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Our ref: DCP_NRC_003130

February 25, 2011

Subject: CI-SRP16-CTSB-38, CI-SRP16-CTSB-39, and CI-23-18

Westinghouse is submitting responses to NRC confirmatory items from Chapter 16 and Chapter 23 in support of the AP1000® Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the list of NRC issues for DCD Revision 18, Chapter 16. Enclosure 1 also contains the corresponding resolutions to the non-editorial issues. Enclosure 2 contains the corresponding DCD corrections that will be incorporated into Revision 19. From Enclosure 2, DCD pages Tech Spec 3.7.9-2 and Tech Spec Bases 3.7.9 markups are also shown in DCP_NRC_003131.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

R. F. Ziesing
Director, U.S. Licensing

/Enclosure

1. Original list of DCD Revision 18 CTSB Issues, and Westinghouse and NRC agreed upon resolution for CTSB Non-Editorial Issues.
2. Markups to be incorporated into DCD Revision 19, CI-SRP16-CTSB-38, CI-SRP16-CTSB-39, and CI-23-18

DO63
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ENCLOSURE 1

Original List of NRC CTSB Issues for:
DCD Revision 18

AND

Westinghouse and NRC agreed upon resolution for:
CTSB Non-Editorial Issues

This letter intends to cover only the non-editorial issues originally listed in the CTSB issues list sent to Westinghouse on January 4th, 2011. Responses to CTSB editorial issues will be formally documented and sent in a separate letter. The original list of CTSB Issues (including the editorial issues not covered by this letter) is shown italicized below:

CTSB Issues from DCD Revision 18 Review (Confirmatory items)

1. *CI-SRP16-CTSB-38*
   TS 4.3.1.1c states, in part, "... a nominal 11.65 inch center-to-center distance between fuel assemblies placed in the Defective Fuel Cells."
   A value of "11.62 inch" is replaced with "11.65 inch" in Revision 18. This change is not included as a part of the proposed changes in the RAI response and is not consistent with DCD 9.1.2.2.1 description.

2. *CI-SRP16-CTSB-39*
   In the RAI response, changes are proposed to both TS 4.3.1.2 and DCD 9.1.1.3 to resolve inconsistencies between them.
   The proposed change to TS 4.3.1.2 was incorporated in Revision 18 but the proposed change to DCD 9.1.1.3 was missed.

3. *EDITORIAL*
   a. *Page 3.7.6-3. Remove the partition line between the OR and the last Condition F description.*
   b. *Page 5.5-12. Remove the underline from the last paragraph of TS 5.5.13.*
   c. *Page B 3.7.6-9. In the discussion of SR 3.7.6.8 the referenced "SR 3.7.6.8" should be "SR 3.7.6.9." In the discussion of SR 3.7.6.9 the referenced "SR 3.7.6.9" should be "SR 3.7.6.8."*
   d. *Page B 3.7.12-2. In the discussion of Applicable Safety Analyses, the phrase "by LCO 3.7.15" should be "by LCO 5.7.11."*
   e. *TS 3.3.1 (Table 3.3.1-1 page 2 of 4); remove the superscript (i) at bottom of page*
   f. *B 3.3.2 (Nominal Trip Setpoint) 2nd Paragraph 3rd sentence, add a space between "conservativewith" to become "are conservative with respect"*

4. *Turbine trip in TS 3.3.2*
   In TS 3.3.2, Table 3.3.2-1, pg 3 of 13, Function 5, Turbine Trip (c. Safeguard Actuation) and bases page B 3.3.2-9/10 Applicability – Safety Analysis, Function 1, Safeguards Actuation, Turbine Trip, the turbine trip was deleted. We couldn't find the change package that removed these trips; please advise if they were removed with justification and which change package that was included in.

CTSB Issues from DCD Revision 18 Review (Design Change Package Incorporation)
Inconsistencies between TS 3.7.9 and DCD 9.1.3:

5. *DCD 9.1.3.4.3 states, in part, "... minimum volume in the passive containment cooling water storage tank for spent fuel pool makeup is 756700 gallons."*
   SR 3.7.9.2 states "verify the PCCWST volume is ≥ 400,000 gallons."
   The value of "400000 gallons" appears to be for the AP600 design and was carried over to the AP1000 design.

