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: 724-940-8505
e-mail: sisk1rb@westinghouse.com

Your ref: Docket No. 52-006
Our ref: DCP_NRC_003016

August 20, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 23)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 23. 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-DCP-CN66-SRSB-01
RAI-DCP-CN66-SRSB-02
RAI-DCP-CN66-SRSB-03
RAI-DCP-CN66-SRSB-04

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,

Robert Sisk

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

/Enclosure

1. Response to Request for Additional Information on SRP Section 23

D063
NRO

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

ENCLOSURE 1

Response to Request for Additional Information on SRP Section 23

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-DCP-CN66-SRSB-01
Revision: 0

Question:

In its May 25, 2010, letter, Westinghouse proposed system specific changes to address gas intrusion. These changes included adding containment recirculation (CR) highpoint vent valves. In DCD Tier 2, Table 3.2-3, the CR train A highpoint vent valves are identified as PXS-PL-V106 and PXS-PL-V107; however, on Figure 6.3-2 (Section H), the CR highpoint vent valves are identified as V106A and V107A. It appears that there are no CR highpoint vent valves identified on CR train B. In addition, Note 7 was included on Section H but not on Figure 6.3-2 Revision 17.

A. Provide the correct vent valves designation.

B. Provide an explanation for excluding containment recirculation highpoint vent valves on Train B.

C. Note 7 does not appear to be included in the provided DCD mark-up. Confirm whether Note 7 will be included in Revision 18.

Westinghouse Response:

A. The vent valves should be designated PXS-PL-V106 and PXS-PL-V107 as shown in Table 3.2-3. Section H of Figure 6.3-2 is incorrect and the corresponding valve numbers have already been corrected on the P&IDs in Figure 6.3-2 Rev. 18.

B. Train A and Train B of the containment recirculation paths are routed differently. Train A was routed with two high points to avoid other components and lines while Train B did not have layout constraints that required somewhat more complicated routing to avoid interference with other components or lines. Therefore, Train B does not have any local high points that could potentially accumulate gas.

C. The depiction of Note 7 was not supposed to be part of Figure 6.3-2 in DCD Rev. 17 as shown by the absence of Note 7 in the notes section of the figure. The depiction of Note 7 on the figure was not removed coincident with the remainder of the note as it should have been. The markups provided as part of CN66 show this inconsistency with the correct depiction of the note. This issue will be addressed in DCD Rev. 18.

There are no continuous monitors or Technical Specification Surveillance Requirements for gas accumulation or required actions associated with the high point vents (V106 and V107) added to the containment recirculation lines because there are no credible postulated gas intrusion mechanisms by which gas is expected to migrate into these lines (except in the event of improper venting during line filling operations such as after maintenance). This isolated piping section is maintained in a standby condition prior to passive safety system actuation. This local high point is located between the containment recirculation squib valves and the IRWST injection line squib valves, and remains connected to the IRWST so that the tank water elevation head maintains the pressure in this line prior to actuation.

Therefore, there is no need for continuous monitoring similar to that used for lines directly connected to the RCS during plant operations such as the CMT inlets, the PRHR HX inlet, or the IRWST squib valve outlet lines.

It is expected that these high points in the recirculation line would be included in the GL 2008-01 high-point monitoring program and that maintenance procedures would confirm proper venting and the absence of gas voids following any filling operations.

Design Control Document (DCD) Revision:

See attached pages.

PRA Revision:

None

Technical Report (TR) Revision:

None

TABLE 3.2-3 (SHEET 20 OF 75) AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT					
Tag Number	**Description**	**AP1000 Class**	**Seismic Category**	**Principal Construction Code**	**Comments**
Passive Core Cooling System (Continued)					
PXS-PL-V101	PRHR HX Inlet Isolation	A	I	ASME III-1	
PXS-PL-V102A	PRHR HX Inlet Head Vent	B	I	ASME III-2	
PXS-PL-V102B	PRHR HX Inlet Head Drain	B	I	ASME III-2	
PXS-PL-V103A	PRHR HX Outlet Head Vent	B	I	ASME III-2	
PXS-PL-V103B	PRHR HX Outlet Head Drain	B	I	ASME III-2	
PXS-PL-V104A	PRHR HX Flow Transmitter A Isolation	B	I	ASME III-2	
PXS-PL-V104B	PRHR HX Flow Transmitter B Isolation	B	I	ASME III-2	
PXS-PL-V105A	PRHR HX Flow Transmitter A Isolation	B	I	ASME III-2	
PXS-PL-V105B	PRHR HX Flow Transmitter B Isolation	B	I	ASME III-2	
PXS-PL-V106	Containment Recirculation A Highpoint Vent	C	I	ASME III-3	
PXS-PL-V107	Containment Recirculation A Highpoint Vent	C	I	ASME III-3	
PXS-PL-V108A	PRHR HX Control	A	I	ASME III-1	
PXS-PL-V108B	PRHR HX Control	A	I	ASME III-1	
PXS-PL-V109	PRHR HX/RCS Return Isolation	A	I	ASME III-1	
PXS-PL-V111A	PRHR HX Highpoint Vent	B	I	ASME III-2	
PXS-PL-V111B	PRHR HX Highpoint Vent	B	I	ASME III-2	
PXS-PL-V113	PRHR HX Pressure Transmitter Isolation	B	I	ASME III-2	
PXS-PL-V115A	Containment Recirculation A Drain	C	I	ASME III-3	
PXS-PL-V115B	Containment Recirculation B Drain	C	I	ASME III-3	
PXS-PL-V116A	Containment Recirculation A Drain	C	I	ASME III-3	
PXS-PL-V116B	Containment Recirculation B Drain	C	I	ASME III-3	
PXS-PL-V117A	Containment Recirculation A Isolation	C	I	ASME III-3	

TABLE 3.11-1 (SHEET 36 OF 51)

ENVIRONMENTALLY QUALIFIED ELECTRICAL AND MECHANICAL EQUIPMENT

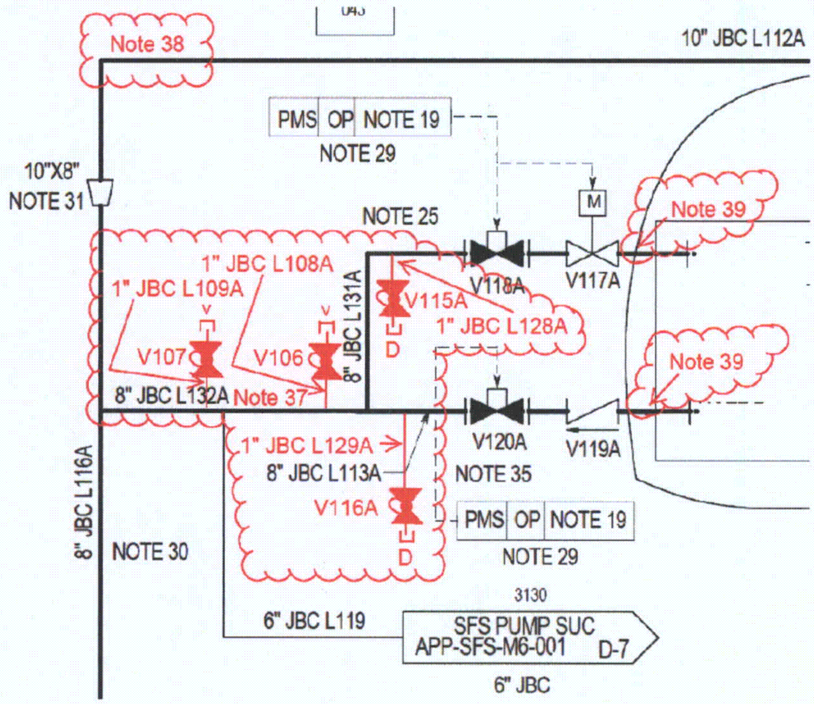
Description	AP1000 Tag No.	Envir. Zone (Note 2)	Function (Note 1)	Operating Time Required (Note 5)	Qualification Program (Note 6)
CMT A Lower Level A Isolation 2	PXS-PL-V093A	1	PB	1 yr	M *
CMT B Lower Level A Isolation 2	PXS-PL-V093B	1	PB	1 yr	M *
CMT A Lower Level A Vent	PXS-PL-V094A	1	PB	1 yr	M *
CMT B Lower Level A Vent	PXS-PL-V094B	1	PB	1 yr	M *
CMT A Lower Level A Drain	PXS-PL-V095A	1	PB	1 yr	M *
CMT B Lower Level A Drain	PXS-PL-V095B	1	PB	1 yr	M *
CMT A Lower Level B Isolation 1	PXS-PL-V096A	1	PB	1 yr	M *
CMT B Lower Level B Isolation 1	PXS-PL-V096B	1	PB	1 yr	M *
CMT A Lower Level B Isolation 2	PXS-PL-V097A	1	PB	1 yr	M *
CMT B Lower Level B Isolation 2	PXS-PL-V097B	1	PB	1 yr	M *
CMT A Lower Level B Vent	PXS-PL-V098A	1	PB	1 yr	M *
CMT B Lower Level B Vent	PXS-PL-V098B	1	PB	1 yr	M *
CMT A Lower Level B Drain	PXS-PL-V099A	1	PB	1 yr	M *
CMT B Lower Level B Drain	PXS-PL-V099B	1	PB	1 yr	M *
PRHR HX Inlet Isolation Limit Switch Motor Operator	PXS-PL-V101 PXS-PL-V101-L PXS-PL-V101-M	1 1 1	PB PAMS ESF	1 yr 1 yr 5 min	M * E * E *
PRHR HX Inlet Head Vent	PXS-PL-V102A	1	PB	1 yr	M *
PRHR HX Inlet Head Drain	PXS-PL-V102B	1	PB	1 yr	M *
PRHR HX Outlet Head Vent	PXS-PL-V103A	1	PB	1 yr	M *
PRHR HX Outlet Head Drain	PXS-PL-V103B	1	PB	1 yr	M *
PRHR HX Flow Transmitter A Isolation	PXS-PL-V104A	1	PB	1 yr	M *
PRHR HX Flow Transmitter B Isolation	PXS-PL-V104B	1	PB	1 yr	M *
PRHR HX Flow Transmitter A Isolation	PXS-PL-V105A	1	PB	1 yr	M *
PRHR HX Flow Transmitter B Isolation	PXS-PL-V105B	1	PB	1 yr	M *
Containment Recirculation A Highpoint Vent	PXS-PL-V106	1	PB	1 yr	M *
Containment Recirculation A Highpoint Vent	PXS-PL-V107	1	PB	1 yr	M *
PRHR HX/RCS Return Isolation	PXS-PL-V109	1	PB	1 yr	M *
PRHR HX Highpoint Vent	PXS-PL-V111A	1	PB	1 yr	M *
PRHR HX Highpoint Vent	PXS-PL-V111B	1	PB	1 yr	M *

