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Our ref: DCP/NRC1615

August 26, 2003

SUBJECT: Transmittal of Westinghouse Responses to Open Items Identified in the AP1000 Draft Safety Evaluation Report

This letter transmits revised Westinghouse responses to open items identified in the AP1000 Draft Safety Evaluation Report (DSER) that was issued on June 16, 2003. A list of the DSER Open Item responses that are transmitted with this letter is provided in Attachment 1. Attachment 2 provides the DSER Open Item responses.

Please contact me if you have questions regarding this transmittal.

Very truly yours,

J. W. Winters, Manager
Passive Plant Projects & Development
AP600 & AP1000 Projects

/Attachments

1. Table 1, "List of Westinghouse's Responses to DSER Open Items Transmitted in DCP/NRC1615"
2. Westinghouse Non-Proprietary Responses to US Nuclear Regulatory Commission DSER Open Items dated August 2003

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Attachment 1

"List of Westinghouse's Responses to DSER Open Items
as Transmitted in DCP/NRC1615"

Attachment 1

Table 1

"List of Westinghouse's Responses to DSER Open Items Transmitted in DCP/NRC1615"

14.2.1.a	14.2.1.n
14.2.1.b	14.2.1.o
14.2.1.c	14.2.1.p
14.2.1.d	14.2.1.q
14.2.1.e	14.2.1.r
14.2.1.f	14.2.1.s
14.2.1.g	14.2.1.t
14.2.1.h	14.2.1.u
14.2.1.i	14.2.1.v
14.2.1.j	14.2.1.w
14.2.1.k	14.2.1.x
14.2.1.l	14.2.1.y
14.2.1.m	14.2.1.z
	14.3.2-12 Rev. 1

Attachment 2

Westinghouse Non-Proprietary Responses to
AP1000 Draft Safety Evaluation Report (DSER) Open Items

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.a

Original RAI Number(s): None

Summary of Issue:

Ref design control document (DCD) Tier 2 Section 14.3 Table 14.3-2.

The three elevations which reference DCD Tier 2 Section 6.2 Table 6.2.2-2 (see page 14.3-20) are not consistent with that table. In addition, the values listed in DCD Tier 2 Section 6.2 Table 6.2.2-2 are not "Nominal" but minimum allowable based on DCD Tier 1 Section 2.2 inspections, tests, analyses, and acceptance criteria (ITAAC) 2.2.2 Table 2.2.2-3, item 7.b) i. The "as listed" values are, however, consistent with DCD Tier 2 Section 6.2 Table 6.2.2-1 and would be considered "Nominal" based on the ITAAC. Please address these inconsistencies.

Westinghouse Response:

The standpipe elevations as calculated and applied for the safety analysis were established as a maximum height with tolerance (e.g., 24.3 ft +0.0 ft, -0.4 ft). The values shown as nominal in Table 6.2.2-2 are correct. Tier 1 Table 2.2.2-3 and Tier 2 Tables 6.2.2-1 and 14.3-2 will be revised as shown in the attachments.

Note that the attached DCD markup incorporates changes from DSER Open Items 14.2-1a through 14.2-1e.

Design Control Document (DCD) Revision:

Revise as show in the attached pages from DCD Revision 6.

PRA Revision:

None

Table 2.2.2-3 (cont.)
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7.a) The PCS provides the delivery of water to the outside of the containment vessel.	i) Testing will be performed to measure the PCCWST delivery rate from two of the three parallel flow paths.	i) When tested two of the three flow paths delivers greater than or equal to: – 471.1 gpm at a PCCWST water level of 27.4 ft + 0.2, - 0.0 ft above the tank floor – 238.4 gpm when the PCCWST water level uncovers the first (i.e. tallest) standpipe. ~~at 24.3 ft ± 0.2 ft above the tank floor~~ – 184.0 gpm when the PCCWST water level ~~of~~ uncovers the second tallest standpipe. ~~at 20.5 ft ± 0.2 ft above the tank floor~~ – 151.4 gpm when the PCCWST water level uncovers the third tallest standpipe. ~~at 17.0 ft ± 0.2 ft above the tank floor~~
	ii) Testing and or analysis will be performed to demonstrate the PCWST inventory provides 72 hours of cooling.	ii) When tested and/or analyzed with all flow paths delivering and an initial water level at 27.4 + 0.2, - 0.00 ft, the water inventory provides greater than or equal to 72 hours of flow with a flow rate greater than or equal to 100.7 gpm.
	iii) Inspection will be performed to determine the PCCWST standpipes elevations.	iii) The elevations of the standpipes above the tank floor are: – 16.8 ~~17.0~~ ft ± 0.2 ft – 20.3 ~~20.5~~ ft ± 0.2 ft – 24.1 ~~24.3~~ ft ± 0.2 ft

Table 6.2.2-1

PASSIVE CONTAINMENT COOLING SYSTEM PERFORMANCE PARAMETERS

~~PCCWST[1] initial inventory duration - Minimum .... 72 hours~~
PCCWST useable capacity for PCS (gal) - Minimum 756,700
PCCWST useable capacity for FPS[2] (gal) - Minimum 18,000
~~Injection flow rate (gpm) - Initial - Minimum Design .... 471.1~~
~~Injection flow rate (gpm) - Flow at 72 hours - Minimum .... 109.6~~
~~Injection~~ Flow duration from PCCWST (days) - Minimum 3
PCCWST minimum temperature (°F) 40
PCCWST maximum temperature (°F) 120

Upper annulus drain rate (per drain) - Minimum .... 525 gpm
PCCAWST[4] long-term makeup rate to containment - Minimum .... 100 gpm
PCCAWST long-term makeup to spent fuel pool – Minimum .... 35 gpm
PCCAWST long-term makeup duration - Minimum .... 4 days

PCCWST long-term makeup to spent fuel pool – Minimum .... 118 gpm

~~Containment Wetting Coverage~~

PCCWST Water Elevation (Note 3) (feet)	Nominal Design Flow (gpm)	Minimum ~~Analysis~~ Design Flow (gpm)	Safety Analysis Flow (gpm)	Wetted Coverage (Note 3) (% of circumference)
27.5~~27.4~~	494.6 (Note 5)	471.1	469.1	90
24.1~~24.3~~	247.1	238.4	226.6	90
20.3~~20.5~~	190.8	184.0	176.3	72.9
16.8~~17.0~~	157.1	151.4	144.2	59.6
4.0 (Note 6)	113.1	109.6		~~41.6~~
			100.7 @ 72 hours	41.6

Notes:

1. PCCWST = passive containment cooling water storage tank
2. FPS = fire protection system
3. PCCWST Water Elevation corresponds to the nominal standpipe elevations in feet above the tank floor (Reference Plant Elevation 298'-9?, see Figure 3.8.4-2). Wetted coverage is measured as the linear percentage of the containment shell circumference wetted measured at the upper spring line for the ~~minimum~~ safety analysis flow rate conditions.
4. PCCAWST = passive containment cooling ancillary water storage tank
5. The initial nominal design flow is based on the nominal PCCWST water elevation.
6. This elevation is the calculated water level at 72 hours after initiation of PCS flow, based on the minimum ~~analysis~~ design flow rates.

Table 14.3-2 (Sheet 3 of 17)

DESIGN BASIS ACCIDENT ANALYSIS

Reference		Design Feature	Value
Table	5. 4-17	Pressurizer Safety Valves - Design Parameters:	
		- Number	2
		- Minimum required relieving capacity per valve (lbm/hr)	≥ 750,000
		- Set pressure (psig)	2485 ± 25
Table	6. 1-2	The exterior of the containment vessel (above plant elevation 135' 3?) and the interior of the containment vessel (above 7' above the operating deck) is coated with an inorganic zinc coating.	
Section	6. 1. 2. 1. 5	The nonsafety-related coatings used inside containment on walls, floors, ceilings, structural steel which is part of the building structure, and on the polar crane have a minimum dry film density (lb/ft^3).	≥ 100
Section	6. 2. 1. 1. 3	Internal containment structures, both metallic and concrete, act as passive internal heat sinks during a LOCA or a MSLB.	
Figure	6. 2. 2-1	The passive containment cooling system consists of a water storage tank, cooling water flow discharge path to the containment shell, a water distribution system for the containment shell, and a cooling air flow path.	
Figure	6. 2. 2-1	The minimum duration the PCS cooling water flow is provided from the PCCWST (hours)	≥ 72
Table	6. 2. 2-1	The water coverage of the containment shell exceeds the amount used in the safety analysis.	
Table	6. 2. 2-1	The minimum drain flow rate capacity of the upper annulus drain (gpm).	≥ 525
Table	6. 2. 2-1	The minimum makeup flow rate capability from an external source to the PCS water storage tank (gpm).	≥ 100
Table	6. 2. 2-1	The minimum makeup flow rate capability from the PCS water storage tank to the spent fuel pit (gpm).	≥ 118
Table	6. 2. 2-1	The minimum PCS water storage tank volume for makeup to the spent fuel pit (non-coincident with PCS operation) (gallons).	≥ 756,700
Table	6. 2. 2-1	The minimum long term makeup capability from the PCCAWST to the PCCWST (days).	≥ ~~3~~ 4
Table	6. 2. 2-1	The minimum long term makeup flow capability from the PCCAWST to the PCCWST (gpm).	≥ 100

Table 14.3-2 (Sheet 4 of 17)

DESIGN BASIS ACCIDENT ANALYSIS

Reference		Design Feature	Value
Table	6. 2. 2-1	The minimum long term makeup flow capability from the PCCAWST to the spent fuel pool (gpm).	> 35
Table	6. 2. 2-2	The first (i.e. tallest) ~~or top~~ standpipe's elevation above the tank floor (feet).	~~24.3~~ 24.1 ± 0.2
Table	6. 2. 2-2	The second tallest standpipe's elevation above the tank floor. (feet)	~~20.5~~ 20.3 ± 0.2
Table	6. 2. 2-2	The third tallest standpipe's elevation above the tank floor ~~lowest or bottom standpipe~~ (feet).	~~17.0~~ 16.8 ± 0.2
Table	6.2.2-1	The minimum passive containment cooling water flow rate at a PCCWST water level 4.0 ft. (±0.2 ft) above the tank floor. (This supports analysis that ensures that delivered flow at 72 hours will be greater than 100.7 gpm.) (gpm)	≥ 109.6
~~Figure~~ Table	6. 2. 2-1~~3~~	The minimum passive containment cooling water flow rate when the PCCWST water level uncovers the third tallest standpipe. ~~with water inventory at a height above the lowest standpipe of 17.0 ft.~~ (gpm)	≥ 151.4 ~~144.2~~
~~Figure~~ Table	6. 2. 2-1~~3~~	The minimum passive containment cooling water flow rate when the PCCWST water level uncovers the second tallest standpipe. ~~with water inventory at a height above the lowest standpipe of 20.5 ft.~~ (gpm)	> 184.0 ~~176.3~~
~~Figure~~ Table	6. 2. 2-1~~3~~	The minimum passive containment cooling water flow rate when the PCCWST water level uncovers the first (i.e. tallest) standpipe. ~~with water inventory at a height above the lowest standpipe of 24.3 ft.~~ (gpm)	> 238.4 ~~226.6~~
Table	6. 2. 2 - 1	The minimum passive containment cooling water flow rate with water inventory at a level of 27.4 ft +0.2, -0.0 ft above the tank floor (gpm)	≥ 471.1
Section	6. 3	The passive core cooling system provides core decay heat removal during design basis events.	
Section	6. 3	The passive core cooling system provides RCS makeup, boration, and safety injection during design basis events.	
Section	6.3	The passive core cooling system provides pH adjustment of water flooding the containment following design bases events.	
Section	6. 3. 1. 1	The passive core cooling system is designed to provide emergency core cooling during events involving increases and decreases in secondary side heat removal and decreases in reactor coolant system inventory.	

