructed.
CMT Discharge Isolation Valves (PXS-PL-V014A/B, PXS-PL-V015A/B)	RAW/CCF	These air-operated valves automatically open to allow core makeup tank injection.
CMT Discharge Check Valves (PXS-PL-V016A/B, PXS-PL-V017A/B)	RAW/CCF	These check valves are normally open. They close during rapid accumulator injection.
Accumulator Discharge Check Valves (PXS-PL-V028A/B, -V029A/B)	RAW/CCF	These check valves open when the RCS pressure drops below the accumulator pressure to allow accumulator injection.
PRHR Heat Exchanger Control Valves (PXS-PL-V108A/B)	RAW/CCF	The PRHR heat exchangers provide core cooling following non-LOCAs, steam generator tube ruptures, and anticipated transients without scram. The air-operated valves automatically open to initiate PRHR heat exchanger operation.

# AP1000 DCD SER Open Item REVIEW

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DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
Containment Recirculation Squib Valves (PXS-PL-V118A/B, PXS-PL-V120A/B)	RAW/CCF	The containment recirculation lines provide long-term core cooling following a LOCA. These squib valves open automatically to allow containment recirculation when the IRWST level is reduced to about the same level as the containment level. These squib valves can also allow long-term core cooling to be provided by the RNS pumps.  These squib valves can provide a rapid flooding of the containment to support in-vessel retention during a severe accident.
IRWST Injection Check Valves (PXS-PL-V122A/B, -V124A/B)	RAW/CCF	The containment recirculation lines provide long-term core cooling following a LOCA. These check valves open when the IRWST level is reduced to approximately the same level as the containment level.
IRWST Injection Squib Valves (PXS-PL-V123A/B, -V125A/B)	RAW/CCF	The IRWST injection lines provide long-term core cooling following a LOCA. These squib valves open automatically to allow injection when the RCS pressure is reduced to below the IRWST injection head.
IRWST Gutter Bypass Isolation Valves (PXS-PL-V130A/B)	RAW/CCF	These valves direct water collected in the IRWST gutter to the IRWST. This capability extends PRHR heat exchanger operation.
System: Reactor Coolant System (RCS)		
ADS Stage 1/2/3 Valves (MOV) (RCS-PL-V001A/B, -V002A/B, -V003A/B, -V011A/B, -V012A/B, -V013A/B)	RAW/CCF	The ADS provides a controlled depressurization of the RCS following LOCAs to allow core cooling from the accumulator, IRWST injection, and containment recirculation. The ADS provides "bleed" capability for feed/bleed cooling of the core. The ADS also provides depressurization of the RCS to prevent a high-pressure core melt sequence.
ADS Stage 4 Valves (Squib) (RCS-PL-V004A/B/C/D)	RAW/CCF	The ADS provides a controlled depressurization of the RCS following LOCAs to allow core cooling from the accumulator, IRWST injection, and containment recirculation. The ADS provides "bleed" capability for feed/bleed cooling of the core. The ADS also provides depressurization of the RCS to prevent a high-pressure core melt sequence.

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
Pressurizer Safety Valves (RCS-PL-V005A/B)	RRW <del>EP</del>	These valves provide overpressure protection of the RCS.
Reactor Vessel Insulation Water Inlet and Steam Vent Devices (RCS-MN-01)	EP	These devices provide an engineered flow path to promote in-vessel retention of the core in a severe accident.
Reactor Cavity Doorway Damper	EP	This device provides a flow path to promote in-vessel retention of the core in a severe accident.
Fuel Assemblies (157 assemblies with tag numbers beginning with RXS-FA)	SMA	The nuclear fuel assembly includes the fuel pellets, fuel cladding, and associated support structures. This equipment, which provides a first barrier for release of radioactivity and allows for effective core cooling, had the least margin in the seismic margin analysis.
System: Normal Residual Heat Removal System (RNS)		
Residual Heat Removal Pumps (RNS-MP-01A/B)	RAW/CCF	These pumps provide shutdown cooling of the RCS. They also provide an alternate RCS lower pressure injection capability following actuation of the ADS. The operation of these pumps is important to investment protection during shutdown reduced-inventory conditions. RNS valve realignment is not required for reduced-inventory conditions.
RNS Motor-Operated Valves (RNS-PL-V011, -V022, -V023, -V055)	RRW <del>EP</del>	These MOVs align a flow path for nonsafety-related makeup to the RCS following ADS operation, initially from the cask loading pit and later from the containment.
RNS Stop Check Valves (RNS-PL-V015A/B), RNS Check Valves (RNS-PL-V017 A/B)	CCF/EP	These stop check valves and check valves are in the discharge of the RNS pumps. They prevent backflow from the RCS.
RNS Check Valves (RNS-PL-V007 A/B, -V013, -V056)	L2 RAW/EP	Check valves V007 A/B and V013 provide a flow path from the RNS pumps to the RCS. Failure of these valves to open will result in the loss of long-term cooling from the RNS. Check valve V056 provides a flow path from the cask loading pit to the RNS pump inlet.
System: Spent Fuel Cooling System (SFS)		
Spent Fuel Cooling Pumps (SFS-MP-01A/B)	EP	These pumps provide flow to the heat exchangers for removal of the design basis heat load.