TABLE 3I.6-3 (SHEET 17 OF 32)

LIST OF AP1000 SAFETY-RELATED ELECTRICAL AND MECHANICAL EQUIPMENT NOT HIGH FREQUENCY SENSITIVE

Description	AP1000 Tag Number	Comment
PRHR HX Outlet Head Drain	PXS-PL-V103B	2
PRHR HX Flow Transmitter A Isolation	PXS-PL-V104A	2
PRHR HX Flow Transmitter B Isolation	PXS-PL-V104B	2
PRHR HX Flow Transmitter A Isolation	PXS-PL-V105A	2
PRHR HX Flow Transmitter B Isolation	PXS-PL-V105B	2
Containment Recirculation A Highpoint Vent	PXS-PL-V106	2
Containment Recirculation A Highpoint Vent	PXS-PL-V107	2
PRHR HX/RCS Return Isolation	PXS-PL-V109	2
PRHR HX Highpoint Vent	PXS-PL-V111A	2
PRHR HX Highpoint Vent	PXS-PL-V111B	2
PRHR HX PZR Transmitter Isolation	PXS-PL-V113	2
Containment Recirculation A Drain	PXS-PL-V115A	2
Containment Recirculation B Drain	PXS-PL-V115B	2
Containment Recirculation A Drain	PXS-PL-V116A	2
Containment Recirculation B Drain	PXS-PL-V116B	2
Recirc Sump A Isolation	PXS-PL-V117A	2
Recirc Sump B Isolation	PXS-PL-V117B	2
IRWST Line A Isolation	PXS-PL-V121A	2
IRWST Line B Isolation	PXS-PL-V121B	2
IRWST Injection Check Test	PXS-PL-V126A	2

Correction to Section H of Figure 6.3-2



AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-DCP-CN66-SRSB-02
Revision: 0

Question:

In its May 25, 2010, letter, Westinghouse proposed changes to the Technical Specifications (TS) Section 3.5 surveillance requirements to verify the volume of the noncondensible gases in each of the four IRWST injection squib valve outlet line pipe stubs is equal or less than 0.2 cubic feet.

A. Provide the bases for selecting 0.2 cubic feet as the noncondensible gas volume limit.
B. Describe how the volume of the noncondensible gas is measured.
C. Describe how the 0.2 cubic feet volume of noncondensible gas is accounted for in the safety analyses for LOCA and post-LOCA long term cooling.

Westinghouse Response:

As a result of discussions with vendors and others related to the calculated high-point pipe stub void volume, Westinghouse decided to modify the Surveillance Requirements (SRs) associated with gas accumulation in high-point pipe stubs (i.e., SRs 3.5.2.4, 3.5.4.3, and 3.5.6.3). The reason for modifying the surveillance requirements is that the specified volumes of noncondensible gas are, in fact, not directly related to the OPERABILITY of the attached system piping.

The response to question A, below, describes the justification for the specified volume of 0.2 cubic feet and introduces the proposed changes to clarify the surveillance requirements.

Additionally, the response to question B includes further detail on the operation of the level sensors and the response to question C elaborates on the justification for not incorporating the noncondensible gas volume specified in the SR, which will change following acceptance of the new proposed SRs.

A. The noncondensable gas volume limit of 0.2 cubic feet was originally chosen because 0.2 cubic feet is slightly greater than the internal volume of the piping between where the sensors are located in the pipe stubs and the first of two normally closed manual vent valves. Although gas accumulation is not expected in this line following plant filling, venting, and startup, this relatively small gas accumulation volume generates an alarm to alert the operators sufficiently early to help mitigate any adverse consequences. Once this gas accumulation occurs, containment entry can be made and the gas can be vented before a significant amount of gases have accumulated that might adversely affect passive safety injection OPERABILITY. However, it is expected that following actuation, passive safety injection line flow helps to clear high-point voiding (based on the anticipated Froude number for the anticipated safety injection flow) so that sufficient passive safety injection flow is provided, particularly since there are four parallel IRWST safety injection flow paths. The volume of 0.2 cubic feet was chosen to be consistent with the SR requirements for the physical arrangement that is similar to the CMT Inlet high point pipe stubs (SR 3.5.2.4) since the pipe stubs and sensor configuration is similar to those added to the IRWST injection line high points.

As discussed, the specified volume of 0.2 cubic feet is based on the water volume within the boundary of the high-point piping, which consists of 6 inches of 8-inch nominal diameter schedule 160 piping, an 8-inch cap, an 8x1 inch reducer, approximately 13 inches of 1-inch nominal diameter schedule 80S piping, and the sensor pipe stub volume made up of 12 inches of 2-inch schedule 160 piping, minus the physical volume of the redundant sensors inserted in each sensor pipe stub. The total calculated volume within this boundary is less than the volume of 0.2 cubic feet specified in the surveillance requirement.

Based on the considerations of how the specified volume of 0.2 cubic feet was understood as a surveillance requirement, the Surveillance Requirements for the IRWST injection line and CMT and PRHR HX inlet line pipe stubs will be modified to be more general, since the specified volume is not specifically relevant to the OPERABILITY of the safety injection lines. Consequently, the surveillance requirements have been revised, as shown in the attached DCD and Technical Specification markups, to verify that the volume of noncondensible gas has not caused the water level to drop below the sensor. This revised SR wording should successfully show that the Surveillance Requirement is concerned with the alarms being actuated rather than a specific volume of gas being accumulated. This will also help to eliminate potential changes to the DCD in the event of slight re-routing of the vent line as part of evolving design details during design finalization. Additionally, this helps to emphasize that for the IRWST injection lines, as well as inlet lines on the CMT and PRHR HX, when a high-point alarm is actuated, while actions are immediately taken to vent the affected high-point, safety system OPERABILITY of the associated line is not necessarily immediately challenged, although it is considered to be inoperable for purposes of Technical Specifications. For each line, the alarm occurs before voiding extends into the line, and some amount of voiding in the associated line can be accommodated. Some amount of void clearing can occur as a result of flow in the affected line, based on the calculated Froude number at the point in time when line flow is initiated. Therefore, receipt of a high-point alarm does not necessarily render any of the high-point inoperable when the alarm actuates.

B. The volume of noncondensible gas is not directly measured. The sensors are thermal dispersion sensors consisting of one heated RTD and one non-heated RTD that act as point sensors to determine when a single specific condition has been met. In this case, that condition is when the sensor is exposed to noncondensible gas rather than water, which is the typical condition without a void. The dual RTD setup allows the sensors to sense a difference between water and noncondensable gas. As such, the sensors are located at a specific height in the pipe stubs and the volume above the sensors before the first closed valve is calculated. This volume is less than the 0.2 cubic feet specified in the TS SRs. Therefore, when the sensors signal the alarms, a known volume of gas has been accumulated and must be vented.

The operation of the high-point level-sensing instruments is to function as a thermal-dispersion level switch using RTDs that do not function as a temperature indicator where normally the parameter of interest would be measurement of a specific temperature or temperature range.

The important function for this application is indication of water uncovery of the RTD elements, which function to produce a differential temperature between the heated and unheated elements of the level switch.

A voltage is applied to one RTD element, causing it to be heated. The temperature difference that is established between the two elements is characteristic of the thermal conductivity of the medium in contact with the two elements. In normal operation, the elements are submerged in water. If gas accumulates in the pipe stubs, the elements become exposed to the gas void and the change in the differential temperature of the elements causes the output switch to actuate. Because of the large difference in thermal conductivity between a gas void and water-filled volume, the transition point when a gas void occurs is readily detectable and quick to respond.