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.b

Original RAI Number(s): None

Summary of Issue:

Ref DCD Tier 2 Section 14.3 Table 14.3-2.

There is no DCD Tier 2 Section 6.2 Figure 6.2.2-3 (see page 14.3-20). The correct location for the flow rates is found in DCD Tier 2 Section 6.2 Table 6.2.2-1. The values as listed in DCD Tier 2 Section 14.3 Table 14.3-2 are not consistent with DCD Tier 2 Section 6.2 Table 6.6.2-1 or DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3 item 7.a) i. In addition, DCD Tier 2 Section 14.3 Table 14.3-2 should include an entry following the third flow rate to be consistent with DCD Tier 2 Section 6.2 Table 6.2.2-1 and DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3 item 7.a) i, similar to:

Reference	Design Feature	Value
Table 6.2.2-1	The minimum passive containment cooling water flow rate with water inventory at a minimum level of 24.7 ft (gpm)	≥ 471.1

Please address these inconsistencies.

Westinghouse Response:

The comment is correct; the appropriate reference for PCS flowrates is Table 6.2.2-1. The DCD has been revised to incorporate this correction.

The flowrates in Table 14.3-2 have been corrected and are now consistent within the DCD.

A new item has been added to Table 14.3-2, specifying the required minimum flowrate with the passive containment cooling water storage tank at initial water level (which is 27.5 feet nominal). This new item reads as follows:

Reference	**Design Feature**	**Value**
Table 6. 2. 2 - 1	The minimum passive containment cooling water flow rate with water inventory at a level of 27.4 ft +0.2, -0.0 ft above the tank floor (gpm)	≥ 471.1

Design Control Document (DCD) Revision:

As shown in the markups attached to the response to DSER Open Item 14.2-1a, which incorporate changes from DSER Open Items 14.2-1a through 14.2-1e.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.c

Original RAI Number(s): None

Summary of Issue:

Ref DCD Tier 2 Section 14.3 Table 14.3-2.

The long term makeup duration is not consistent with DCD Tier 2 Section 6.2 Table 6.2.2-1 or DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3 item 8.a). Please address these inconsistencies.

Westinghouse Response:

Table 14.3-2 has been corrected to show makeup from the PCCAWST for a minimum of four days.

Design Control Document (DCD) Revision:

As shown in the markups attached to the response to DSER Open Item 14.2-1a, which incorporate changes from DSER Open Items 14.2-1a through 14.2-1e.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.d

Original RAI Number(s): None

Summary of Issue:

Ref DCD Tier 2 Section 14.3 Table 14.3-2.

The long-term makeup to the spent fuel pool (35 gpm) is not addressed in the Initial Test Program to confirm the value in DCD Tier 2 Section 6.2 Table 6.2.2-1 and DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3 item 8.b). Please address this inconsistency, for example following the PCCAWST to PCCWST [passive containment cooling water storage tank] flow rate:

Reference		Design Feature	Value
Table	6.2.2-1	The minimum long term makeup flow capacity from the PCCAWST to the spent fuel pool (gpm)	≥ 35

Westinghouse Response:

The requirement for long term makeup from the PCCAWST to the spent fuel pool has been added as shown above.

Design Control Document (DCD) Revision:

As shown in the markups attached to the response to DSER Open Item 14.2-1a, which incorporate changes from DSER Open Items 14.2-1a through 14.2-1e.

PRA Revision:

None

DSER Open Item Number: 14.2-1.e

Original RAI Number(s): None

Summary of Issue:

Ref DCD Tier 2 Section 14.3 Table 14.3-2.
Ref DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3, Item 7.a) ii.

DCD Tier 2 Section 6.2 Table 6.2.2-1 indicates the minimum flow at 72 hours is 109.6 gpm. DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3, Item 7.a) ii allows for a minimum value of 100.7 gpm. In addition, DCD Tier 2 Section 14.3 Table 14.3-2 should include an entry before the first flow rate to be consistent with DCD Tier 2 Section 6.2 Table 6.2.2-1 and DCD Tier 1 Section 2.2 ITAAC 2.2.2 Table 2.2.2-3 item 7.a) ii, similar to,:

Reference	Design Feature	Value
Table 6.2.2-1	The minimum passive containment cooling water flow rate at 72 hours (gpm)	≥ 109.6

Please address these inconsistencies.

Westinghouse Response:

The minimum PCS flow rate at 72 hours used in the safety analyses is 100.7 gpm. This is consistent with DCD Tier 1 ITAAC Table 2.2.2-3. The flow rate of 109.6 gpm is the minimum calculated design flow at 72 hours. DCD Table 6.2.2-1 will be revised to make this difference clear.

The PCS flow rate at 72 hours will depend upon the tank level, which in turn depends upon how quickly the tank has drained through the several stages, which depends upon the as-built system resistances. The initial test values that have been specified demonstrate system performance and allow resistance to be calculated through all flow paths:

- Flow through all three standpipes plus the tank outlet;
- Flow through the lower two standpipes plus the tank outlet;
- Flow through the lowest standpipe plus the tank outlet; and
- Flow through the tank outlet only.

Thus the system performance can be accurately modeled during initial testing. ITAAC acceptance criteria 7.a) ii) allows 72 hour PCS performance to be established by either testing or analysis.

If PCS system resistances are on the high end of the tolerance band, flows will be minimized. In this case there will be four feet of water remaining at 72 hours, and with that water level (and relatively high system resistance) the flow is calculated to be 109.6 gpm, as shown in Table 6.2.2-1. If PCS resistances are on the low end of the tolerance band, the tank will have less water remaining at 72 hours. Calculation with minimum system resistance shows the tank empties at 73 hours.

Since it is expected that some minor flow instability will occur as the PCS tank empties, specification of a test to demonstrate a "tank empty" flow rate is undesirable. Therefore, a verification point with four feet of water in the tank has been added to the PCS preoperational tests (Table 14.3-2). This test point will support analysis to demonstrate that delivered flow will be at least at the ITAAC requirement of a minimum of 100.7 gpm delivered at 72 hours.

Addition to Table 14.3-2:

Reference		Design Feature	Value
Table	6.2.2-1	The minimum passive containment cooling water flow rate at a PCCWST water level 4.0 ft. (±0.2 ft) above the tank floor. (This supports analysis that ensures that delivered flow at 72 hours will be greater than 100.7 gpm.) (gpm)	≥ 109.6

Design Control Document (DCD) Revision:

As shown in the markups attached to the response to DSER Open Item 14.2-1a, which incorporate changes from DSER Open Items 14.2-1a through 14.2-1e.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.f

Original RAI Number(s): None

Summary of Issue:

The staff requests that Westinghouse identify whether, during the initial test program, the combined license (COL) applicant will monitor (e.g., acoustic monitoring) the primary and secondary sides of the steam generator for indications of loose parts or anomalous internals vibration that can lead to tube degradation. If this type of monitoring will be performed, Westinghouse should make appropriate additions to the DCD. If this type of monitoring will not be performed, Westinghouse should identify the reasons such monitoring is not believed necessary.

Westinghouse Response:

A digital metal impact monitoring system, described in DCD 4.4.6.4, is included in the AP1000 Special Monitoring System (SMS). This system monitors the reactor coolant system for metallic loose parts. This system is installed prior to preoperational testing and is tested and calibrated during preoperational testing as described in DCD subsection 14.2.9.4.16. DCD 14.2.9.1.2 will be revised as shown below to clarify that the special monitoring system will be operational during the steam generator testing.

Design Control Document (DCD) Revision:

14.2.9.1.2 Steam Generator System Testing

Prerequisites

The construction tests of the as-installed system have been completed. The reactor coolant system as well as other systems used in power generation are functional since portions of the steam generator system testing is performed during the plant hot functional tests. Prerequisite testing of required interfacing systems are completed to the extent sufficient to support the specified testing and the appropriate system configuration. **Construction and installation testing of the special monitoring system has been completed to the extent necessary to support preoperational testing. Required electrical power supplies are energized and operational.**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.g

Original RAI Number(s): None

Summary of Issue:

For the PMS testing, equipment or components which can not be actuated without damage or upsetting the plant are isolated using the test switches provided by the PMS to block device actuation. However, for the Plant Control System testing (14.2.9.2.12) and the Diverse Actuation System testing (14.2.9.2.14), there is no mention of the "test switches" being provided to block the unwanted device actuation. Please clarify the testing design provisions of the Plant Control System and the Diverse Actuation System.

Westinghouse Response:

Westinghouse will revise DCD sections 14.2.9.2.12 and 14.2.9.2.14 as shown below to clarify that test switches, or racking-out circuit breakers, will be utilized where necessary to block device actuation/operation.

Design Control Document (DCD) Revision:

14.2.9.2.12 Plant Control System Testing

Purpose

The purpose of the plant control system testing is to verify that the as-installed components perform the following nonsafety-related defense-in-depth functions, described in Section 7.1:

- Provide control and coordination of the plant during startup, ascent to power, power operation and shutdown conditions by integrating the automatic and manual control of the reactor, reactor coolant and reactor support processes required for normal and off-normal conditions. This includes rod control, pressurizer pressure and level control, steam generator water level control, steam dump (turbine bypass) control and rapid power reduction.
- Provide control of other defense-in-depth systems and components.

Prerequisites

Construction and installation testing of the plant control system has been completed. Related system interfaces are available or simulated as necessary to support the specified test configurations. Component testing and instrument calibrations have been completed. The reactor vessel integrated head package is in place, all control rod drive mechanism cables are connected and the integrated head and control rod drive mechanism cooling system is operational. Programming has been completed and the initial software diagnostics tests have been completed. Required electrical power supplies and control circuits are energized and operational. Required plant control system field wiring is electrically isolated to prevent operation of components controlled by the plant control system. **Equipment or components which can not be operated without damage or upsetting the plant are isolated, either by using test switches provided by the Plant Control System or by racking out power circuit breakers, to block device operation. Continuity of wiring up to the equipment is verified.**

14.2.9.2.14 Diverse Actuation System Testing

Purpose

The purpose of the diverse actuation system preoperational testing is to verify that the as-installed components properly perform the following nonsafety-related defense-in-depth functions, described in Section 7.7:

- Provide diverse (from the safety-related protection and safety monitoring system) automatic actuation of the following:
  - Reactor/turbine trip
  - Passive residual heat removal heat exchanger
  - Core makeup tanks/reactor coolant pump trip
  - Passive containment cooling
  - Isolation of selected containment penetrations
- Provide a diverse, alternate means for manual actuation of reactor trip and engineered safety features functions
- Provide a diverse system for monitoring selected plant parameters used to provide guidance for manual operation and confirmation of reactor trip and selected engineered safety features actuation

Prerequisites

Construction and installation testing of the diverse actuation system has been completed to the extent necessary to support preoperational testing. Related system interfaces are available or simulated as necessary to support the specified test configurations. Component testing and instrument calibrations have been completed. Programming has been completed and initial system diagnostics tests have been determined acceptable. Required electrical power supplies and control circuits are energized and operational. Required field wiring is electrically isolated to prevent operation of components controlled by the diverse actuation system. Exceptions are specifically identified in the preoperational test procedures if plant systems or components are to be operated during testing and these systems or components are to be properly aligned and have proper support systems operating prior to actuation of the particular system or component. **Equipment or components which can not be actuated without damage or upsetting the plant are isolated using the test switches provided by the Diverse Actuation System to block device actuation. Continuity of wiring up to the actuation equipment is verified.**

PRA Revision:

None

DSER Open Item Number: 14.2-1.h

Original RAI Number(s): None

Summary of Issue:

For Plant Communication System testing (14.2.9.4.13) acceptance criteria verification should also include "maximum potential noise levels" to be consistent with DCD 9.5.2.