6. *SR 3.7.9.3 states "verify the water level in the cask washdown pit is ≥ 13.75 ft. and in communication with the spent fuel storage pool."*

   The phrase "and in communication with the spent fuel storage pool" is not consistent with the discussion of SR 3.7.9.3 and DCD 9.1.3.4.3 description which indicates use of manual isolation valves between the cask washdown pit and the spent fuel storage pool.

7. *SR 3.7.9.4 states "verify the water level in the cask loading pit is ≥ 43.9 ft. and in communication with the spent fuel storage pool."*
   The discussion of SR 3.7.9.4 in the bases which indicates use of manual isolation valves between the cask loading pit and the spent fuel storage pool is not consistent with SR 3.7.9.4 requirements and DCD 9.1.3.4.3 description which require opening of a gate.

8. *On Page B 3.7.9-1, 4th Paragraph, 1st Sentence, the phrase "below 4.6 MWt" should be "below 4.7 MWt."*

From the above issue list, those issues not labeled as editorial (all items excluding item 3), plus any additional non-editorial issues discovered after the list was sent to Westinghouse, are covered and answered by Westinghouse in the responses given below:

1. **CI-SRP16-CTSB-38**
   TS 4.3.1.1c states, in part, "... a nominal 11.65 inch center-to-center distance between fuel assemblies placed in the Defective Fuel Cells."

   A value of "11.62 inch" is replaced with "11.65 inch" in Revision 18. This change is not included as a part of the proposed changes in the RAI response and is not consistent with DCD 9.1.2.2.1 description.

Westinghouse Response (Item #1):

The nominal 11.65" center-to-center distance between fuel assemblies placed in the Defective Fuel Cells comes from a revision to our Spent Fuel Pool (SFP) Structural Analysis, TR54 R3 (APP-GW-GLR-033 R3) created in Fall 2009. This analysis was sent to the NRC in DCP_NRC_002697 on November 20th, 2009, but DCD markups were not included with the letter. Westinghouse realized this oversight during finalization of DCD Revision 18, and decided to update Ch. 16 with the new numbers resulting from the analysis (documented as Westinghouse Management Issue Item #CR42). Impacts to Chapter 9 as a result of this change were missed at the time. During the Chapter 16 phone call, Westinghouse proposed to keep the 11.65" dimension in Chapter 16, and update Ch. 9 to reflect this change in nominal fuel assembly distance for assemblies placed in the Defective Fuel Cells. During the NRC reactor systems branch review of this proposed mark-up, new issues were discovered by the NRC with the Westinghouse SFP criticality analysis. As a result, the DCD mark-up to Chapter 9 for this resolution are dependent upon resolution to the SFP criticality issue, and the mark-up will be included in DCP_NRC_003133.

2. **CI-SRP16-CTSB-39**

In the RAI response, changes are proposed to both TS 4.3.1.2 and DCD 9.1.1.3 to resolve inconsistencies between them.

The proposed change to TS 4.3.1.2 was incorporated in Revision 18 but the proposed change to DCD 9.1.1.3 was missed.

Westinghouse Response (Item #2):

Westinghouse agrees that the change proposed in the RAI was not incorporated into Chapter 9. During the NRC Chapter 16 phone call, Westinghouse proposed to properly incorporate the change as it is shown in the RAI response. The NRC agreed with one exception: the words "new fuel" should not be removed to be consistent with other DCD sections. Westinghouse agreed, and this proposed change will be incorporated into the DCD for Revision 19. The corresponding DCD mark-up for this resolution is attached in Enclosure 2.

4. **Turbine trip in TS 3.3.2**

In TS 3.3.2, Table 3.3.2-1, pg 3 of 13, Function 5, Turbine Trip (c. Safeguard Actuation) and bases page B 3.3.2-9/10 Applicability – Safety Analysis, Function 1, Safeguards Actuation, Turbine Trip, the turbine trip was deleted. We couldn't find the change package that removed these trips; please advise if they were removed with justification and which change package that was included in.