This same technology has been used in PWR's for Sump / Flood Level Switch Applications.

C. The proposed volume is not considered in any safety analyses. The pipe stub and sensor configuration allows a certain volume of gas to accumulate in the pipe stub before the actual injection path begins to void. In fact, the alarms are tripped when less than half of the volume of gas that could potentially begin to affect the injection flow capability has accumulated. Consequently, the volume accumulated when the alarms sound are not expected to immediately affect the passive safety injection flow capability. Additionally, since there are no credible postulated gas intrusion mechanisms for these locations, the rate of gas accumulation is expected to be sufficiently slow and/or small to allow for the 8 hour required action to make containment entry and vent the gas void. Thus, the configuration of the high point pipe stub and sensors was designed to collect the specified volume of gas such that the OPERABILITY of the passive safety injection is not challenged and therefore, the specified volume of gas does not need to be considered in the safety analyses.

The specified volume of 0.2 cubic feet is simply the maximum volume of gas that could potentially accumulate before the alarms will sound. As discussed in Item 1, the alarm occurs sufficiently early so that venting of a gas void can be accomplished and OPERABILITY of the passive safety injection does not need to consider gas voiding effects. While safety analyses do not credit gas void clearing phenomena, it is recognized that the safety injection flow can provide relatively effective void clearing for some limited void fraction. Therefore, the high-point alarms are intended to provide monitoring and allow resolution of a potential gas accumulation prior to an event before it can potentially challenge OPERABILITY.

Design Control Document (DCD) Revision:

See attached sheets

PRA Revision:

None

Technical Report (TR) Revision:

None

DCD Additions to address Gas Accumulation

~~**5.4.7.6.2 Periodic Inspection**~~

~~Periodic system surveillance and venting procedures are implemented to prevent gas accumulation and minimize or eliminate gas whenever identified. Locations identified by the gas accumulation assessment, especially where high point vents exist, are specified within the periodic system surveillance and venting procedures. In particular, locations outfitted with pipe stub collection and alarm features have Technical Specifications including Surveillance Requirements to continuously monitor for gas accumulation and Required Actions subsequent to identifying gas accumulation in those locations to vent the identified gas accumulation. The surveillance and venting procedures include a means to track and trend accumulated gas such that problem areas can be systematically identified, documented and corrected.~~

6.3.6.3 Mitigation of Gas Accumulation

Periodic system surveillance and venting procedures, in addition to specific design features, are implemented that aim to prevent gas accumulation and minimize or eliminate gas whenever found. Locations identified by the gas accumulation assessment have been equipped with manual vent valves or continuously monitored and alarmed pipe stubs with manual vent valves. These locations are specified within the periodic system surveillance and venting procedures as locations of high importance. Locations outfitted with pipe stub collection and alarm features have Technical Specifications including Surveillance Requirements to continuously monitor for gas accumulation and Required Actions subsequent to identifying gas accumulation in those locations to vent the identified gas accumulation. Plant startup and operational procedures include venting and surveillance steps that provide a means to track and trend accumulated gas such that problem areas can be systematically identified, monitored and corrected.

6.3.6.3.1 System Gas Accumulation Assessment

Reviews of pipe layout and routing drawings to identify high-point vent and low-point drain locations are included as part of system design finalization activities. This existing design activity was expanded for the AP1000 passive safety systems, to integrate the draft Interim Staff Guidance (ISG) document ISG-019 regarding gas intrusion assessment guidance into the design process, helping to confirm that the potential issues identified in Generic Letter (GL) 2008-01 have been addressed within the design. Westinghouse also performed a comprehensive assessment for gas intrusion within the passive safety systems, consistent with the methodology in NEI 09-10 as applied in current operating plants, and consistent with the additional guidance in the ISG.

6.3.6.3.2 System Design Features to Mitigate Gas Intrusion

The gas intrusion assessment described in 6.3.6.3.1 helped to identify:

- Potential gas accumulation locations in the passive core cooling system piping
- Potential gas intrusion mechanisms during various plant conditions (including plant startup, shutdown, post-maintenance system restoration and filling, power operation, and accident conditions)

- Passive core cooling system design features to provide the capability to perform system high-point venting and to continuously monitor several high-point locations

These passive core cooling system design features help to eliminate the potential for significant gas accumulation in specific passive safety system injection lines that could adversely impact passive safety system operation. System venting capabilities are provided for the following passive safety system locations:

- IRWST injection line squib valve inlet lines
  - Vents located at the piping high points upstream of the parallel paths in both IRWST safety injection lines
  - Vents located between the check and squib valves in each line of the parallel paths in both IRWST safety injection lines
- CMT outlet lines
  - Vents located upstream of the first check valves in both CMT outlet lines
  - Vents located between the series check valves in the CMT A outlet line
  - Vents located between the second check and manual isolation valves in both CMT outlet lines
- Containment recirculation Line A
  - Vents located at the high points in the common containment recirculation Line A path between the recirculation squib valves and the IRWST injection line (before and after the Spent Fuel System connection tee)

The potential for gas accumulation in passive safety system IRWST injection lines following accumulator injection is precluded by connecting the accumulator injection line in the DVI line riser section vertically above the IRWST injection line connection to the DVI line riser.

In addition, passive safety system design features are provided to monitor for gas accumulation at several specific locations. These design features include pipe stub gas collection chambers with redundant instrumentation at each high point, are continuously monitored and alarmed, have hard piped vent lines, are accessible during power operation, and include Technical Specifications and Surveillance Requirements specifically intended to identify unintended gas accumulations that could potentially challenge passive safety system operability for the following locations:

- CMT inlet highpoints
- PRHR HX inlet high point
- IRWST injection line squib valve outlet high points

To ensure that all of the vent locations identified above function properly, notes are included on the system Piping and Instrumentation Diagrams that specify layout sloping requirements. The intent of the layout requirements are to help ensure that the installed vents can effectively vent accumulated gases from the associated line segments. These notes also appear on the isometric drawings to make certain that the layout sloping requirements are observed during fabrication, construction, and installation.

The continuously monitored and alarmed pipe stub gas collection chamber, including TSs and SRs, was not utilized for the high points in the containment recirculation Line A because there are no credible postulated gas intrusion mechanisms by which gas is expected to migrate into these lines (except in the event of improper venting during line filling operations such as after maintenance). This isolated piping section is maintained in a standby condition prior to passive safety system actuation. This local high point is located between the containment recirculation squib valves and the IRWST injection line squib valves, and remains connected to the IRWST so that the tank water elevation head maintains the pressure in this line prior to actuation.

Passive safety system locations equipped with manual vent valves will be inspected according to the system surveillance and venting procedures to eliminate any identified gas accumulation. Locations equipped with pipe stub gas collection and alarm features will be continuously monitored via alarm indications in the main control room. Because the locations with pipe stub collection and alarm features are continuously monitored and have Surveillance Requirements and Required Actions, the potential exists that these locations will be vented at RCS pressure. Consequently, these locations have manual vent valves and are hard-piped to either the IRWST or the Reactor Coolant Drain Tank (RCDT) for potential venting at RCS pressure.

For AP1000, the Structures, Systems, and Components (SSCs) of the passive safety systems that are used to establish and maintain safe shutdown conditions for the plant are identified and discussed in DCD Sections 7.4.1.1 and 7.4.2, and listed in Table 7.4-1. These same SSCs that provide the AP1000 safe shutdown capability also provide the passive, safety-related accident mitigation functions, including those that are equivalent to the ECCS, DHR, and containment spray system functions for active plants specified in the GL.

DCD Changes to Table 7.4-1 to include Containment Sump Recirculation

Table 7.4-1 **SYSTEMS REQUIRED FOR SAFE SHUTDOWN**
Protection and Safety Monitoring System
Passive Core Cooling System Passive Residual Heat Removal Heat Exchanger Core Makeup Tanks Accumulators In-Containment Refueling Water Storage Tank Containment Sump Recirculation Automatic Depressurization Valves
Passive Containment Cooling System
Class 1E dc and UPS System
Containment Isolation Valves
Reactor System Control Rods

3.5 PASSIVE CORE COOLING SYSTEM (PXS)

3.5.2 Core Makeup Tanks (CMTs) – Operating

LCO 3.5.2 Both CMTs shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4 with the RCS not being cooled by the Normal Residual Heat Removal System (RNS).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CMT inoperable due to one CMT outlet isolation valve inoperable.	A.1 Restore outlet isolation valve to OPERABLE status.	72 hours
B. One CMT inoperable due to one or more parameters (water temperature, boron concentration) not within limits.	B.1 Restore water temperature or boron concentration to within limits.	72 hours
C. Two CMTs inoperable due to water temperature or boron concentration not within limits.	C.1 Restore water temperature or boron concentration to within limits for one CMT.	8 hours if Condition B of LCO 3.5.1 has not been entered <u>OR</u> 1 hour if Condition B of LCO 3.5.1 has been entered
D. One CMT inoperable due to presence of non-condensible gases in one high point vent.	D.1 Vent noncondensible gases.	24 hours
E. One CMT inoperable for reasons other than Condition A, B, C, or D.	E.1 Restore CMT to OPERABLE status.	8 hours if Condition B of LCO 3.5.1 has not been entered <u>OR</u> 1 hour if Condition B of LCO 3.5.1 has been entered