Westinghouse Response:

This issue was addressed in response to RAI 420.048, item c. DCD 14.2.9.4.13 will be revised as shown below to clarify that Plant Communication System testing will include maximum noise levels.

Design Control Document (DCD) Revision:

As stated in response to RAI 420.048, DCD Section 14.2.9.4.13 will be revised as shown:

14.2.9.4.13 Plant Communications System Testing

Purpose

The purpose of the plant communications system testing is to verify that the as-installed components properly perform the functions of verifying the proper operation and adequacy of the plant communication systems used during normal and abnormal operations, as described in Section 9.5.

Prerequisites

The construction testing of the communication system has been completed. Required support systems, electrical power supplies and control circuits are operational.

General Test Method and Acceptance Criteria

Plant communications system performance is observed and recorded during a series of individual component and integrated system testing. The inplant communications system includes the following subsystems:

- Wireless telephone system
- Telephone/page system
- Private Automatic Branch Exchange (PABX) System

- Sound Powered Phone System
- Emergency Response Facility Communication System
- Security Communication System

The following testing verifies that the system functions as described in Section 9.5 and appropriate design specifications:

a) Transmitters and receivers are verified to operate without excessive interference.

b) Proper operation of controls, switches, and interfaces is verified.

c) Proper operation of the public address, including the plant emergency alarms, is verified.

d) The proper operation of equipment expected to function under abnormal conditions such as a loss of electrical power, shutdown from outside the control room, or execution of the plant emergency plan is verified. **This functional testing will be performed under conditions that simulate the maximum plant noise levels being generated during the various operating conditions, including fire and accident conditions, to demonstrate system capabilities.**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.i

Original RAI Number(s): None

Summary of Issue:

In the request for additional information (RAI) 410.021, the NRC staff requested a summary of ventilation flows and corresponding ambient pressure data similar to AP600 design for the radiologically controlled area ventilation system (VAS), non-radioactive ventilation system (VBS), health physics and hot machine shop HVAC system (VHS), and radwaste building HVAC system (VRS). Westinghouse provided a response to RAI 410.021 (10/30/2002) as follows:

System	Nominal Outside Supply Airflow (cfm)	Nominal Exhaust Airflow (cfm)	Ambient Pressure
Fuel Handling Area - VAS	17,300	19,000	Negative
Auxiliary/Annex Buildings –VAS	33,000	36,000	Negative
MCR/TSC – VBS	1,350	650	Positive
Health Physics and Hot Machine Shop - VHS	12,750	14,000	Negative
Radwaste Building – VRS	16,200	18,000	Negative

However, Tier 2 Sections 9.4.3 (VAS), 9.4.8 (VRS), and 9.4.11 (VHS) and ITAAC Tables 2.7.5-2 provide the system flow information as follows:

- Tier 2 Section 9.4.3 states that the fuel handling area ventilation subsystem of VAS consists of two 50% capacity supply air handling units of about 9,500 scfm each, and two 50% capacity exhaust air fans sized to allow the system to maintain a negative pressure.

- Tier 2 Section 9.4.8 states that the VRS supply air system consists of two 50% capacity supply air handling units of about 9,000 scfm each, and exhaust air system consists of two 50% capacity fans sized to allow the system to maintain a negative pressure.

- Tier 2 Section 9.4.11 states that the VHS supply air system consists of two 100% capacity supply air handling units of about 14,000 scfm each, and exhaust air system consists of two 100% capacity fans sized to allow the system to maintain a negative pressure.

Also, ITAAC Tables 2.7.5-2 provide the testing and Acceptance Criteria information on VAS as follows:

- Tables 2.7.5-2, Item 2 states that the VAS maintains each building area at a slightly negative pressure relative to the atmosphere or adjacent clean plant areas.

  i. The Testing will be performed to confirm the ventilation flow rate through the auxiliary building fuel handling area when operating all VAS supply AHUs [air handling units] and all VAS exhaust fans to meet Acceptance Criteria. The Acceptance Criteria states that a report exists and concludes that the calculated exhaust flow rate based on the measured flow rates is greater than or equal to 15,300 cfm.

  ii. The testing will be performed to confirm the auxiliary building radiologically controlled area ventilation flow rate when operating all VAS supply AHUs and all VAS exhaust fans to meet Acceptance Criteria. The Acceptance Criteria states that a report exists and concludes that the calculated exhaust flow rate based on the measured flow rates is greater than or equal to 22,500 cfm.

Clarify the VAS flow discrepancies in the RAI 410.021, and Tier 1 and Tier 2 materials, as discussed above, and revise as necessary in order to maintain a negative pressure with respect to the adjacent areas inside the fuel handling area and radiologically controlled area served by VAS, health physics and hot machine shop served by VHS, and radwaste building served by VRS.

Westinghouse Response:

The minimum measured ventilation flow rate for the auxiliary building fuel handing area required to support analysis assumptions is 15,300 cfm (Tier 1 Table 2.7.5-2, Item 2.ii)). This will be provided by an air handling subsystem of VAS that includes two 50% air handling units of about 9,500 cfm each (total 19,000 cfm) (Tier 2 Section 9.4.3.2.1.2).

The minimum measured ventilation flow rate for the radiologically controlled area required to support analysis assumptions is 22,500 cfm (Tier 1 Table 2.7.5-2, Item 2.iii)). This will be provided by an air handling subsystem of VAS that includes two 50% air handling units of about 18, 000 cfm each (total 36,000 cfm) (Tier 2 Section 9.4.23.2.1.1).

As with all multi-subsystem HVAC systems, those in AP1000 will be tested and balanced during the initial test program. Tier 1, Table 2.7.5-2, Item 2.i) requires that VAS maintain its areas at a slightly negative pressure relative to the atmosphere or adjacent clean plant areas. VAS will be adjusted to meet minimum flow rates and maintain negative pressures. Tier 2 Sections 14.2.9.4.19 and 14.2.9.4.20 state that similar testing and balancing to ensure negative pressures will be performed for VHS and VRS, respectively.

Negative pressures are created by providing more exhaust flow than supply flow. As discussed above, there is no discrepancy among the Tier 1, Tier 2 and RAI response values. The Tier 1 values represent minimum rather than nominal flows and should not match either the Tier 2 or the RAI response values.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

DSER Open Item Number: 14.2-1.j

Original RAI Number(s): None

Summary of Issue:

14.2.9.1.1 Reactor Coolant System Testing

The list in the "Purpose" section of reactor coolant system (RCS) safety-related and defense-in-depth functions to be verified during the RCS preoperational test is not complete. For example, it does not include Integrated System Test stated in Regulatory Guide 1.68, Appendix A, Item 1.a, Reactor Coolant System. It also does not include many safety functions of the RCS described in DCD Tier 1, Section 2.1.2, Item 8 of Design Description of the Reactor Coolant system, such as pressurizer safety valves for overpressure protection; the reactor coolant pumps rotating inertia providing RCS flow coastdown on loss of power; the RCP flywheel assembly being able to withstand a design overspeed condition; the automatic depressurization system providing automatic depressurization during design basis events; and the RCS providing emergency letdown during design basis event.

In addition, there is a mismatch between the RCS functions described in the "Purpose" section and the scope of tests described in the "General Test Method and Acceptance Criteria" section for verification of these functions. Many RCS functions to be verified are not covered by the RCS preoperational tests abstract.

Please provide a complete list of important RCS functions to be verified during the preoperational tests, and a corresponding test abstract, including acceptance criteria, for verification of each of these functions.

Westinghouse Response:

The complete set of important high-level RCS functions to be verified during the preoperational testing program are described in 14.2.9.1.1 under the Purpose heading. The individual functions identified in this open item support the higher level functions identified in 14.2.9.1.1 and are identified in various sections of Chapter 14. The attached matrix provides a cross-reference of the functions identified in this open item to the test abstracts discussed in the AP1000 DCD. The individual test abstracts identified in the table below provide the acceptance criteria for each test.

Function Discussed In Open Item	RCS High Level-Function Listed in 14.2.9.1.1	Test Abstract
Integrated System Test	NA	14.2.9.1.1 Items m through r
Pressurizer safety valves for overpressure protection	Reactor Coolant Pressure Boundary function	14.2.9.1.1 Item c
Reactor coolant pump rotating inertia	Core cooling	14.2.10.1.18 (Pre-critical test)
RCP flywheel assembly being able to withstand design overspeed condition	Reactor Coolant Pressure Boundary function	NA – this test is not conducted as part of the pre-operational test program but is performed by the pump vendor prior to pump delivery to the site.
Automatic depressurization system testing	Core Cooling	14.2.9.1.3 Item b, d, p, q, s, t
Emergency letdown	Core cooling	14.2.9.1.1 Item i

DCD Revision

None

PRA Revision

None

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Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.k

Original RAI Number(s): None

Summary of Issue: 14.2.9.1.3 Passive Core Cooling System Testing

The "General Test Method and Acceptance Criteria" section described various testings to be performed to verify the passive core cooling system's emergency core decay heat removal function, emergency makeup and boration function, and safety injection function. However, it does not specify the acceptance criteria regarding the passive residual heat removal heat exchanger (PRHRHX) heat transfer capability, in-containment refueling water storage tank (IRWST) heatup characteristics, flow resistances of the core makeup tank (CMT) pressure balance and injection lines, accumulator injection line, IRWST injection line, sump recirculation line, and the flow paths of various stages of automatic depressurization system (ADS).

Provide the acceptance criteria, either the values or reference, for the tests of the above listed systems and components.

Westinghouse Response:

For the PRHR HX testing, DCD section 14.2.9.1.3 will be revised to include the following:

Item f - The PRHR HX acceptance criteria for this natural circulation test will be added to this item. Note that 14.2.9.1.3 item f, will be modified to state that the final RCS temperature is ≤ 420°F, instead of 400°F to make it consistent with the ITAAC's. Since this acceptance criteria provides a more direct source for the PRHR HX ITAAC, Table 14.3-2 will be revised to use this criteria.

Item g - A reference to DCD Table 3.9-17 will be added for the acceptance criteria for this forced circulation test. Note that 14.2.9.1.3 item g, will be modified to state that the RCS temperature should be cooled to a temperature of ≤ 250°F as is shown in DCD Table 3.9-17.

Item h – A statement will be added to this item saying that the acceptance criteria for the IRWST temperature distribution is that it must support a PRHR HX heat transfer rate that is sufficient to allow the AP1000 to meet the safe shutdown temperature / time criteria.

For the PXS line resistances, the resistances will be added to each item in DCD section 14.2.9.1.3 (items i, l, m, n, o, p, q). In addition the following corrections / clarifications will be made:

- Item n will be revised to delete the reference to adjusting an orifice, since the orifice has been removed from these lines.
- Items n and q will be revised to clarify that a test fixture piece may be used to simulate the squib valves in these lines, as is done in item o.
- Items l, m, n, and o will be revised to delete the word "empty" from the statement "through the ~~empty~~ direct vessel injection flow path".