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
<b>System: Steam Generator System (SGS)</b>		
Main Steam Safety Valves (SGS-PL-V030A/B, -V031A/B, -V032A/B, -V033A/B, -V034A/B, -V035A/B)	RRW <del>EP</del>	The steam generator main steam safety valves provide overpressure protection of the steam generator. They also provide core cooling by venting steam from the steam generator.
Main Steam and Feedwater Isolation Valves (SGS-PL-V040A/B, -V057A/B)	RAW/EP	The steam generator main steam and feedwater isolation valves provide isolation of the steam generator following secondary line breaks and steam generator tube rupture.
<b>System: Service Water System (SWS)</b>		
Service Water Pumps and Cooling Tower Fans (SWS-MP-01A/B, SWS-MA-01A/B)	EP	These pumps and fans provide cooling of the CCS heat exchanger which is important to investment protection during shutdown reduced-inventory conditions. Service water system valve realignment is not required for reduced-inventory conditions.
<b>System: Nuclear Island Nonradioactive Ventilation System (VBS)</b>		
VBS MCR and I&C Rooms B/C Ancillary Fans (VBS-MA-10A/B, -11, -12)	EP	For post-72 hour actions, these fans are available to provide cooling of the MCR and the two I&C rooms (B/C) that provide post-accident monitoring.
<b>System: Containment Air Filtration System (VFS)</b>		
VFS Containment Purge Isolation Valves (VFS-PL-V003, -V004, -V009, -V010)	RAW	The VFS containment purge isolation valves provide isolation of containment following an accident. These containment isolation valves are important in limiting offsite releases following core melt accidents.
<b>System: Chilled Water System (VWS)</b>		
Air Cooled Chillers and Pumps (VWS-MS-02, -03, VWS-MP-02, -03)	EP	This VWS subsystem provides chilled cooling water to the CVS makeup pump room. The pumps and chillers are important components of the VWS.
<b>System: Liquid Radwaste System (WLS)</b>		
Sump Containment Isolation Valves (WLS-PL-V055, -V057)	RAW	The sump containment isolation valves provide isolation of containment following an accident. These containment isolation valves are important in limiting offsite releases following core melt accidents.
<b>System: Onsite Standby Power System (ZOS)</b>		

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

DCD TABLE 17.4-1		
RISK-SIGNIFICANT SSCs WITHIN THE SCOPE OF D-RAP		
System, Structure, or Component (SSC) <sup>(1)</sup>	Rationale <sup>(2)</sup>	Insights and Assumptions
Onsite Diesel Generators (ZOS-MS-05A/B)	RAW/CCF EP	These diesel generators provide ac power to support operation of nonsafety-related equipment such as the startup feedwater pumps, CVS pumps, RNS pumps, CCS pumps, SWS pumps, and the PLS. Providing ac power to the RNS and the equipment necessary to support its operation is important to investment protection during reduced inventory conditions.
Engine Room Exhaust Fans (VZS-MY-V01A/B, -V02A/B)	RAW/CCF EP	These fans provide ventilation of the rooms containing the onsite diesel generators.

### Notes:

- Only includes equipment at the **component** level. Other parts of the SSC or support systems are not included unless specifically listed.
- Definition of Rationale Terms:
  - CCF = Common Cause Failure (for the SSCs whose inclusion rationale is RAW/CCF, the RAW is based on common cause failure of two or more of the specified SSCs.
  - EP = Expert Panel
  - RAW = Risk Achievement Worth
  - RRW = Risk Reduction Worth
  - SMA = Seismic Margin Analysis
- Maintenance/surveillance recommendations for equipment are documented in each appropriate DCD section.
- This category captures instrumentation and control equipment common cause failures across systems.
- ~~The following containment isolation valves are controlled by DAS:~~
  - ~~Chemical and Volume Control Letdown Discharge IRC~~ CVS PL V045
  - ~~Chemical and Volume Control Letdown Discharge ORC~~ CVS PL V047
  - ~~Containment Purge Inlet Containment Isolation Valve ORC~~ VFS PL V003
  - ~~Containment Purge Inlet Containment Isolation Valve IRC~~ VFS PL V004
  - ~~Containment Purge Discharge Containment Isolation Valve IRC~~ VFS PL V009
  - ~~Containment Purge Discharge Containment Isolation Valve ORC~~ VFS PL V010
  - ~~Sump Discharge Containment Isolation Valve IRC~~ WLS PL V055
  - ~~Sump Discharge Containment Isolation Valve ORC~~ WLS PL V057
- The PLS provides control of the following functions:
  - CVS Reactor Makeup
  - RNS Reactor Injection from Cask Loading Pit
  - Startup Feedwater from CST
  - Spent Fuel Cooling
  - Component Cooling of RNS and SFS Heat Exchangers
  - Service Water Cooling of the CCS Heat Exchangers
  - Onsite Diesel Generators
  - Hydrogen Igniters

# AP1000 DCD SER Open Item REVIEW

## Open Item Resolution

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**PRA Revision:**

None

**Technical Report (TR) Revision:**

None