Westinghouse

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time not met. OR LCO not met for reasons other than A, B, C, D, or E.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.1	Verify the temperature of the borated water in each CMT is < 120°F.	24 hours
SR 3.5.2.2	Verify the borated water volume in each CMT is ≥ 2500 cu. ft.	7 days
SR 3.5.2.3	Verify each CMT inlet isolation valve is fully open.	12 hours
SR 3.5.2.4	Verify the volume of noncondensible gases in each CMT inlet line has not caused the high-point water level to drop below the sensor.~~is ≤ 0.2 ft^3.~~	24 hours
SR 3.5.2.5	Verify the boron concentration in each CMT is ≥ 3400 ppm, and ≤ 3700 ppm.	7 days
SR 3.5.2.6	Verify each CMT outlet isolation valve is OPERABLE by stroking it open.	In accordance with the Inservice Testing Program
SR 3.5.2.7	Verify system flow performance of each CMT in accordance with the System Level OPERABILITY Testing Program.	10 years

3.5 PASSIVE CORE COOLING SYSTEM (PXS)

3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

LCO 3.5.4 The PRHR HX shall be OPERABLE.

- NOTE -

When any reactor coolant pumps (RCPs) are operating, at least one RCP must be operating in the loop with the PRHR HX, Loop 1.

APPLICABILITY: MODES 1, 2, 3, and 4 with the RCS not being cooled by the Normal Residual Heat Removal System (RNS).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One air operated outlet isolation valve inoperable.	A.1 Restore air operated outlet isolation valve to OPERABLE status.	72 hours
B. One air operated IRWST gutter isolation valve inoperable.	B.1 Restore air operated IRWST gutter isolation valve to OPERABLE status.	72 hours
C. Presence of non-condensible gases in the high point vent.	C.1 Vent noncondensible gases.	24 hours
D. Required Action and associated Completion Time of Conditions A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 4 with the RCS cooling provided by the RNS.	6 hours 24 hours
E. LCO not met for reasons other than A, B, or C.	E.1 Restore PRHR HX to OPERABLE status.	8 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time for Condition E not met.	F.1 ------------------------------------ **- NOTE -** Prior to initiating actions to change to a lower MODE, verify that redundant means of providing SG feedwater are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status. ------------------------------------ Be in MODE 3.	6 hours
	<u>AND</u>	
	F.2 ------------------------------------ **- NOTE -** Prior to stopping the SG feedwater, verify that redundant means of cooling the RCS to cold shutdown conditions are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status. ------------------------------------ Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify the outlet manual isolation valve is fully open.	12 hours
SR 3.5.4.2	Verify the inlet motor operated isolation valve is open.	12 hours
SR 3.5.4.3	Verify the volume of noncondensible gases in the PRHR HX inlet line has not caused the high-point water level to drop below the sensor.~~has not depressed the water level below the sensor.is ≤ 0.9 ft³.~~	24 hours
SR 3.5.4.4	Verify that power is removed from the inlet motor operated isolation valve.	31 days
SR 3.5.4.5	Verify both PRHR air operated outlet isolation valves and both IRWST gutter isolation valves are OPERABLE by stroking open the valves.	In accordance with the Inservice Testing Program
SR 3.5.4.6	Verify PRHR HX heat transfer performance in accordance with the System Level OPERABILITY Testing Program.	10 years
SR 3.5.4.7	Verify by visual inspection that the IRWST gutters are not restricted by debris.	24 months

Westinghouse

3.5 PASSIVE CORE COOLING SYSTEM (PXS)

3.5.6 In-containment Refueling Water Storage Tank (IRWST) – Operating

LCO 3.5.6 The IRWST, with two injection flow paths and two containment recirculation flow paths, shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One IRWST injection line actuation valve flow path inoperable. OR One containment recirculation line actuation valve flow path inoperable.	A.1 Restore the inoperable actuation valve flow path to OPERABLE status.	72 hours
B. One IRWST injection line inoperable due to presence of noncondensible gases in one high point vent.	B.1 Vent noncondensible gases.	72 hours
C. One IRWST injection line inoperable due to presence of noncondensible gases in both high point vents.	C.1 Vent noncondensible gases from one high point vent.	8 hours
D. IRWST boron concentration not within limits. OR IRWST borated water temperature not within limits. OR	D.1 Restore IRWST to OPERABLE status.	8 hours

Westinghouse

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
IRWST borated water volume < 100% and > 97% of limit.		
E. One motor operated IRWST isolation valve not fully open. OR Power is not removed from one or more motor operated IRWST isolation valves.	E.1 Restore motor operated IRWST isolation valve to fully open condition with power removed from both valves.	1 hour
F. Required Action and associated Completion Time not met. OR LCO not met for reasons other than A, B, C, D, or E.	F.1 Be in MODE 3. AND F.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.6.1	Verify the IRWST water temperature is < 120°F.	24 hours
SR 3.5.6.2	Verify the IRWST borated water volume is > 73,100 cu. ft.	24 hours
SR 3.5.6.3	Verify the volume of noncondensible gases in each of the four IRWST injection squib valve outlet line pipe stubs has not caused the high-point water level to drop below the sensor.	24 hours

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.5.6.4	Verify the IRWST boron concentration is ≥ 2600 ppm and ≤ 2900 ppm.	31 days <u>AND</u> Once within 6 hours after each solution volume increase of 15,000 gal
SR 3.5.6.5	Verify each motor operated IRWST isolation valve is fully open.	12 hours
SR 3.5.6.6	Verify power is removed from each motor operated IRWST isolation valve.	31 days
SR 3.5.6.7	Verify each motor operated containment recirculation isolation valve is fully open.	31 days
SR 3.5.6.8	Verify each IRWST injection and containment recirculation squib valve is OPERABLE in accordance with the Inservice Testing Program.	In accordance with the Inservice Testing Program
SR 3.5.6.9	Verify by visual inspection that the IRWST screens and the containment recirculation screens are not restricted by debris.	24 months
SR 3.5.6.10	Verify IRWST injection and recirculation system flow performance in accordance with the System Level OPERABILITY Testing Program.	10 years

B 3.5 PASSIVE CORE COOLING SYSTEM (PXS)

B 3.5.2 Core Makeup Tanks (CMTs) – Operating

BASES

BACKGROUND

Two redundant CMTs provide sufficient borated water to assure Reactor Coolant System (RCS) reactivity and inventory control for all design basis accidents (DBAs), including both loss of coolant accident (LOCA) events and non-LOCA events (Ref. 1).

The CMTs are cylindrical tanks with hemispherical upper and lower heads. They are made of carbon steel and clad on the internal surfaces with stainless steel. They are located in containment at an elevation slightly above the reactor coolant loops. Each tank is full of borated water at > 3400 ppm. During normal operation, the CMTs are maintained at RCS pressure through a normally open pressure balance line from the cold leg.

The outlet line from each CMT is connected to one of two direct vessel injection lines, which provides an injection path for the water supplied by the CMT. The outlet line from each CMT is isolated by parallel, normally closed, fail open valves. Upon receipt of a safeguards actuation signal, these four valves open to align the CMTs to the RCS.

The CMTs will inject to the RCS as inventory is lost and steam or reactor coolant is supplied to the CMT to displace the water that is injected. Steam or reactor coolant is provided to the CMT through the cold leg balance line, depending upon the specific event that has occurred. The inlet line from the cold leg is sized for LOCA events, where the cold legs become voided and higher CMT injection flows are required.

The injection line from each CMT contains a flow tuning orifice that is used to provide a mechanism for the field adjustment of the injection line resistance. The orifice is used to establish the required flow rates for the associated plant conditions assumed in the CMT design. The CMT flow is based on providing injection for a minimum of 20 minutes after CMT actuation.

The CMT size and injection capability are selected to provide adequate RCS boration and safety injection for the limiting DBA. One CMT is adequate for this function during a small break LOCA where one CMT completely spills via the pipe break (Ref. 2). The Probabilistic Risk Assessment (PRA) (Ref. 3) shows that none of the CMTs are required for small LOCAs, assuming that at least one accumulator is available.

BASES

APPLICABLE SAFETY ANALYSES

The CMTs are assumed to be OPERABLE to provide emergency boration and core makeup when the Chemical and Volume Control System (CVS) is inoperable, and to mitigate the consequences of any DBA which requires the safety injection of borated water (Ref. 2).

Following a non-LOCA event such as a steam line break, the RCS experiences a decrease in temperature and pressure due to an increase in energy removal by the secondary system. The cooldown results in a reduction of the core SHUTDOWN MARGIN due to the negative moderator temperature coefficient, with a potential for return to power. The actuation of the CMTs following this event provides injection of borated water to mitigate the reactivity transient and ensure the core remains shut down.