Design Control Document (DCD) Revision:

DCD section 14.2.9.1.3 will be revised as follows:

The passive core cooling system emergency core decay heat removal function is verified by the following testing of the passive residual heat removal heat exchanger.

e) During hot functional testing of the reactor coolant system, the heat exchanger supply and return line piping water temperatures are recorded to verify that natural circulation flow initiates.

f) The heat transfer capability of the passive residual heat removal heat exchanger is verified by measuring natural circulation flow rate and the heat exchanger inlet and outlet temperatures while the reactor coolant system is cooled to ≤ 42~~0~~0°F. This testing is performed during hot functional testing with the reactor coolant system initial temperature ≥ 540°F and the reactor coolant pumps not running. **The acceptance criteria for the PRHR HX heat transfer under natural circulation conditions is that the heat transfer rate is ≥ 1.78 E+08 BTU/hr based on a 520°F hot leg temperature, 80°F IRWST temperature and the design number of tubes plugged. These plant conditions are selected to be close to the expected test conditions and are different than those listed in DCD Table 6.3-4. The PRHR HX heat transfer rate has been adjusted to account for these different conditions. The heat transfer rate measured in the test should be adjusted to account for differences in hot leg and IRWST temperatures and number of tubes plugged.**

g) The proper operation of the passive residual heat removal heat exchanger and its heat transfer capability with forced flow is verified by initiating and operating the heat exchanger with all four reactor coolant pumps running. This testing is performed during hot functional testing with the reactor coolant system at an elevated initial temperature ~~between~~ ≥ 350°F~~ and 400°F~~. The heat exchanger heat transfer is determined by measuring the heat exchanger flow rate and its inlet and outlet temperatures while the reactor coolant system is cooled ~~down~~to ≤ 250°F. **The acceptance criteria for the PRHR HX heat transfer under forced circulation conditions is listed in Table 3.9-17. The heat transfer rate measured in the test should be adjusted to account for differences in hot leg and IRWST temperatures and number of tubes plugged.**

h) The heatup characteristics of the in-containment refueling water storage tank water are verified by measuring the vertical water temperature gradient that occurs in the in containment refueling water storage tank water at the passive residual heat removal heat exchanger tube bundle and at several distances from the tube bundle, during testing in Item e), above. Note that this verification is required only for the first plant. **The acceptance criteria for the IRWST heatup characteristics is that they support meeting the RCS safe shutdown temperature criteria (refer to DCD section 19.E.4.10.2).**

The passive core cooling system emergency makeup and boration function is verified by the following testing of the core makeup tanks.

i) The resistance of the core makeup tank cold leg balance lines is determined by filling the core makeup tanks with flow from the cold legs. This testing is performed by filling the cold, depressurized reactor coolant system using a constant, measured discharge flow from the normal residual heat removal pumps. The reactor coolant system is maintained at a constant level above the top of the cold leg balance line(s). The normal residual heat removal system flow rate and the differential pressure across the cold leg balance lines are used to determine the resistance of the balance lines. **The acceptance criteria for the resistance of these lines is $\leq 7.21 \times 10^{-6}$ ft/gpm^2.**

j) During hot functional testing of the reactor coolant system, the core makeup tank cold leg balance line piping water temperature at various locations is recorded to verify that the water in this line is sufficiently heated to initiate recirculation flow through the CMTs.

k) [Proper operation of the core makeup tanks to perform their reactor water makeup and boration function is verified by initiating recirculation flow through the tanks during hot functional testing with the reactor coolant system at ≥ 530°F. This testing is initiated by simulating a safety signal which opens the tank discharge isolation valves, and stops reactor coolant pumps after the appropriate time delay. The proper tank recirculation flow after the pumps have coasted down is verified. Based on the cold leg temperature, CMT discharge temperature, and temporary CMT flow instrumentation, the net mass injection rate into the reactor is verified. Note that this verification is required only for the first three plants.]*

The passive core cooling system safety injection function is verified by the following testing of the core makeup tanks, accumulators, in-containment refueling water storage tank, containment sump, automatic depressurization, and their associated piping and valves

l) Proper flow resistance of each of the core makeup tank injection lines is verified by gravity draining each tank filled with cold water through the ~~empty~~ direct vessel injection flow path, while measuring the CMT level (driving head) and discharge flow rate. Air enters the top of the draining tank from the reactor coolant system cold leg via the cold leg balance line. If necessary, the flow limiting orifice in the core makeup tank discharge line is to be resized, and the core makeup tank retested to obtain the required line resistance. **The acceptance criteria for the resistance of these lines is $\leq 2.25 \times 10^{-5}$ ft/gpm^2 and $\geq 1.81 \times 10^{-5}$ ft/gpm^2 with all valves open.**

m) The proper flow resistance of each of the accumulator injection lines is verified by performing a blowdown from a partially pressurized accumulator through the ~~empty~~ direct vessel injection flow path, while measuring the change in accumulator level and pressure. If necessary, the flow orifice in the accumulator discharge line is to be resized and the accumulator retested to obtain the required discharge line resistance. **The acceptance criteria for the resistance of these lines is $\leq 1.83 \times 10^{-5}$ ft/gpm^2 and $\geq 1.47 \times 10^{-5}$ ft/gpm^2.**

n) The proper flow resistance of each of the in-containment refueling water storage tank injection lines is verified by gravity draining water from the tank through the ~~empty~~ direct vessel injection flow path, while measuring the water level (driving head) and discharge flow rate using temporary instrumentation. ~~If necessary, the flow orifice in the in-containment refueling water storage tank~~

~~injection line is resized and retested, until the required line resistance is achieved.~~ **A test fixture with prototypical resistance may be used to simulate the squib valves in the flow paths tested. The acceptance criteria for the resistance of these lines is ≤ 9.20 x 10^{-6} ft/gpm^2 and ≥ 5.53 x 10^{-6} ft/gpm^2 for line A and ≤ 1.03 x 10^{-5} ft/gpm^2 and ≥ 6.21 x 10^{-6} ft/gpm^2 for line B with all valves open.**

o) The flow resistance of each of the flow paths from the in-containment refueling water storage tank to each containment sump, and from each containment sump to the reactor is verified by a series of tests. These tests gravity drain water from the in-containment refueling water storage tank to the containment sump, and from the sump through the ~~empty~~ direct vessel injection flow path, while measuring the storage tank water level (driving head) and injection flow rate using temporary instrumentation. This testing is performed using temporary piping to prevent flooding of the containment. A test **fixture**~~spool piece~~ with prototypical resistance may be used to simulate the squib valves in the flow paths tested. **The acceptance criteria for the resistance of the lines between each containment sump and the reactor is ≤ 1.11 x 10^{-5} ft/gpm^2 for line A and ≤ 1.03 x 10^{-5} ft/gpm^2 for line B with all valves open. The acceptance criteria for the resistance of the lines between the IRWST and each containment sump is ≤ 4.07 x 10^{-6} ft/gpm^2.**

p) The resistance of each automatic depressurization stage 1, 2, and 3 flowpath and flowpath combination is verified by pumping cold water from the in-containment refueling water storage tank into the cold, depressurized, water-filled reactor coolant system; and back to the in-containment refueling water storage tank using the normal residual heat removal pump(s). The resistances are determined by measuring the residual heat removal pump flow rate and the pressure drop across the flow paths tested using temporary instrumentation. **The acceptance criteria for the resistance of these lines is ≤ 2.91 x 10^{-6} ft/gpm^2 for each ADS stage 1,2,3 group with all valves open.**

q) The resistance of each automatic depressurization stage 4 flowpath and their flowpath combinations is verified by pumping cold water from the in-containment refueling water storage tank into the cold, depressurized, water-filled reactor coolant system using the normal residual heat removal pump(s). The resistances are determined by measuring the residual heat removal pump flow rate and the pressure drop across the flow paths tested using temporary instrumentation. ~~The automatic depressurization stage 4 squib valves are not required to be included in this test.~~ **A test fixture with prototypical resistance may be used to simulate the squib valves in the flow paths tested. The acceptance criteria for the resistance of these lines is ≤ 1.70 x 10^{-7} ft/gpm^2 for ADS stage 4 on loop 1 and ≤ 1.57 x 10^{-7} ft/gpm^2 for ADS stage 4 on loop 2 with all valves open.**

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DCD Table 14.3-2 will be revised as follows:

Table 14.3-2 (Sheet 7 of 17)

DESIGN BASIS ACCIDENT ANALYSIS

Reference		Design Feature	Value
Table	6. 3-4	Each sparger has a minimum discharge flow area (in^{32}).	≥ 274
Table	6. 3-4	The passive core cooling system has two pH adjustment baskets each with a minimum required volume (ft^3).	280
Section ~~Table~~	14.2.9.1.3 f ~~6.~~ ~~3-4~~	The passive residual heat removal heat exchanger minimum natural circulation heat transfer rate (BTU/hr)	
		- With 520~~67~~°F Hot Leg and ~~1~~280°F IRWST	≥ 1.78~~2.01~~ E+08

PRA Revision:

None

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Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.l

Summary of Issue:

14.2.9.2.4 Normal Residual Heat Removal System Testing

Provide the acceptance criteria, either the values or reference, for the normal residual heat removal system (RNS) tests which verify the following RNS functions: core and spent fuel pool decay heat removal capability; RCS makeup at low pressure; and low-temperature overpressure protection.

Westinghouse Response:

The General Test Acceptance Criteria section of the Test Abstract 14.2.9.2.4 currently references DCD subsection 5.4.7 and appropriate design specifications as the appropriate reference for the functions to be verified in the initial startup test program. DCD section 5.4.7.6.1 provides a discussion of the acceptance criteria for the preoperational inspection and testing. 14.2.9.2.4 will be revised as follows to reference 5.4.7.6.1. In addition, DCD subsection 5.4.9 will be referenced for the low temperature overpressure protection function.

DCD Revision:

14.2.9.2.4 Normal Residual Heat Removal System Testing

General Test Acceptance Criteria and Methods

Normal residual heat removal system performance is observed and recorded during a series of individual component and system testing, that characterizes system operation. The following testing verifies that the normal residual heat removal system performs its defense-in-depth functions as described in subsection 5.4.7.6.1 and appropriate design specifications:

a) Operation of valves to open, to close, or to control flow as required to perform the above defense-in-depth functions is verified.

b) Operation of system controls, alarms, instrumentation, and interlocks associated with performing the above defense-in-depth functions is verified. In addition, the proper operation of the normal residual heat removal system/reactor coolant system isolation valve interlocks specified in Section 7.6 is verified.

c) The normal residual heat removal system pumps testing includes verification that the pump flow rate corresponds to the expected system alignment, proper pump miniflow operation, and verification that adequate net positive suction head is available for the configurations tested. The following system configurations are tested with each pump operating individually and with two pumps operating:

- Recirculation from and to the reactor coolant system with the reactor coolant system at mid-loop hot leg water level and atmospheric pressure

- Makeup to the reactor from the in-containment refueling water storage tank with approximately 4 feet of water in the tank
- Makeup to the reactor from the cask loading pit with water in the pit at a sufficient level to support pump operation
- Recirculation from and to the spent fuel pool with the pool at normal minimum level.

d) During the verifications of normal residual heat removal system flow to the reactor coolant system, verify that the pumped flow provides sufficient back pressure to maintain a water level in the CMT.

e) The capability of the normal residual heat removal heat exchangers to provide the required heat removal rate from the reactor coolant system is verified by testing performed with flow from and to the heated reactor coolant system, with each normal residual heat removal pump/heat exchanger operating individually.

f) The capability of the normal residual heat removal heat exchangers to provide the required heat removal rate from the spent fuel pool is verified. Since the spent fuel pool is not heated during pre-operational testing, this verification can be made based on the flowrate from Item c and heat removal capability from Item e, above.

g) Operation of the normal residual heat removal system relief valve which provides low temperature overpressure protection for the reactor coolant system is verified by the performance of baseline in-service testing, as specified in subsection 3.9.6. **The acceptance criteria is based on the valve performance criteria specified in subsection 5.4.9.**

h) Operation of the system to facilitate draining the reactor coolant system water level to near the centerline of the hot leg for reduced inventory operations is verified. This test is performed in conjunction with the chemical and volume control system, and is used to demonstrate the performance of the reactor coolant system hot leg level instruments as discussed in subsection 14.2.9.1.1.

PRA Revision

None

DSER Open Item Number: 14.2-1.m

Original RAI Number(s): None

Summary of Issue:

14.2.10.1.2 Reactor Systems Sampling for Fuel Loading

Please specify the required operator actions if boron concentration is outside the predetermined range or if the boron readings are not uniform.