In the case of a steam generator tube rupture (SGTR), CMT injection provides borated water to compensate for RCS LEAKAGE.

In the case of an RCS leak of 10 gallons per minute, the CMTs can delay depressurization for at least 10 hours, providing makeup to the RCS and remain able to provide the borated water to compensate for RCS shrinkage and to assure the RCS boration for a safe shutdown.

In the case of a LOCA, the CMTs provide a relatively large makeup flow rate for approximately 20 minutes, in conjunction with the accumulators to provide the initial core cooling.

CMTs satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO establishes the minimum conditions necessary to ensure that sufficient CMT flow will be available to meet the initial conditions assumed in the safety analyses. OPERABILITY is not expected to be challenged due to small gas accumulations in the high point and rapid gas accumulations are not expected during plant operation. However, a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of natural circulation flow. Therefore, noncondensible gas accumulation in the inlet line high point that causes the water level to drop below the sensor will require operator action to investigate the cause of the gas accumulation and to vent the associated high point(s). ~~– [CLONE this where applicable]~~

The volume of each CMT represents 100% of the total injected flow assumed in LOCA analysis. If the injection line from a single CMT to the vessel breaks, no single active failure on the other CMT will prevent the injection of borated water into the vessel. Thus the assumptions of the LOCA analysis will be satisfied.

BASES

For non-LOCA analysis, two CMTs are assumed. Note that for non-LOCA analysis, the accident cannot disable a CMT.

BASES

APPLICABILITY

In MODES 1, 2, 3, and 4 when the RCS is not being cooled by the Normal Residual Heat Removal System (RNS) the CMTs are required to be OPERABLE to provide borated water for RCS inventory makeup and reactivity control following a design basis event and subsequent cooldown.

The CMT requirements in MODE 5 with the RCS pressure boundary intact are specified in LCO 3.5.3, "Core Makeup Tanks (CMTs) – Shutdown, RCS Intact."

The CMTs are not required to be OPERABLE while in MODE 5 with the RCS pressure boundary open or in MODE 6 because the RCS is depressurized and borated water can be supplied from the In-containment Refueling Water Storage Tank (IRWST), if needed.

In the unlikely event of a total loss of AC power sources, coupled with an inoperable Passive Residual Heat Removal Heat Exchanger (PRHR HX) (beyond DBA), the CMTs may be used in a feed and bleed sequence to remove heat from the RCS.

ACTIONS

A.1

With one outlet isolation valve inoperable on one CMT, action must be taken to restore the valve. In this Condition, the CMT is capable of performing its safety function, provided a single failure of the remaining parallel isolation valve does not occur. A Completion Time of 72 hours is acceptable for two train ECCS systems which are capable of performing their safety function without a single failure.

B.1

If the water temperature or boron concentration of one CMT is not within limits, it must be returned to within limits within 72 hours. The deviations in these parameters are expected to be slight, considering the frequent surveillances and control room monitors. With the temperature above the limit, the full core cooling capability assumed in the safety analysis may not be available. With the boron concentration not within limits, the ability to maintain subcriticality following a DBA may be degraded. However, because only one of two CMTs is inoperable, and the deviations of these parameters are expected to be slight, it is probable that more than a required amount of boron and cooling capability will be available to meet

Westinghouse

the conditions assumed in the safety analysis.

ACTIONS (continued)

Since the CMTs are redundant, safety class components, the 72 hour Completion Time is consistent with the times normally allowed for this type of component.

C.1

With two CMTs inoperable due to water temperature or boron concentration, at least one CMT must be restored to within limits in 8 hours. The deviations in these parameters are expected to be slight, considering the frequent surveillances and control room monitors. A Completion Time of 8 hours is considered reasonable since the CMTs are expected to be capable of performing their safety function with slight deviations in these parameters and the accumulators are required to be available for LOCA mitigation (i.e., entry into Condition B of LCO 3.5.1 has not occurred). The effectiveness of accumulator injection is demonstrated in analysis performed to justify PRA success criteria (Ref. 3). The analysis contained in this reference shows that for a small LOCA, the injection from one accumulator without any CMT injection supports adequate core cooling. This analysis provides a high confidence that with the unavailability of two CMTs due to water temperature or boron concentration deviations, the core can be cooled following design bases accidents.

The 1 hour Completion Time, in the case with simultaneous entry into Condition B of LCO 3.5.1, requires very prompt actions to restore either the CMT or the accumulator to OPERABLE status. This Completion Time is considered reasonable because of the low probability of simultaneously entering these multiple PXS Conditions and the very small likelihood of a LOCA occurring at the same time.

D.1

Excessive amounts of noncondensible gases in a CMT inlet line may interfere with the natural circulation flow (hot water from the RCS through the balance line into the CMT and cold water from the CMT through the direct vessel injection line into the vessel) assumed in the safety analyses for some transients. For CMT injection following a LOCA (steam will enter the CMT through the balance line, displacing the CMT water), gases in the CMT inlet line are not detrimental to the CMT function. The presence of some noncondensible gases does not mean that the CMT natural circulation capability is immediately inoperable, but that gases are collecting and should be vented.

~~The level sensor location has been selected to permit additional gas accumulation prior to significantly affecting the natural circulation flow, so~~

~~that adequate time may be provided to permit containment entry for~~

ACTIONS (continued)

The level sensor location has been selected to permit additional gas accumulation prior to significantly affecting the natural circulation flow, so that adequate time may be provided to permit containment entry for venting the gas. Anticipated noncondensible gas accumulation in this piping segment is expected to be relatively slow.

The venting of these gases requires containment entry to manually operate the vent valves. A Completion Time of 24 hours is permitted for venting noncondensible gases and is acceptable, since, for the transients, the natural circulation capability of one CMT is adequate to ensure mitigation assuming less conservative analysis assumptions regarding stuck rods and core characteristics.

E.1

With one CMT inoperable for reasons other than Condition A, B, C, D, operation of the CMT may not be available. Action must be taken to restore the inoperable CMT to OPERABLE status within 8 hours. The remaining CMT is sufficient for DBAs except for LOCA in the OPERABLE CMTs DVI line. The 8 hour Completion Time is based on the required availability of injection from the accumulators (provided that entry into Condition B of LCO 3.5.1 has not occurred) to provide SI injection. The effectiveness of accumulator injection is demonstrated in analysis performed to justify PRA success criteria (Ref. 3). The analysis contained in this reference shows that for a small LOCA, the injection from one accumulator without any CMT supports adequate core cooling. This analysis provides a high confidence that with the unavailability of one CMT, the core can be cooled following design bases accidents.

The 1 hour Completion Time, in the case with simultaneous entry into Condition B of LCO 3.5.1, requires very prompt actions to restore either the CMT or the accumulator to OPERABLE status. This Completion Time is considered reasonable because of the low probability of simultaneously entering these multiple PXS Conditions and the very small likelihood of a LOCA occurring at the same time.

F.1 and F.2

If the Required Action or associated Completion Time of Condition A, B, C, D, or E are not met or the LCO is not met for reasons other than Conditions A through E, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1 and SR 3.5.2.2

Verification every 24 hours and 7 days that the temperature and the volume, respectively, of the borated water in each CMT is within limits ensures that when a CMT is needed to inject water into the RCS, the injected water temperature and volume will be within the limits assumed

SURVEILLANCE REQUIREMENTS (continued)

in the accident analysis. The 24 hour Frequency is adequate, based on the fact that no mechanism exists to rapidly change the temperature of a large tank of water such as a CMT. These parameters are normally monitored in the control room by indication and alarms. Also, there are provisions for monitoring the temperature of the inlet and outlet lines to detect in-leakage which may affect the CMT water temperature.

SR 3.5.2.3

Each CMT inlet isolation valve must be verified to be fully open each 12 hours. Frequent verification is considered to be important, since a CMT can not perform its safety function, if the valve is closed. Control room instrumentation is normally available for this verification.

SR 3.5.2.4

Verification that excessive amounts of noncondensible gases have not caused the water level to drop below the sensor~~are not present~~ in the inlet line is required every 24 hours. The inlet line of each CMT has a vertical section of pipe which serves as a high point collection point for noncondensible gases. Control room indication of the water level in the high point collection point is available to verify that noncondensible gases have collected to the extent that the water level is depressed below the allowable level. The thermal dispersion sensor locations on the vertical pipe sections have been selected to permit additional gas accumulation before injection flow is significantly affected, so that adequate time may be provided to permit containment entry for venting the gas.

The 24 hour Frequency is based on the expected low rate of gas accumulation and the availability of control room indication.

SR 3.5.2.5

Verification every 7 days that the boron concentration in each CMT is within the required limits ensures that the reactivity control from each CMT, assumed in the safety analysis, will be available as required. The 7 day Frequency is adequate to promptly identify changes which could occur from mechanisms such as in-leakage.

SR 3.5.2.6

Verification that the redundant outlet isolation valves are OPERABLE by stroking the valves open ensures that each CMT will function as designed when these valves are actuated. Prior to opening the outlet isolation valves, the inlet isolation valve should be closed temporarily. Closing the inlet isolation valve ensures that the CMT contents will not be diluted or heated by flow from the RCS. Upon completion of the test, the inlet isolation valves must be opened. The Surveillance Frequency references the inservice testing requirements.