Westinghouse Response:

In the event that reactor system boron concentration is outside the predetermined range, the operator would add boron via the chemical and volume control system, until the boron concentration is within the predetermined limits. If the boron readings are not uniform, the operators would continue to operate the residual heat removal system to circulate the coolant in the reactor until the readings were uniform. DCD section 14.2.10.1.2 will be revised as follows to provide this information.

14.2.10.1.2 Reactor Systems Sampling for Fuel Loading

Objective

- Verify that the dissolved boron concentration in the reactor coolant system and directly connected portions of associated auxiliary systems is uniform and equals or exceeds the value required by the plant Technical Specifications for fuel loading.

Prerequisites

- Plant Technical Specifications for fuel loading are complete and verified
- Boric acid storage tanks, transfer pumps, and associated piping and equipment are filled and operable
- The reactor vessel is filled with borated water to a level approximately equal to the centerline of the outlet nozzles
- The water in the reactor vessel and reactor coolant system piping, including all directly connected auxiliary systems, is borated to a value that equals or exceeds the value specified in the plant Technical Specifications for fuel loading, and that water is circulating through the normal residual heat removal system at a rate that provides reasonable assurance of a uniform concentration.

Test Method

- Obtain and analyze samples from at least one representative point in each auxiliary system and at four equidistant depths in the reactor vessel for boron concentration
- Periodically repeat sampling until the performance criteria are met

Performance Criteria

- The minimum boron concentration of all samples equals or exceeds the value specified in the plant Technical Specifications for fuel loading. **If the minimum boron concentration criteria is not met, the chemical and volume control system is used to increase the boron concentration to above the specified limit**
- The boron concentrations of the samples obtained in the reactor vessel and operating residual heat removal loop are within the specified range of each other. **The normal residual heat removal system continues to operate until a uniform concentration is established**

PRA Revision

None

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DSER Open Item Number: 14.2-1.n

Original RAI Number(s): None

Summary of Issue:

14.2.10.1.3 Fuel Loading Instrumentation and Neutron Source Requirements

The operability of the core loading instrumentation and neutron source has been established, but the expected "correct" response has not been defined.

Please specify the expected "correct" response of neutron monitoring instrumentation.

Westinghouse Response:

DCD 14.2.10.1.3 will be revised as shown below so that the performance criterion requires the operator to verify that the nuclear instrumentation is operating properly and is responding to changes in the neutron flux levels. The instrumentation response is also described in the detailed startup test procedure developed by the Combined License (COL) applicant.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.
Sections 14.2.10.1.4 and 14.2.10.1.5 provide additional information on neutron monitoring instrumentation.

DCD 14.2.10 requires that the specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the COL applicant/holder in the form of plant, system and component performance and testing procedures. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems. The specific criteria for the response of the neutron monitoring instrumentation will be provided in these detailed startup test procedures developed by the COL applicant.

The startup test procedures are followed by plant operators and other utility test personnel conducting the startup testing. The test procedures provide sufficient information to confirm plant performance during the conduct of the test, as well as providing guidance to the operators for taking appropriate required actions in the event that abnormal conditions occur.

Design Control Document (DCD) Revision:

Performance Criteria for Startup Test 14.2.10.1.3

Equipment used for neutron monitoring during fuel loading is operating correctly and is responsive to changes in neutron flux levels. **Minimum count rates of 1/2 counts per second, attributable to core neutrons, are required on at least two of the available pulse-type nuclear channels at all times following installation of the initial nucleus of fuel assemblies (approximately eight fuel assemblies, one of which contains a neutron source) which permits meaningful inverse count-rate monitoring.**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

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DSER Open Item Number: **14.2-1.o**

Original RAI Number(s): **None**

Summary of Issue:

14.2.10.1.4 Inverse Count Rate Ratio Monitoring for Fuel Loading

No guidance is provided to the operator concerning the count rate and what criteria would warrant a "stop loading" or "unload" action. For example, there is no guidance as to the actions the operators should take if they realize that an assembly is loaded in the wrong direction or the wrong position.

Please provide such guidance and criteria.

Westinghouse Response:

DCD 14.2.10.1.4 will be revised to provide specific ICRR performance criteria for operator guidance during the initial fuel loading.

DCD 14.2.10.1.5, Initial Fuel Loading, will be revised as shown in the response to DSER OI 14.2-1.p to provide the operator with guidance concerning the count rate and what criteria would warrant a "stop loading" or "unload" action. In addition, the guidance includes criteria related to moderator boron concentration since this also affects core reactivity.

The response to DSER OI 14.2-1.p also includes a revision to DCD 14.2.10.1.5 to address correct fuel assembly positioning and orientation during core loading. Incorrect positioning or orientation of an individual fuel assembly may not be identifiable by the neutron monitoring and ICRR calculations and the administrative controls described in DCD 14.2.10.1.5 will confirm correct positioning of the fuel assemblies.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

The specific details of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the Combined Licsense (COL) applicant in the form of plant, system and component performance and testing procedures.

Specific guidance and criteria for operator actions in the event of an abnormal inverse count rate ratio (ICRR) are provided in these detailed startup test procedures. The test procedures are followed by plant operators and other utility test personnel conducting the startup testing. The test procedures provide sufficient information to confirm correct plant performance during the conduct of the test, as well as providing guidance to the operators for taking appropriate required actions in the event that abnormal conditions occur.

Design Control Document (DCD) Revision:

The performance criteria for DCD Startup Test 14.2.10.1.4 will be revised as follows.

- Monitoring data are consistent with calculations showing the predicted response and, for plants subsequent to the first plant, with data obtained during a previous similar fuel loading. **Each subsequent fuel addition will be accompanied by detailed neutron count rate monitoring to determine that the just loaded fuel assembly does not excessively increase the count rate and that the extrapolated ICRR is behaving as expected and not decreasing for unexplained reasons.**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.p

Original RAI Number(s): None

Summary of Issue:

14.2.10.1.5 Initial Fuel Loading

The order of test abstracts 14.2.10.1.4 and 14.2.10.1.5 should be reversed because one cannot implement [an inverse] neutron count until after there is fuel in the core.

Please specify the conditions which would warrant a "stop loading" action.

It should be stated that the fuel loading operation must be supervised by a licensed senior operator with no concurrent duties.

Westinghouse Response:

The sequence of DCD test abstracts 14.2.10.1.4 (Inverse Count Rate Ratio [ICRR] Monitoring for Fuel Loading) and 14.2.10.1.5 (Initial Fuel Loading) generally follow the expected sequence of startup and power ascension tests. But the DCD sequence is not the approved sequence followed by the operations and test personnel during plant testing. An approved detailed test procedure will be developed by the Combined License (COL) applicant and followed during the startup and power ascension testing to ensure that the evolution will be completed in the proper sequence, and in a safe and controlled manner.

Startup Test 14.2.10.1.4 is identified first in the DCD Startup Test sequence since it is recognized that preparations for the ICRR monitoring should be completed before core loading is initiated. As specified in the response to DSER OI 14.2-1.n for DCD 14.2.10.1.3, an initial nucleus of fuel assemblies must be installed so that meaningful ICRR monitoring can be initiated after establishing the background count rates for each neutron monitoring channel used for each ICRR calculation. Therefore, it is recognized that a small number of fuel assemblies must actually be loaded into the reactor vessel before ICRR monitoring can begin. But the Startup Test sequence in the DCD was intended to help reinforce the need to complete preparations for ICRR monitoring before the initiation of core loading.

Following loading of the initial fuel assembly nucleus, the background count rate for each nuclear instrumentation channel is required so that the ICRR can be re-calculated after each fuel assembly is placed into the reactor vessel. The purpose of the ICRR calculation is to monitor the insertion of every fuel assembly into the core, to confirm that there is no approach to criticality during the core loading. The boron concentration requirements of Technical Specification 3.9.1 help to ensure that the shutdown margin during fuel loading is at least 5 percent, so that an approach to criticality is not expected any time during initial fuel loading.

Postulated plant events such as a boron dilution of the refueling cavity water volume could potentially reduce the shutdown margin below the allowable limit. Neutron monitoring to support the ICRR calculation and periodic boron concentration sampling provides continuing indication of any abnormal changes in core reactivity that would require termination of the fuel assembly loading.

Therefore, the simultaneous calculation of the ICRR in Test 14.2.10.1.4 during the fuel assembly loading in Test 14.2.10.1.5 is vital to confirm the core reactivity conditions satisfy the design basis. As previously discussed, the baseline data for the ICRR test must be recorded after the initial fuel assembly nucleus is loaded. New baseline data is taken during the core loading process following any relocation of the neutron source assemblies.

DCD 14.2.10.1.5 will be revised as shown below to identify specific criteria that would require termination of fuel assembly loading.

DCD 14.2.10.1.5 will also be revised to include a requirement for supervision of the fuel loading operation by a licensed senior reactor operator (SRO) with no concurrent duties.

Both of these requirements will be included in the detailed startup test procedures developed by the COL applicant to support the plant startup testing.

As discussed in the response to DSER OI 14.2-1.o, the following revision to DCD 14.2.10.1.5 will also be made to provide information related to procedures and operator guidance to confirm correct fuel assembly positioning and orientation.

Design Control Document (DCD) Revision:

The following statement in the Prerequisites for DCD Startup Test 14.2.10.1.5 will be modified as indicated

- The boron concentration in the reactor coolant equals or exceeds the concentration required by the plant Technical Specifications for refueling. **Core moderator chemistry conditions (particularly boron concentration) are prescribed in the core loading procedure document and are verified periodically by chemical analysis of moderator samples taken prior to and periodically during core loading operations.**

The following statement will be added to the Prerequisites for DCD Startup Test 14.2.10.1.5

- **The overall process of initial fuel loading will be supervised by a licensed senior reactor operator with no other concurrent duties.**

The following statements will be added to the Test Method for DCD Startup Test 14.2.10.1.5

- **Fuel assemblies, together with inserted components (control rod assemblies, burnable poison inserts, source spider, or thimble plugging devices) are placed in the reacgtor vessel one at a time according to a previously established and approved sequence which was developed to provide reliable core monitoring with minimum possibliity of core mechanical damage. The core loading procedure documents include detailed tabular check sheets which prescribe and verify the successive movements of each fuel assembly and its specified inserts from its initial position in the storage racks to its final position and orientation in the core. Multiple checks are made of component serial numbers and types at successive transfer points to guard against possible inadvertent exchanges or substitutions of components, and fuel assembly status boards are maintained throughout the core loading operation. The results of each loading step will be reviewed and evaluated before the next prescribed step is started.**

- **The criteria for safe loading require that loading operations stop immediately I**

  - **An unanticipated increase in the neutron count rate by a factor of two occurs in all responding nuclear channels during any single loading step after the initial nucleus of fuel assemblies is loaded**

  - **An unanticipated increase in the count rate by a factor of five occurs on any individual responding nuclear channel during any single loading step after the initial nucleuse of fuel assemblies is loaded**

  - **A decrease in boron concentration greater than 20 ppm is determined from two successive samples of reactor coolant system water until the decrease is explained**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.q

Original RAI Number(s): None

Summary of Issue:

<u>14.2.10.1.6 Post-Fuel Loading Precritical Test Sequence</u>

In specifying the sequence of the pre-critical test, the evolution should be such that plant safety does not depend entirely upon non-tested systems. It is not clear that this testing principle was taken into account.

Regulatory Guide (RG) 1.68 provides for a final calibration of the source range instrumentation and verification of the alarm and protective functions of the source and the intermediate range monitors.

Please identify the instrumentation to be used, and provide guidance to the operators that prevents their reliance on untested instrumentation. Please describe and specify these tests.

Westinghouse Response:

DCD 14.2.10.1.6 will be revised to identify operability requirements for equipment that provides protection during the precritical test sequence.