~~BASES~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

SR 3.5.2.7

This SR requires performance of a system performance test of each CMT to verify flow capabilities. The system performance test demonstrates that the CMT injection line resistance assumed in DBA analyses is maintained. Although the likelihood that system performance would degrade with time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

REFERENCES

1. Section 6.3, "Passive Core Cooling System."
2. Chapter 15, "Accident Analysis."
3. AP1000 PRA.

B 3.5 PASSIVE CORE COOLING SYSTEM (PXS)

B 3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

BASES

BACKGROUND

The normal heat removal mechanism is the steam generators, which are supplied by the startup feedwater system. However, this path utilizes non-safety related components and systems, so its failure must be considered. In the event the steam generators are not available to remove decay heat for any reason, including loss of startup feedwater, the heat removal path is the PRHR HX (Ref. 1).

The principle component of the PRHR HX is a 100% capacity heat exchanger mounted in the In-containment Refueling Water Storage Tank (IRWST). The heat exchanger is connected to the Reactor Coolant System (RCS) by a inlet line from one RCS hot leg, and an outlet line to the associated steam generator cold leg channel head. The inlet line to the passive heat exchanger contains a normally open, motor operated isolation valve. The outlet line is isolated by two parallel, normally closed air operated valves, which fail open on loss of air pressure or control signal. There is a vertical collection point at the top of the common inlet piping high point which serves as a gas collector. It is provided with level detectors that indicate when noncondensible gases have collected in this area. There are provisions to manually vent these gases to the IRWST.

In order to preserve the IRWST water for long term PRHR HX operation, a gutter is provided to collect and return water to the IRWST that has condensed on the inside surface of the containment shell. During normal plant operation any water collected by the gutter is directed to the normal containment sump. During PRHR HX operation, redundant series air operated valves are actuated to block the draining of condensate to the normal sump and to force the condensate into the IRWST. These valves fail closed on loss of air pressure or control signal.

The PRHR HX size and heat removal capability is selected to provide adequate core cooling for the limiting non-LOCA heatup Design Basis Accidents (DBAs) (Ref. 2). The Probability Risk Assessment (PRA) (Ref. 3) shows that PRHR HX is not required assuming that passive feed and bleed is available. Passive feed and bleed uses the Automatic Depressurization System (ADS) for bleed and the CMTs/accumulators/ IRWST for feed.

APPLICABLE SAFETY ANALYSES

In the event of a non-LOCA DBA during normal operation, the PRHR HX is automatically actuated to provide decay heat removal path in the event the normal path through the steam generators is not available (Ref. 2).

The non-LOCA events which establish the PRHR HX parameters are those involving a decrease in heat removal by the secondary system, such as loss of main feedwater or other failure in the feedwater system. Since the PRHR HX is passive, it will mitigate the consequences of these events with a complete loss of all AC power sources. The PRHR HX actuates when the CMTs are actuated during LOCA events.

The PRHR HX satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the PRHR HX be OPERABLE so that it can respond appropriately to the DBAs which may require its operation. Since this is a passive component, it does not require the actuation of active components such as pumps for its OPERABILITY and will be OPERABLE if the inlet valves are in their normally open position, and the normally closed, fail open outlet valves open on receipt of an actuation signal.

In addition to the appropriate valve configuration, OPERABILITY may be impaired by ~~flow blockage caused by~~ noncondensible gases collecting in the system. OPERABILITY is not expected to be challenged due to small gas accumulations in the high point and rapid gas accumulations are not expected during plant operation. However, a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of natural circulation flow. Therefore, noncondensible gas accumulation in the inlet line high point that causes the water level to drop below the sensor will require operator action to investigate the cause of the gas accumulation and to vent the associated high point(s). ~~[CLONED WORDS HERE]~~ ~~Thus the absence of noncondensible gases in the high point is necessary for system OPERABILITY.~~

The note requires a reactor coolant pump (RCP) to be operating in the loop with the PRHR HX, Loop 1, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX.

APPLICABILITY

The PRHR HX must be OPERABLE in MODES 1, 2, 3, and 4 with the RCS not cooled by the Normal Residual Heat Removal System (RNS) if a plant cooldown is required and the normal cooldown path is not available. Under these conditions, the PRHR HX may be actuated to provide core cooling and to mitigate the consequences of a DBA.

The PRHR HX requirements in MODE 4 with RCS cooling provided by the RNS and in MODE 5 with the RCS pressure boundary intact are specified in LCO 3.5.5, "Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Shutdown, RCS Intact."

The PRHR HX is not capable of natural circulation cooling of the RCS in MODE 5 with the RCS pressure boundary open or in MODE 6.

ACTIONS

A.1

The outlet line from the PRHR HX is controlled by a pair of normally closed, fail open, air operated valves, arranged in parallel. Thus they are redundant and, if either valve is OPERABLE, the system can function at 100% capacity, assuming other OPERABILITY conditions are met.

If one valve is inoperable, a Completion Time of 72 hours has been allowed to restore the inoperable valve(s) to OPERABLE status. This Completion Time is consistent with the Completion Times specified for other parallel redundant safety related systems.

B.1

With one air operated IRWST gutter isolation valve inoperable, the remaining isolation valve can function to drain the gutter to the IRWST. Action must be taken to restore the inoperable gutter isolation valve to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable based on the capability of the remaining valve to perform 100% of the required safety function assumed in the safety analyses.

C.1

Excessive amounts of noncondensible gases in the PRHR HX inlet line may interfere with the natural circulation flow of reactor coolant through the PRHR HX. The presence of some noncondensible gases does not mean that the PRHR HX is immediately inoperable, but that gases are collecting and should be vented.

The level sensor location has been selected to permit additional gas accumulation before natural circulation flow is significantly affected, so that sufficient time may be provided to permit containment entry for venting the gas. Anticipated noncondensible gas accumulation in this piping segment is expected to be relatively slow.~~The calculated gas accumulation rate is sufficiently slow that additional accumulation for approximately 24 hours is not expected to significantly affect the flow.~~

The venting of these gases requires containment entry to manually operate the appropriate vent valves. A Completion Time of 24 hours is acceptable considering that passive feed and bleed cooling is available to remove heat from the RCS.

D.1 and D.2

If any of the above Required Actions have not been accomplished in the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4, with the RCS cooled by the RNS, within 24 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

ACTIONS (continued)

E.1

With the LCO not met for reasons other than Condition A, B, or C, the PRHR HX must be restored within 8 hours. The 8 hour Completion Time is based on the availability of passive feed and bleed cooling to provide RCS heat removal. The effectiveness of feed and bleed cooling has been demonstrated in analysis and evaluations performed to justify PRA success criteria (Ref. 3). The analysis contained in this reference shows that for a range of events including loss of main feedwater, SGTR, and small LOCA (as small as 1/2") that feed and bleed cooling provides adequate core cooling.

These analyses and evaluations provide a high confidence that with the unavailability of the PRHR HX the core can be cooled following design bases accidents.

F.1 and F.2

If the PRHR HX is not restored in accordance with Action E.1 within 8 hours, the plant must be placed in a MODE in which the LCO does not apply. This is accomplished by placing the plant in MODE 3 within 6 hours and in MODE 5 within 36 hours.

Action F.1 is modified by a Note which requires that prior to initiating cooldown of the plant to MODE 3, redundant means of providing SG feedwater be verified as OPERABLE. Possible means include main feedwater and startup feedwater pumps. With the PRHR HX and redundant means of feeding the SGs INOPERABLE, the unit is in a seriously degraded condition with no means for conducting a controlled cooldown. In such a condition, the unit should not be perturbed by any action, including a power change, that might result in a trip. If redundant means of feeding the SGs are not available, the plant should be maintained in the current MODE until redundant means are restored.

LCO 3.0.3 and all other Required Actions shall be suspended until the redundant means are restored, because they could force the unit into a less safe condition.

Action F.2 is modified by a Note which requires that prior to stopping SG feedwater, redundant means of cooling the RCS to cold shutdown conditions must be verified as OPERABLE. One redundant means of cooling the RCS to cold shutdown includes the normal residual heat removal system (RNS) and its necessary support system (both component cooling system pumps and heat exchangers, and both service water system pumps and fans). Without availability of these redundant

ACTIONS (continued)

cooling means, the unit is in a seriously degraded condition with no means for continuing the controlled cooldown. Until the redundant cooling means are restored, heat removal using SG feedwater should be maintained. LCO 3.0.3 and all other Required Actions shall be suspended until the systems and equipment required for further cooldown are restored, because they could force the unit into a less safe condition.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

Verification, using remote indication, that the common outlet manual isolation valve is fully open ensures that the flow path from the heat exchangers to the RCS is available. Misalignment of this valve could render the heat exchanger inoperable. A 12 hour Frequency is reasonable considering that the valve is manually positioned and has control room position indication and alarm.

SR 3.5.4.2

Verification that the motor operated inlet valve is fully open, as indicated in the main control room, ensures timely discovery if the valve is not fully open. The 12 hour Frequency is consistent with the ease of verification, confirmatory open signals, and redundant series valve controls that prevent spurious closure.

SR 3.5.4.3

Verification that excessive amounts of noncondensible gases have not caused the water level to drop below the sensor~~are not present~~ in the inlet line is required every 24 hours. The inlet line of the PRHR HX has a vertical section of pipe which serves as a high point collection point for noncondensible gases. The thermal dispersion sensor location on the vertical pipe section has have been selected to permit additional gas accumulation before natural circulation flow is significantly affected, so that sufficient time may be provided to permit containment entry for venting the gas.

Control room indication of the water level in this high point collection point is available to verify that noncondensible gases have not collected to the extent that the water level is depressed below the allowable level. The 24 hour Frequency is based on the expected low rate of gas accumulation and the availability of control room indication.

SR 3.5.4.4

Verification is required to confirm that power is removed from the motor operated inlet isolation valve every 31 days. Removal of power from this valve reduces the likelihood that the valve will be inadvertently closed as a result of a fire. The 31 day Frequency is acceptable considering the frequent surveillance of valve position and that the valve has a confirmatory open signal.

~~BASES~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

SR 3.5.4.5

Verification that both air operated outlet valves and both IRWST gutter isolation valves are OPERABLE ensures that the PRHR HX will actuate on command, with return flow from the gutter to the IRWST, since all other components of the system are normally in the OPERABLE configuration. Since these valves are redundant, if one valve is inoperable, the system can function at 100% capacity. Verification requires the actual operation of each valve through a full cycle to demonstrate OPERABILITY. The Surveillance Frequency is provided in the Inservice Testing Program.

SR 3.5.4.6

This SR requires performance of a system performance test of the PRHR HX to verify system heat transfer capabilities. The system performance test demonstrates that the PRHR HX heat transfer assumed in accident analyses is maintained. Although the likelihood that system performance would degrade with time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

SR 3.5.4.7

This surveillance requires visual inspection of the IRWST gutters to verify that the return flow to the IRWST will not be restricted by debris. A Frequency of 24 months is adequate, since there are no known sources of debris with which the gutters could become restricted.

REFERENCES

1. Section 6.3, “Passive Core Cooling System.”
2. Chapter 15, “Safety Analysis.”
3. AP1000 PRA.

B 3.5 PASSIVE CORE COOLING SYSTEM (PXS)

B 3.5.6 In-containment Refueling Water Storage Tank (IRWST) – Operating

BASES

BACKGROUND	The IRWST is a large stainless steel lined tank filled with borated water (Ref. 1). It is located below the operating deck in containment. The tank is designed to meet seismic Category 1 requirements. The floor of the IRWST is elevated above the reactor coolant loop so that borated water can drain by gravity into the Reactor Coolant System (RCS). The IRWST is maintained at ambient containment pressure. The IRWST has two injection flow paths. The injection paths are connected to the reactor vessel through two direct vessel injection lines which are also used by the accumulators and the core makeup tanks. Each path includes an injection flow path and a containment recirculation flow path. Each injection path includes a normally open motor operated isolation valve and two parallel actuation lines each isolated by one check valve and one squib valve in series. The IRWST has two containment recirculation flow paths. Each containment recirculation path contains two parallel actuation flow paths, one path is isolated by a normally open motor operated valve in series with a squib valve and one path is isolated by a check valve in series with a squib valve. During refueling operations, the IRWST is used to flood the refueling cavity. During abnormal events, the IRWST serves as a heat sink for the passive residual heat removal heat exchangers, as a heat sink for the depressurization spargers, and as a source of low head (ambient containment pressure) safety injection during loss of coolant accidents (LOCAs) and loss of decay heat removal in MODE 5 (loops not filled). The IRWST can be cooled by the Normal Residual Heat Removal System (RNS) system. The IRWST size and injection capability is selected to provide adequate core cooling for the limiting Design Basis Accidents (DBAs) (Ref. 2).
APPLICABLE SAFETY ANALYSES	During non-LOCA events, the IRWST serves as the initial heat sink for the PRHR Heat Exchanger (PRHR HX) if used during reactor cooldown to MODE 4. If RNS is available, it will be actuated in MODE 4 and used to continue the plant cooldown to MODE 5. If RNS is not available, cooldown can continue on PRHR. Continued PRHR HX operation will result in the water in the IRWST heating up to saturation conditions and

BASES

APPLICABLE SAFETY ANALYSES (continued)

boiling. The steam generated in the IRWST enters the containment through the IRWST vents. Most of the steam generated in the IRWST condenses on the inside of the containment vessel and drains back to the IRWST.

For events which involve a loss of primary coolant inventory, such as a large break LOCA, or other events involving automatic depressurization, the IRWST provides low pressure safety injection (Ref. 2). The IRWST drain down time is dependent on several factors, including break size, location, and the return of steam condensate from the passive containment cooling system. During drain down, when the water in the IRWST reaches the Low 5 level, the containment sump will be sufficiently flooded, to initiate containment sump recirculation. This permits continued cooling of the core by recirculation of the spilled water in the containment sumps via the sump recirculation flow paths. In this situation, core cooling can continue indefinitely.

When the plant is in midloop operation, the pressurizer Automatic Depressurization System (ADS) valves are open, and the RNS is used to cool the RCS. The RNS is not a safety related system, so its failure must be considered. In this situation, with the RCS drained and the pressure boundary open, the PRHR HX cannot be used. In such a case, core cooling is provided by gravity injection from the IRWST, venting the RCS through the ADS. Injection from the IRWST provides core cooling until the tank empties and gravity recirculation from the containment starts. With the containment closed, the recirculation can continue indefinitely, with the decay heat generated steam condensing on the containment vessel and draining back into the IRWST.

The IRWST satisfies Criteria 2 and 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The IRWST requirements ensure that an adequate supply of borated water is available to act as a heat sink for PRHR and to supply the required volume of borated water as safety injection for core cooling and reactivity control.

To be considered OPERABLE, the IRWST must meet the water volume, boron concentration, and temperature limits defined in the surveillance requirements. The motor operated injection isolation valves must be open with power removed, and the motor operated sump recirculation isolation valves must be open. OPERABILITY is not expected to be challenged due to small gas accumulations in the high point and rapid gas accumulations are not expected during plant operation. However, a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before

BASES

the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of passive safety injection flow. Therefore, noncondensible gas accumulation in the injection line high point that causes the water level to drop below the sensor will require operator action to investigate the cause of the gas accumulation and to vent the associated high point(s). ~~[CLONED WORDS HERE]~~

BASES

APPLICABILITY

In MODES 1, 2, 3, and 4, a safety related function of the IRWST is to provide a heat sink for PRHR. In MODES 1, 2, 3, and 4, a second safety related function is the low head safety injection of borated water following a LOCA for core cooling and reactivity control. Both of these functions must be available to meet the initial assumptions of the safety analyses. These assumptions require the specified boron concentration, the minimum water volume, and the maximum water temperature.

The requirements for the IRWST in MODES 5 and 6 are specified in LCO 3.5.7, In-containment Refueling Water Storage Tank (IRWST) – Shutdown, MODE 5 and LCO 3.5.8, In-containment Refueling Water Storage Tank (IRWST) – Shutdown, MODE 6.

ACTIONS

A.1

If an IRWST injection line actuation valve flow path or a containment recirculation line actuation valve flow path is inoperable, then the valve actuation flow path must be restored to OPERABLE status within 72 hours. In this condition, three other IRWST injection or containment sump recirculation flow paths are available and can provide 100% of the required flow assuming a break in the direct vessel injection line associated with the other injection train, but with no single failure of the actuation valve flow path in the same injection or sump recirculation flow path. The 72 hour Completion Time is consistent with times normally applied to degraded two train ECCS systems which can provide 100% of the required flow without a single failure.

B.1

Excessive amounts of noncondensible gases in one of the high point vents in one IRWST injection line may interfere with the passive injection of IRWST water into the reactor vessel from the associated parallel flow path in the affected injection line. Analyses have shown that with enough noncondensible gas accumulation, IRWST injection through the affected flow path could be delayed. However, the presence of some noncondensible gases does not mean that the IRWST injection capability is immediately inoperable, but that gases are collecting and should be vented. The venting of these gases requires containment entry to manually operate the vent valves. In this Condition, the parallel flow path in the affected injection line is capable of providing 100% of the required injection flow and the other IRWST injection line remains fully OPERABLE. These IRWST flow paths can provide the credited flow in the event of a DVI line break downstream of the fully OPERABLE injection line, provided a single failure of the remaining parallel isolation

ACTIONS (continued)

valve does not occur. A Completion Time of 72 hours is acceptable for two train ECCS systems, which are capable of performing their safety function without a single failure.

C.1

Excessive amounts of noncondensible gases in both of the high point vents in one IRWST injection line may affect the passive injection of IRWST water into the reactor vessel from the affected injection line. Sufficient gas accumulation could potentially challenge IRWST injection capability. However, the presence of some noncondensible gases does not immediately render the IRWST injection capability inoperable, but that gases are collecting and should be vented.