The required operability of key plant systems and components that provide both monitoring and protection for the plant during post-fuel loading precritical testing is specified in the AP1000 Technical Specifications. Technical Specifications also specify the required plant parameters and conditions necessary for safe plant operation in each operational mode. Technical Specifications specifically protect against dependence on non-tested or inoperable equipment for plant protection. DCD 14.2.9.1 identifies the Preoperational Tests of Systems with Safety-Related Functions, including the protection and safety monitoring system and its Class 1E DC power supply. The nuclear instrumentation testing is performed in DCD 14.2.10.1.3 and 14.2.10.1.9.

As an example of the Technical Specification requirements, Table 3.3.1-1 of TS 3.3.1 identifies the specific requirements for the appropriate reactor trip instrumentation including source and intermediate range monitors to be operable during plant conditions in Modes 1 to 5 conditions (where plant physics testing is performed), including any time that the reactor trip breakers are closed and the plant control system is capable of rod withdrawal. The required instrumentation provides monitoring capability when the plant is not capable of rod withdrawal and reactor trip protection when rod withdrawal can occur (whenever the reactor trip breakers are closed). Other Technical Specifications identify additional Limiting Conditions for Operation (LCOs) that must be satisfied for the various plant conditions to assure plant safety.

In general, most of the reactor trip instrumentation required during any specific plant operating condition (mode) is required to be operable during the plant physics testing. TS 3.1.8 identifies several specific exceptions to the TS instrumentation operability requirements during the performance of the plant physics testing. The only relaxations allowed for instrumentation are that the required number of operable channels for four different instruments may be reduced from four to three channels during the physics testing.

The sequence of pre-critical plant testing selected by the Combined License (COL) Applicant does not eliminate the TS requirements for operability of the monitoring and protection instrumentation and other LCO requirement, such as required shutdown margin during sub-critical conditions.

The pre-critical testing sequence followed in the detailed startup test procedures developed by the COL Applicant is organized to establish and confirm the operability of the required monitoring and protection equipment operability before beginning any specific testing activities where the monitoring or protection capability is needed, as well as other required plant conditions. For example, the startup test procedures first confirm that required fuel loading prerequisites and periodic checks are completed before fuel loading can begin. These prerequisites include detailed checklists of required plant equipment, and verify conditions such as the reactor coolant system boron concentration (which provides adequate shutdown margin), as well as installed and temporary neutron monitoring instrumentation. Before critical plant operation can begin, the plant monitoring, process conditions, and shutdown (control rod trip) capability are confirmed. These tests include alignment, calibration, and response testing of neutron monitoring instrumentation and verification of trip setpoints, and confirmation that physical plant parameters such as rod drop time, reactor coolant flow rate, reactor coolant system flow coastdown, and plant pressure control equipment meets the assumptions of accident analyses.

The overall startup test program is intended to be consistent with the guidelines provided in Regulatory Guide 1.68 for Initial Test Programs for Water-Cooled Nuclear Power Plants. DCD Appendix 1A provides a summary of the AP1000 conformance to Regulatory Guide 1.68.

Specific criteria and guidance for operators regarding instrumentation operability and testing to confirm equipment operability are provided for the operators in the Technical Specification and in the detailed startup test procedures developed by the Combined License (COL) Applicant to support the plant startup testing.

The test procedures are followed by plant operators and other utility test personnel conducting the startup testing. The test procedures must provide sufficient information to confirm correct plant performance during the conduct of the test, as well as providing guidance to the operators for taking appropriate required actions in the event that abnormal conditions occur.

As discussed in Subsection 14.2.10, the DCD provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the Combined License applicant/holder in the form of plant, system and component performance and testing procedures.

Design Control Document (DCD) Revision:

The following statement will be added to Prerequisites for DCD 14.2.10.1.6

The systems, structures, and components required by Technical Specifications shall be operable as required for the specified plant operational mode prior to initiation of precritical testing. Preoperational and precritical tests shall be completed to confirm the operability of required plant safety systems to support precritical testing prior to the initiation of the precritical tests.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: **14.2-1.r**

Original RAI Number(s): **None**

Summary of Issue:

14.2.10.1.14 Rod Drop Time Measurement

Initial control rod drive testing seems to be limited to rod drop time measurement. The functional testing of the reactor protection system such as trip setpoints, logic, operability of scram breakers and manual scram functions are not listed. Guidance is not available to the operators regarding actions if drop tests are outside the expected range.

Please supplement this test to follow the guidance of RG 1.68.

Westinghouse Response:

Startup test 14.2.10.1.14 is limited to the rod drop time measurement for the two plant conditions specified and to verification of the control rod deceleration device operability.

The functional testing of the reactor protection system, including trip setpoints, logic, operability of scram breakers and manual scram functions is separately addressed in Preoperational Test 14.2.9.1.12. The Protection and Safety Monitoring System (PMS) equipment and functions tested are described in the subsection on General Test Methods and Acceptance Criteria in the DCD for Test 14.2.9.1.12.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

For some other preoperational tests, actions are required in the event that performance criteria are not met, or where adjustments or repairs to equipment being tested can be performed in the event that performance criteria are not met. However, it is unlikely that corrective actions by either the operators or test personnel actions could be taken to satisfy the rod drop time measurement, if the test if correctly performed. Therefore, no specific operator guidance is provided in the DCD in the unlikely event that rod drop tests are outside of the expected range.

Specific criteria and guidance for operators in the event that acceptance criteria for the rod drop test are not satisfied are provided for the operators in the detailed startup test procedures developed by the Combined License (COL) applicant to support the plant startup testing.

The test procedures are followed by plant operators and other utility test personnel conducting the startup testing. The test procedures provide sufficient information to confirm correct plant performance during the conduct of the test, as well as providing guidance to the operators for taking appropriate required actions in the event that abnormal conditions occur.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the COL applicant in the form of plant, system and component performance and testing procedures.

The overall startup test program is intended to be consistent with the guidelines provided in Regulatory Guide 1.68 for Initial Test Programs for Water-Cooled Nuclear Power Plants. DCD Appendix 1A provides a summary of the AP1000 conformance to Regulatory Guide 1.68.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

DSER Open Item Number: **14.2-1.s**

Original RAI Number(s): **None**

Summary of Issue:

14.2.10.1.19 Pressurizer Spray Capability and Continuous Spray Flow Verification

With regard to the pressurizer spray capability tests, one of the performance criteria is that the pressurizer pressure response to the opening of the pressurizer spray valves is within design basis functional limits as specified in subsection 7.7.1.6. Subsection 7.7.1.6 does not specifically define the design basis functional limits for the pressurizer pressure control system, except that the primary system pressure is regulated to prevent the actuation of the engineered safety feature to prevent overstressing the pressure boundary or the possibility of departure from nucleate boiling.

Provide specific acceptance criteria for the pressurizer spray test.

Westinghouse Response:

Specific test acceptance criteria are included in the detailed test procedures developed by the COL applicant for the initial test program as specified in DCD section 14.4. Since the pressurizer spray flow can not be directly measured, the general acceptance criteria provided in 14.2.10.1.19 refers to DCD subsection 7.7.1.6 Pressurizer Pressure Control System to serve as the basis for the pressurizer pressure control functional requirements that will be used to establish the specific test acceptance criteria. The intent of this test is to operate pressurizer spray and measure the pressure response. From this measured response, the overall pressure control capability is determined, and the effectiveness of the installed pressurizer spray capacity can be assessed. The detailed control system functional design documentation will be used by the COL applicant to establish the specific test acceptance criteria for this test.

DCD Revision

DCD subsection 14.2.10.1.19 will be revised as follows:

14.2.10.1.19 Pressurizer Spray Capability and Continuous Spray Flow Verification

Objectives

- Establish the optimum continuous spray flow rate
- Determine the effectiveness of the normal control spray

Prerequisites

- The reactor coolant system is at no-load operating temperature and pressure.
- All reactor coolant pumps are operating

Test Method

- While maintaining constant pressurizer level, adjust spray bypass valves until a minimum flow is achieved that maintains the temperature difference between the spray line and the pressurizer within acceptable limits.
- With the pressurizer heaters de-energized, fully open both spray valves, and record the time to lower the pressurizer pressure a specified amount.

Performance Criteria

- The spray bypass valves are throttled so that the minimum flow necessary to keep the spray line warm is achieved.
- The pressurizer pressure response to the opening of the pressurizer spray valves is within design basis functional limits as specified in subsection 7.7.1.6 and the appropriate pressure control system design specification documentation.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: **14.2-1.u**

Original RAI Number(s): **None**

Summary of Issue:

14.2.10.3.4 Isothermal Temperature Coefficient Measurement

The "prerequisites" do not include Xenon and Samarium equilibration. Also, no required actions is specified if the moderator temperature coefficient (MTC) is equal to or significantly exceeds the technical specification (TS) value.

Please specify the missing prerequisites in this test.

Westinghouse Response:

Startup test 14.2.10.3.4 is conducted as part of low-power physics testing following the initial core loading.

The basis for successfully measuring the MTC reactivity effects during low-power physics testing is to stabilize all reactivity contributors so that reactor coolant system temperature changes performed during the test are the only source of core reactivity changes. Therefore, it is inherent in the test requirements that no other significant reactivity variations can occur during the MTC testing.

This test is performed by manually varying Tave and determining the amount of reactivity inserted or removed by the temperature change. This test takes a very short time (a few minutes) to complete, so that Xenon and Samarium concentration changes during the duration of this test are not significant. In addition, for an initial core loading, there is no Xenon or Samarium initially in the core. Due to the low-power conditions while conducting the physics testing, neither fission product poison concentration changes enough during the testing to significantly impact MTC measurement. Therefore, Xenon and Samarium equilibrium conditions are not required as prerequisites for this low-power physics test.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the Combined License applicant in the form of plant, system and component performance and testing procedures.

For some startup tests, actions are required in the event that performance criteria are not met, or adjustments or repairs to equipment being tested can be performed in the event that performance criteria are not met. However, it is unlikely that corrective actions by either the operators or test personnel actions could be taken in the event that the Technical Specification MTC limit is not met, if the test if correctly performed. Therefore, no specific operator guidance is provided in the DCD in the unlikely event that rod drop tests are outside of the expected range.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.v

Original RAI Number(s): None

Summary of Issue:

14.2.10.3.7 Passive Residual Heat Removal Heat Exchanger (First Plant only)

Section 14.2.10.3.7 indicates that the low-power PRHRHX test is to be performed for the first AP1000 plant only. It also contains a note stating that this test is not required to be performed if a large scale test of the AP600 or AP1000 type PRHRHX has been conducted, and has provided data confirming adequate heat removal capability (underline added).

Clarify the note with an example of existing large scale PRHRHX tests that can fit into the above underlined category. Justify why this large scale test can substitute for the low power test to be performed for the first AP1000 plant, or delete the note.

Westinghouse Response:

DCD Section 14.2.10.3.7 will be revised to delete the note.

Design Control Document (DCD) Revision:

14.2.10.3.7 Passive Residual Heat Removal Heat Exchanger (First Plant Only)

Objective

[*Demonstrate the heat removal capability of the passive residual heat removal heat exchanger with the reactor coolant system at prototypic temperatures and natural circulation conditions.*]* Note that this test is performed in conjunction with the reactor coolant system natural circulation test with heat removal via the steam generators described in subsection 14.2.10.3.6. ~~Also note that this test is not required to be performed if a large scale test of the AP600 or AP1000 type passive residual heat removal heat exchanger has been conducted, and has provided data confirming adequate heat removal capability.~~

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.w

Original RAI Number(s): None

Summary of Issue:

<u>14.2.10.4.19 Reactor Power Control System</u>

Please explain why Xenon and Samarium equilibration is not part of the prerequisites if it is expected that T_{avg} will return to T_{ref} .

Westinghouse Response:

The purpose of the reactor power control system testing is to demonstrate that the reactor control system can compensate for anticipated reactivity variations to maintain Tave within the programmed Tref band.

This test is performed by manually varying Tave and then placing the reactor control system in automatic and confirming that Tave is restored to the Tref setpoint tolerance without manual intervention. This test takes a very short time (a few minutes) to complete, so that Xenon and Samarium concentration changes during the duration of this test are not significant. Therefore, since the Xenon and Samarium time constants are significantly longer than the control system response, Xenon and Samarium equilibrium conditions are not required for this power ascension test.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the Combined License (COL) applicant in the form of plant, system and component performance and testing procedures.

Specific information on Xenon and Samarium concentration variations and equilibrium conditions and any other related power ascension testing guidance are provided in the detailed startup test procedures and the startup test program reference document developed by the COL applicant to support the plant startup testing. Due to the short duration of this test, no prerequisites are needed in either the DCD discussion or the detailed test procedures for this test.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.x

Original RAI Number(s): None

Summary of Issue:

14.2.10.4.20 Load Swing Test

The load swing test requires a 10% load change from 100% power.

Please clarify that this is not a 10% load increase from 100% power, or specify the required operator response.

Westinghouse Response:

DCD 14.2.10.4.20 will be revised to indicate that the core power should not exceed 100 percent indicated by the excore nuclear instrumentation during the load swing test. The core power limit is also described in the detailed startup test procedure developed by the Combined License (COL) applicant.

Reactor power is limited to the rated core thermal power limit specified in the AP1000 Technical Specifications of 3400 MWt, which corresponds to 100 percent indicated core power.

During the power ascension testing, the load swing test involves 10 percent step-load increases and decreases. Since 100 percent reactor power is not allowed to be exceeded, the load swing test at 100 percent power consists of a 10 percent step load decrease to 90 percent power, followed by a 10 percent load step increase. This prevents exceeding 100 percent power.

Design Control Document (DCD) Revision:

Test Method for Startup Test 14.2.10.4.20

Change the turbine-generator output as rapidly as possible to achieve a step 10 percent load increase or decrease. Monitor and record plant parameters of reactor power, reactor coolant system temperature, pressurizer pressure and level, and steam generator pressure and level during the load transients. **Core power should not exceed 100 percent power as indicated by the excore nuclear instrumentation.**

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: **14.2-1.y**

Original RAI Number(s): **None**

Summary of Issue:

14.2.10.4.23 Hot Full Power Boron Endpoint

Please explain the origin of the burn-up data for a startup test of a new plant.

Westinghouse Response:

The current core burnup data identified in the prerequisites for Startup Test 14.2.10.4.23 are generated during core power operation associated with the power ascension testing. The power generation results in a small amount of fuel burnup and, therefore, core burnup data can be taken during the power ascension testing for use in the hot full power boron endpoint test procedure.

Design Control Document (DCD) Revision:

None

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.z

Original RAI Number(s): None

Summary of Issue:

Refer to the AP1000 Design Control Document (DCD), Section 14.2.9.1.9, Reactor Vessel Internals Vibration Testing:

In the "Prerequisites" paragraph, DCD Table 3.9-4 is referenced for the specified locations of test instrumentation used for the reactor internals vibration measurement program. However, WCAP-15949-P, Table 7-1, also specifies transducer locations and types to be used for the AP1000 internals vibration measurement program, and is not completely consistent with DCD Table 3.9-4 regarding the number and locations of transducers required.

Please provide the following clarifications and appropriate revisions:

1) Identify which set of transducer numbers and locations, either DCD, Table 3.9-4 or WCAP-15949-P, Table 7-1, is intended for the AP1000 internals vibration measurement program.

2) Provide appropriate corrections to the DCD and WCAP to eliminate any inconsistencies.

3) In the "General Test Method and Acceptance Criteria" paragraph in DCD Section 14.2.9.1.9, provide a cross reference to WCAP-15949-P, Section 7, to ensure that the additional preoperational test criteria for the reactor internals vibration measurement program specified in the WCAP document is included in the Initial Test Program description.

Reference:

AP1000 Design Control Document (DCD), APP-GW-GL-701 Rev.3, dated January 2003.

AP1000 WCAP-15949-P, "AP1000 Reactor Internals Flow-Induced Vibration Assessment Program," Revision 1, dated July 2003

Westinghouse Response:

The set of transducer numbers and locations given in WCAP-15949-P, Table 7-1 is intended for the AP1000 internals vibration measurement program. DCD Table 3.9-4 will be revised to be consistent with Table 7-1 of WCAP-15949-P.

Reference to WCAP-15949 will be added into the discussion of the preoperational test criteria for the reactor internals vibration measurement program in DCD Section 14.2.9.1.9.

Design Control Document (DCD) Revision:
From DCD Revision 6, page 3.9-100:

Table 3.9-4

FIRST PLANT AP1000 REACTOR INTERNALS VIBRATION MEASUREMENT PROGRAM TRANSDUCER LOCATIONS

Instrumented Component	Number and Type of Transducers	Approximate Transducer Locations	Direction of Sensitivity
Core Shroud (inner wall)	4 accelerometers	0°, 180°, 225°, 270°	Radial
Core Shroud to Core Barrel	2 relative displacement transducers	0°	Radial
Core Barrel Flange (Outer Wall)	4 strain gages	0°, 90°, 180°, 270°	Axial
Core Barrel Flange (Inner Wall)	2 strain gages	180°, 270°	Axial
Core Barrel Mid-elevation	4-3 accelerometers	0°, 180°, 225°, 270°	Radial
Core Barrel Mid-elevation	1 pressure transducer	0°	Radial
Upper Support Skirt (Inside and Outside)	2-3 strain gages	180°, 90° inside 90° outside	Axial
Lower Core Support Plate Weld (Outside)	2 strain gages	0°, 90°	Vertical
Lower Support Plate (Lower Surface)	2 accelerometers	Near Center	Vertical
Vortex Suppression Plate Support Columns (2)	4 strain gages or	On column near lower core support plate	Axial
	4 accelerometers	or on vortex suppression ring	Horizontal
Reactor Vessel (Head Studs)	4 accelerometers	0°, 90°, 180°, 270°	Vertical
	2-3 accelerometers	0°, 90°, 180°	Horizontal
Support Column Extension	2 strain gages	0°, 90°	Axial
Guide Tube B-6	3-4 strain gages	0°, 90°, 180°, 270°	Axial
Guide Tube P-8	3 strain gages	0°, 90°, 180°	Axial

Upper Support Column ~~(Column B-7)~~	~~3~~ 4 strain gages	0°, 90°, 180°, 270°	Axial

From DCD Revision 6, Section 14.2.9.1.9, page 14.2-31:

General Test Method and Acceptance Criteria

Reactor vessel internals testing is performed for the first plant only by measuring and recording strains or accelerations of components in order to determine actual displacements that occur with the reactor coolant pumps operating. This testing is performed at several reactor coolant system temperatures during the system hot functional test. The analysis of data obtained from this testing, combined with a pre-test and post-test visual inspection of the internals, are intended to confirm that the stresses and wear on the AP1000 internals, due to flow induced vibration during plant operation, are acceptably low. The criteria for evaluating testing results is established in the AP1000 reactor internals flow-induced vibration assessment program **(see Section 7 of WCAP-15949, Reference 18)**, and appropriate design specifications.

For the first plant only, the internals are instrumented to obtain data during the following reactor coolant system operating conditions:

a) Background noise in the instrumentation and recording equipment is recorded with no reactor coolant pumps running

b) Data is recorded during the initial startup of the reactor coolant pumps and with all four pumps operating and with the reactor coolant at cold temperature

c) Data is recorded at several increasing coolant temperatures with the pumps operating

d) Data is recorded at the hot functional testing temperature with all four pumps operating

e) Data is recorded at the hot functional testing temperature with the appropriate combinations of reactor coolant pumps operating, including pump start and stop transients

For all plants subsequent to the first plant, visual inspections are performed before and after the hot functional test. When no indications of harmful vibrations or signs of abnormal wear are detected and no structural damage or changes are apparent, the core support structures are considered to be structurally adequate and sound for operation. If such indications are detected, further evaluation is required.

PRA Revision:

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.3.2-12 (Response Revision 2)

Original RAI Number(s): None

Summary of Issue:

Section 3.1, "Emergency Response Facilities," the staff finds this ITAAC unacceptable because it does not address the radiological habitability or the ventilation system for the technical support center; both of which should be the same as, or comparable to the main control room ITAAC. This is Open Item 14.3.2-12.

Westinghouse Response:

Westinghouse will revise the DCD as shown below.

NRC Additional Comments:

The proposed additional Tier 1 ITAAC is: "The TSC provides a suitable workspace environment." First, what does "suitable" mean? It is not clear that it means "habitable" and compliance with the GDC 19 criteria for all design basis accidents. Second, it ties the Inspections, Tests, Analyses, and Acceptance Criteria to Table 2.7.1-4, which includes reference to the MCR. Third, the MCR (and now, proposed TSC) criteria in Table 2.7.1-4 are ambiguous, as it applies to meeting GDC 19 criteria for the TSC, and limit testing to controls in the MCR only.

The logic seems to imply that if the control room-operated testing is successful, then the equipment works, then the MCR (and TSC) are "habitable," and then they meet GDC 19, and this applies to all design basis accidents. Such a connection is not clearly laid out.

The specific testing does not indicate whether (or not) there are any non-MCR controlled components that need to be tested, in order to confirm the TSC habitability design commitment. The ITAAC could be something as simple as: "The TSC meets GDC 19 criteria for all design basis accidents;" or possibly something like "The TSC provides a habitable workspace environment," with clear Inspections, Tests, Analyses, and Acceptance Criteria on what "habitable" means – rather than reference to another section (unless, of course, that reference and criteria are clear). The logic appears to be too remote from what should be a clear TSC design commitment statement (including the Inspections, Tests, and Analyses statement), and having an objective Acceptance Criteria. Then, a reference to Inspections, Tests, Analyses, and Acceptance Criteria elsewhere in the Tier 1 DCD is appropriate. This should be clearly indicated in both the Tier 2 DCD and Tier 1 ITAAC, as appropriate.

Westinghouse Additional Response: (Revision 1)

The word "suitable" in the original proposed revision to DCD Tier 1 will be changed to "habitable" as shown below.

Also, a clarification of the intent of references to other ITAACs in the ITAAC tables will be add to the DCD as shown below.

In addition to the ITAAC testing, preoperational testing of the VBS is described in DCD Tier 2 subsection 14.2.9.2.10. The changes shown below will be made to DCD Tier 2 subsection 14.2.9.2.10 to clarify the importance of the TSC-related functions.

Design Control Document (DCD) Revision: (Response Revision 1)

DCD Tier 1 section 3.1

- Add new item 6, under Design Description as follows:

"6. The TSC provides a ~~suitable~~ **habitable** workspace environment."

- Revise Table 3.1-1 to include new item 6 as follows:

6. The TSC provides a ~~suitable~~ habitable workspace environment.	See Tier 1 Material, ~~subsection 2.7.1~~**Table 2.7.1-4, items 1, 8a), 8c), 12 and 13, Nuclear Island** Nonradioactive Ventilation System	See Tier 1 Material, ~~subsection 2.7.1~~**Table 2.7.1-4, items 1, 8a), 8c), 12 and 13, Nuclear Island** Nonradioactive Ventilation System

DCD Tier 1 section 2.7.1

- Revise item 8.c) under Design Description as follows:

The VBS maintains MCR **and** TSC habitability when radioactivity is detected.

- Revise item 8.c) in Table 2.7.1-4 under Design Commitment as follows:

8.c) The VBS maintains MCR and TSC habitability when radioactivity is detected.	See item 12 in this table.	See item 12 in this table.