The level sensor location has been selected to permit additional gas accumulation before injection flow is significantly affected, so that adequate time may be provided to permit containment entry for venting the gas. Anticipated noncondensible gas accumulation in this piping segment is expected to be relatively slow.

In this Condition the remaining OPERABLE IRWST injection line is capable of performing the safety function for all plant events except for one, a direct vessel injection (DVI) line break. For this one event~~In this case~~, the line with gas accumulation in both high point vents will be capable of performing the safety function with a small amount of voiding that is not expected to significantly challenge the required injection flow.

The venting of these gases requires containment entry to manually operate the vent valves. Considering the relatively slow rate of gas accumulation, venting within 8 hours should normally prevent accumulation of amounts of noncondensible gases that could significantly challenge IRWST injection capability. A Completion Time of 8 hours is permitted for venting noncondensible gases and is acceptable, since the injection capability of the other IRWST injection line is sufficient to ensure event mitigation, or, in the event of a break in the DVI line connected to the OPERABLE injection line, the injection line with gas accumulation will be capable of providing the required injection flow with some voiding. If only one of the affected high point vents is vented, then Condition B will apply to the remaining high point vent with noncondensible gas accumulation.

D.1

If the IRWST water volume, boron concentration, or temperature are not within limits, the core cooling capability from injection or PRHR HX heat transfer and the reactivity benefit of injection assumed in safety analyses may not be available. Due to the large volume of the IRWST, online monitoring of volume and temperature, and frequent surveillances, the deviation of these parameters is expected to be minor. The allowable deviation of the water volume is limited to 3%. This limit prevents a significant change in boron concentration and is consistent with the long-term cooling analysis performed to justify PRA success criteria (Ref. 3), which assumed multiple failures with as many as 3 CMTs/Accum not injecting. This analysis shows that there is significant margin with respect to the water supplies that support containment recirculation operation. The 8-hour Completion Time is acceptable, considering that the IRWST will be fully capable of performing its assumed safety function in response to DBAs with slight deviations in these parameters.

ACTIONS (continued)

E.1

If the motor operated IRWST isolation valves are not fully open or valve power is not removed, injection flow from the IRWST may be less than assumed in the safety analysis. In this situation, the valves must be restored to fully open with valve power removed in 1 hour. This Completion Time is acceptable based on risk considerations.

F.1 and F.2

If the IRWST cannot be returned to OPERABLE status within the associated Completion Times or the LCO is not met for reasons other than Conditions A, B, C, D, or E, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.6.1

The IRWST borated water temperature must be verified every 24 hours to ensure that the temperature is within the limit assumed in the accident analysis. This Frequency is sufficient to identify a temperature change that would approach the limit and has been shown to be acceptable through operating experience.

SR 3.5.6.2

Verification every 24 hours that the IRWST borated water volume is above the required minimum level will ensure that a sufficient initial supply is available for safety injection and floodup volume for recirculation and as the heat sink for PRHR. During shutdown with the refueling cavity flooded with water from the IRWST, this Surveillance requires that the combined volume of borated water in the IRWST and refueling cavity meet the specified limit. Since the IRWST volume is normally stable, and is monitored by redundant main control indication and alarm, a 24 hour Frequency is appropriate.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.6.3

Verification that excessive amounts of noncondensible gases have not caused the water level to drop below the sensor in the four IRWST injection line squib valve lines is required every 24 hours. The 8x8x8 inch tee after the outlet of the IRWST injection line squib valve lines has a vertical section of pipe which serves as a high point collection point for noncondensible gases. The thermal dispersion sensor locations on the vertical pipe sections have been selected to permit additional gas accumulation prior to significantly affecting the injection flow, so that adequate time may be provided to permit containment entry for venting the gas.

Control room indication of the water level in this high point collection point is available to verify that noncondensible gases have not collected to the extent that the water level is depressed below the allowable level. The 24 hour Frequency is based on the expected low rate of gas accumulation and the availability of control room indication.

SR 3.5.6.4

Verification every 31 days that the boron concentration of the IRWST is greater than the required limit, ensures that the reactor will remain subcritical following a LOCA. Since the IRWST volume is large and normally stable, the 31 day Frequency is acceptable, considering additional verifications are required within 6 hours after each solution volume increase of 15,000 gal. In addition, the relatively frequent surveillance of the IRWST water volume provides assurance that the

BASES

IRWST boron concentration is not changed.

SR 3.5.6.5

This surveillance requires verification that each motor operated isolation valve is fully open. This surveillance may be performed with available remote position indication instrumentation. The 12 hour Frequency is acceptable, considering the redundant remote indication and alarms and that power is removed from the valve operator.

SR 3.5.6.6

Verification is required to confirm that power is removed from each motor operated IRWST isolation valve each 31 days. Removal of power from these valves reduces the likelihood that the valves will be inadvertently closed. The 31 day Frequency is acceptable considering frequent surveillance of valve position and that the valve has a confirmatory open signal.

SR 3.5.6.7

Each motor operated containment recirculation isolation valve must be verified to be fully open. This valve is required to be open to improve containment recirculation reliability. The 31 day Frequency is acceptable considering the valve has a confirmatory open signal. This surveillance may be performed with available remote position indication instrumentation.

~~BASES~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

SR 3.5.6.8

This Surveillance requires verification that each IRWST injection and each containment recirculation squib valve is OPERABLE in accordance with the Inservice Testing Program. The Surveillance Frequency for verifying valve OPERABILITY references the Inservice Testing Program.

The squib valves will be tested in accordance with the ASME OM Code. The applicable ASME OM Code squib valve requirements are specified in paragraph 4.6, Inservice Tests for Category D Explosively Actuated Valves. The requirements include actuation of a sample of the installed valves each 2 years and periodic replacement of charges.

SR 3.5.6.9

Visual inspection is required each 24 months to verify that the IRWST

BASES

screens and the containment recirculation screens are not restricted by debris. A Frequency of 24 months is adequate, since there are no known sources of debris with which the gutters could become restricted.

SR 3.5.6.10

This SR requires performance of a system inspection and performance test of the IRWST injection and recirculation flow paths to verify system flow capabilities. The system inspection and performance test demonstrates that the IRWST injection and recirculation capabilities assumed in accident analyses is maintained. Although the likelihood that system performance would degrade with time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

REFERENCES

1. Section 6.3, "Passive Core Cooling."
2. Section 15.6, "Decrease in Reactor Coolant Inventory."
3. AP1000 PRA.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-DCP-CN66-SRSB-03
Revision: 0

Question:

In its May 25, 2010 letter to address gas intrusion, Westinghouse proposed design changes included instrumentation level switches, LS 070 through LS 077, as shown in Sections H and J of Figure 6.3-2.

A. Identify the table where these switches are listed and classified.
B. Describe the calibration frequency of these switches.
C. Discuss whether the calibration frequency is controlled by Technical Specifications.
D. Discuss whether the new instrumentation and valve components are included in the ITAAC. If they are not included in ITAAC, provide a justification.

Westinghouse Response:

A. These sensors are not listed in the DCD Table 3.2-3 or Table 3.11-1 because they are non-safety-related instruments. Therefore, there are no tables that require identifying these types of instruments in the DCD. They are used to monitor the OPERABLE status of the associated injection line piping prior to the initiation of an event.

B. For single-point level switches mounted in fixed positions in the process piping, there is limited periodic calibration or functional checking required. The Licensee may establish a schedule for periodic functional verification, which may include readjustment of the output relay setpoint, if required.

C. The calibration frequency for these switches is not controlled by Technical Specifications because they are not credited for accident detection, automatic actuation or post-accident monitoring.

D. These high-point level actuation switches, like those for the PRHR and CMT inlets, are intended to provide pre-event OPERABILITY confirmation and are not used for reactor trip, safeguards actuation, or post-accident monitoring functions (level indication). Therefore, these high-point level instruments do not require ITAACs. Following an event, if the RCS level decreases sufficiently as a result of the loss of RCS inventory, these level instruments may actuate, but no operator actions are dependent on the status of these level switches.

Background

For information regarding the operation of the level sensors see the discussion in the response to RAI-DCP-CN66-SRSB-02.

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-DCP-CN66-SRSB-04
Revision: 0

Question:

In its May 25, 2010 letter, Westinghouse proposed design changes included components identified in DCD tables and figures. However, some revision markups do not appear to be consistent between the tables and diagrams. Section H of Figure 6.3-2 identifies valves V106A and V107A enclosed in a revision “cloud” but the same valves in DCD Tier 2 Table 3.2-3 are not enclosed in a revision “cloud.” Discuss this apparent discrepancy. In addition, explain why some changes are annotated by red text while others appear with a revision “cloud.”

Westinghouse Response:

Changes to DCD figures are indicated by enclosing the changed section in a revision “cloud.”

Changes to DCD tables and text are indicated differently. The changed or added sections are supposed to be displayed in red text with a change bar along the left side of the page.

The DCD tables and text markups should not have included any “cloud” marking. These clouds, if any, will not be included in the next update to the Westinghouse application to amend the AP1000 Design Certification (DCD Revision 18).

The inconsistency between Figure 6.3-2 and Table 3.2-3 is addressed in the response to RAI-DCP-CN66-SRSB-01.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None