DCD Tier 1 section 1.2

- Revise Tier 1 Section 1.2 as follows:

Implementation of ITAAC

The ITAACs are provided in tables with the following three-column format:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria

Each design commitment in the left-hand column of the ITAAC tables has an associated ITA requirement specified in the middle column of the tables.

The identification of a separate ITA entry for each design commitment shall not be construed to require that separate inspections, tests, or analyses must be performed for each design commitment. Instead, the activities associated with more than one ITA entry may be combined, and a single inspection, test, or analysis may be sufficient to implement more than one ITA entry.

An ITA may be performed by the licensee of the plant or by its authorized vendors, contractors, or consultants. Furthermore, an ITA may be performed by more than a single individual or group, may be implemented through discrete activities separated by time, and may be performed at any time prior to fuel load (including before issuance of the combined license for those ITAACs that do not necessarily pertain to as-installed equipment). Additionally, an ITA may be performed as part of the activities that are required to be performed under 10 CFR Part 50 (including, for example, the quality assurance (QA) program required under Appendix B to Part 50); therefore, an ITA need not be performed as a separate or discrete activity.

Many of the acceptance criteria include the words "A report exists and concludes that..." When these words are used it indicates that the ITAAC for that design commitment will be met when it is confirmed that appropriate documentation exists. Appropriate documentation can be a single document or a collection of documents that meet the stated acceptance criteria. Examples of appropriate documentation include design reports, test reports, inspection reports, analysis reports, evaluation reports, design and manufacturing procedures, certified data sheets, commercial dedication procedures and records, quality assurance records, calculation notes, and equipment qualification data packages.

Many ITAAC are only a reference to another Tier 1 location, either a section, subsection, or ITAAC table entry (e.g., "See Tier 1 Material..."). This reference is an indication that the acceptance criteria for that design commitment are satisfied when the acceptance criteria for the referenced Tier 1 sections, subsections, or table entries are satisfied. If a complete Tier 1 section is referenced, this indicates that all the acceptance criteria in that section must be met before the referencing design commitment is satisfied.

DCD Tier 2 subsection 14.2.9.2.10

14.2.9.2.10 Nuclear Island Nonradioactive Ventilation System Testing

Purpose

The purpose of the nuclear island nonradioactive ventilation system testing is to verify that the as-installed system properly performs the following defense-in-depth functions, as described in subsection 9.4.1:

- Protect the main control room **and technical support center** from smoke infiltration
- Provide the capability to remove smoke from the main control room, **technical support center**, and Class 1E electrical equipment rooms
- Provide heating, ventilation, and cooling for the main control room, **technical support center**, and Class 1E electrical equipment rooms
- Provide air filtration to limit radioactivity in the main control room **and technical support center**
- Maintain passive heat sinks at acceptably low initial temperatures
- Maintain the main control room **and technical support center** at positive pressure

The safety-related functions associated with this system are tested as part of the main control room emergency habitability testing described in subsection 14.2.9.1.6.

Prerequisites

The construction testing of the nuclear island nonradioactive ventilation system has been completed. The required preoperational testing of central chilled water system, the hot water heating system, the ac electrical power and distribution systems, and other interfacing systems required for operation of the above systems has been completed. Data collection is available as needed to support the specified testing and system configurations.

General Test Acceptance Criteria and Methods

Nuclear island nonradioactive ventilation system performance is observed and recorded during a series of individual component and integrated system testing to verify the system performs its defense-in-depth functions. The following testing demonstrates that the system performs its defense-in-depth functions as described in subsection 9.4.1 and appropriate design specifications:

a) Proper function of the fans, filters, heaters, coolers, and dampers is verified.

b) Proper operation of instrumentation, controls, actuation signals, and alarms and interlocks is verified. This testing includes the following:

- Smoke detectors and alarms
- Air handling unit and fan flows, controls, and alarms
- Differential air pressures and alarms
- Air and air filtration unit charcoal temperatures, controls, and alarms
- Air relative humidity measurements, controls, and alarms
- Isolation/shutoff damper controls
- Fire/smoke damper controls

This testing includes operation from the main control room.

c) The proper air flows from and through each air handling unit, as well as to and from the main control room, **technical support center**, and other equipment rooms is established for each mode of operation. |

d) The main control room ~~is~~ **and technical support center are** verified to be maintained at the proper positive pressure. |

e) The main control room, **technical support center**, class 1E equipment rooms, and passive heat sink areas are verified to be maintained at their proper temperature during hot functional testing. |

PRA Revision: (Response Revision 1)

None

NRC Additional Comments to Response Revision 1:

1. Regarding "A report exists and concludes…", these words are often used with an ITA that says "Inspection will be performed for the existence of a report verifying…" These words in the ITA are confusing and should be either changed to clarify what the ITA action is.

2. The proposed changes to Tier 1 Section 1.2 regarding references to other ITAAC sections only address the acceptance criteria. This paragraph should also address the ITA column in the tables.

Westinghouse Additional Response: (Revision 2)

DCD Tier 1 Section 1.2 will be revised as shown below. This revision includes the changes from response revision 1 to this open item. The new changes proposed in response revision 2 are shown with bold to highlight the differences from response revision 1.

Design Control Document (DCD) Revision: (Response Revision 2)

DCD Tier 1 section 1.2

- Revise Tier 1 Section 1.2 as follows:

Implementation of ITAAC

The ITAACs are provided in tables with the following three-column format:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria

Each design commitment in the left-hand column of the ITAAC tables has an associated ITA requirement specified in the middle column of the tables.

The identification of a separate ITA entry for each design commitment shall not be construed to require that separate inspections, tests, or analyses must be performed for each design commitment. Instead, the activities associated with more than one ITA entry may be combined, and a single inspection, test, or analysis may be sufficient to implement more than one ITA entry.

An ITA may be performed by the licensee of the plant or by its authorized vendors, contractors, or consultants. Furthermore, an ITA may be performed by more than a single individual or group, may be implemented through discrete activities separated by time, and may be performed at any time prior to fuel load (including before issuance of the combined license for those ITAACs that do not necessarily pertain to as-installed equipment). Additionally, an ITA may be performed as part of the activities that are required to be performed under 10 CFR Part 50 (including, for example, the quality assurance (QA) program required under Appendix B to Part 50); therefore, an ITA need not be performed as a separate or discrete activity.

Many of the acceptance criteria include the words "A report exists and concludes that..." When these words are used it indicates that the ITAAC for that design commitment will be met when it is confirmed that appropriate documentation exists. Appropriate documentation can be a single document or a collection of documents that meet the stated acceptance criteria. Examples of appropriate documentation include design reports, test reports, inspection reports, analysis reports, evaluation reports, design and manufacturing procedures, certified data sheets, commercial dedication procedures and records, quality assurance records, calculation notes, and equipment qualification data packages.

Many entries in the ITA column of the ITAAC tables include the words "Inspection will be performed for the existence of a report verifying..." When these words are used it indicates that the ITA is tests, type tests, analyses, or a combination of tests, type tests, and analyses and a report will be produced documenting the results. This report will be available to inspectors.

Many ITAAC are only a reference to another Tier 1 location, either a section, subsection, or ITAAC table entry (e.g., "See Tier 1 Material..."). A reference to another ITAAC location is always in both the ITA and acceptance criteria columns for a design commitment. This reference is an indication that the ITA and acceptance criteria for that design commitment are satisfied when the referenced ITA are completed and the acceptance criteria for the referenced Tier 1 sections, subsections, or table entries are satisfied. If a complete Tier 1 section is referenced, this indicates that all the ITA and acceptance criteria in that section must be met before the referencing design commitment is satisfied.

PRA Revision: (Response Revision 2)

None

AP1000 DESIGN CERTIFICATION REVIEW

Draft Safety Evaluation Report Open Item Response

DSER Open Item Number: 14.2-1.t

Original RAI Number(s): None

Summary of Issue:

14.2.10.2.3 Nuclear Instrumentation System Verification

No action statement is stated if the measured reactivity and the corresponding value indicated by the computer are not within tolerance levels.

Please specify appropriate operator action if the measured reactivity and the corresponding value indicated by the computer are not within tolerance levels. Supplement this test with verification of proper operation of associated alarms and protective functions for source-range and intermediate-range monitors.

Westinghouse Response:

Startup test 14.2.10.2.3 is for the Nuclear Instrumentation System Verification and does not include the reactivity computer. The reactivity computer is tested in a separate Startup Test 14.2.10.2.4, Post-Critical Reactivity Computer Checkout. These tests are unrelated.

As discussed in Subsection 14.2.10, the DCD only provides a general description of each startup test and the discussion for each test identifies the test objective, test prerequisites, test description, and test performance criteria, where applicable. In describing a test, the operating and safety-related characteristics to be tested and evaluated are identified.

Where applicable, the relevant performance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant, component systems, and associated equipment. Other criteria may be associated with expectations relating to the performance of systems.

The Performance Criterion of DCD 14.2.10.2.4 will be revised to specify operator actions if the measured reactivity and the corresponding value indicated by the computer are not within tolerance levels. This startup test cannot be successful completed until measurement deviation between the two independent sources of reactivity used for the test are within required tolerances.

The specifics of the startup tests relating to test methodology, plant prerequisites, initial conditions, performance criteria, and analysis techniques are developed by the Combined License (COL) applicant in the form of plant, system and component performance and testing procedures. Therefore, specific guidance for operator actions in the event that the reactivity measurements by the reactivity computer are not within required tolerance levels are provided for the operators in the detailed startup test procedures developed by the COL applicant.

Since the reactivity computer is simply a device to monitor changes in the installed excore instrumentation detector output, it has no associated alarms or protective functions. The alarms and protective functions are part of the permanently-installed excore instrumentation. Therefore, verification of proper operation of associated alarms and protective functions for source-range and intermediate-range monitors are performed in Startup Test 14.2.10.2.3 and not for Startup Test 14.2.10.2.4

Table 3.3.1-1 of Technical Specification 3.3.1 identifies the specific requirements for the appropriate reactor trip instrumentation, including source-range and intermediate-range excore nuclear instrumentation, to be operable during plant conditions in Modes 1 to 5 conditions (where plant physics testing is performed), including any time that the reactor trip breakers are closed and the plant control system is capable of rod withdrawal. The required instrumentation provides monitoring capability when the plant is not capable of rod withdrawal and reactor trip protection when rod withdrawal can occur (whenever the reactor trip breakers are closed).

In general, most of the reactor trip instrumentation required during any specific plant operating condition (mode) is required to be operable during the plant physics testing. TS 3.1.8 identifies several specific exceptions to the TS instrumentation operability requirements during the performance of the plant physics testing. The only relaxations allowed for instrumentation are that the required number of operable channels for four different instruments may be reduced from four to three channels during the physics testing.

The Prerequisites of DCD 14.2.10.2.4 will be revised to require completion of DCD 14.2.10.2.3 prior to the initiation of this test..

Design Control Document (DCD) Revision:

The following statement will be added to Prerequisites for DCD 14.2.10.2.4.

The systems, structures, and components required by Technical Specifications shall be operable as required for the specified plant operational mode prior to initiation of precritical, low power physics, and power ascension testing. Verification of proper operation of source-range and intermediate-range excore nuclear instrumentation and associated alarms and protective functions in Startup Test 14.2.10.2.3 shall be completed prior to initiation of this startup test.

The following revision will be made to the Performance Criterion of DCD 14.2.10.2.4, Post-Critical Reactivity Computer Checkout.

Each measurement deviation between the two independent sources of reactivity is within design tolerances. **Adjustment and recalibration or repair of the reactivity computer may be required if the deviation between the two independent sources of reactivity is not within design tolerances.**

PRA Revision:

None