Westinghouse Response (Item #4):

Safeguards Actuation is not a signal input to a turbine trip. DCD Table 7.3-1, Actuation Signal 7, Turbine Trip, shows that Safeguards actuations is not a signal input. Going back to Revision 15 of the DCD, Safeguards actuation does not exist in Table 7.3-1 as a signal input to a turbine trip. The NRC also acknowledged in the FSER for Chapter 7 of Revision 15 that the only conditions that will initiate turbine trip are reactor trip, high-2 steam generator narrow-range water level, or manual feedwater isolation. The need for removal of function 5 from the Tech Spec was brought to management attention during finalization of Revision 18. This was documented by Westinghouse as Management Issue Item #CR63. Westinghouse also wrote CAP 10-250-M003 in September 2010 to formally document the need to remove this function. Westinghouse management decided that the Tech Spec needed to be revised in Revision 18 to remove function 5.c to be consistent with Chapter 7. Westinghouse explained this position during the NRC Chapter 16 phone call, and the NRC agreed that function 5.c needed to be removed to be consistent with Chapter 7. No DCD mark-up is included for this resolution as the agreed upon revision was properly incorporated into Revision 18 of the DCD.

Resolutions for Inconsistencies between TS 3.7.9 and DCD 9.1.3:

5. DCD 9.1.3.4.3 states, in part, "... minimum volume in the passive containment cooling water storage tank for spent fuel pool makeup is 756700 gallons."

   SR 3.7.9.2 states "verify the PCCWST volume is ≥ 400,000 gallons."

   The value of "400000 gallons" appears to be for the AP600 design and was carried over to the AP1000 design.

Westinghouse Response (Item #5):

Westinghouse agrees that this was a missed impact, and during the NRC Chapter 16 phone call proposed to update Chapter 16 with the correct volume of water, 756,700 gallons to be consistent with Chapter 9. This proposed resolution was agreed to by the NRC during the phone call, and will be incorporated into the DCD for Revision 19. The corresponding DCD mark-ups are attached in Enclosure 2.

6. SR 3.7.9.3 states "verify the water level in the cask washdown pit is ≥ 13.75 ft. and in communication with the spent fuel storage pool ."

   The phrase "and in communication with the spent fuel storage pool" is not consistent with the discussion of SR 3.7.9.3 and DCD 9.1.3.4.3 description which indicates use of manual isolation valves between the cask washdown pit and the spent fuel storage pool.

Westinghouse Response (Item #6):

Westinghouse agrees that the phrase "and in communication with the spent fuel storage pool" is not appropriate for SR 3.7.9.3. Westinghouse proposed to delete the phrase "and in communication with the spent fuel storage pool" in SR 3.7.9.3 during the NRC Chapter 16 phone call. This proposed resolution was agreed to by the NRC during the phone call, and will be incorporated into Revision 19 of the DCD. The corresponding DCD mark-up of this change is attached in Enclosure 2.

7. SR 3.7.9.4 states "verify the water level in the cask loading pit is ≥ 43.9 ft. and in communication with the spent fuel storage pool ."

   The discussion of SR 3.7.9.4 in the bases which indicates use of manual isolation valves between the cask loading pit and the spent fuel storage pool is not consistent with SR 3.7.9.4 requirements and DCD 9.1.3.4.3 description which require opening of a gate.

   Westinghouse Response (Item #7):
   Westinghouse believes the phrase "and in communication with the spent fuel storage pool" is appropriate for SR 3.7.9.4. While the cask washdown pit (CWP) and SFP should not be in communication with each other, the cask loading pit (CLP) and SFP should be connected to each other. Westinghouse proposed to keep this phrase in SR 3.7.9.4 during the NRC Chapter 16 phone call. This proposed resolution was agreed to by the NRC during the phone call with the exception that a description be added to the Tech Spec Bases for SR 3.7.9.4 to clarify how it is in communication with the spent fuel pool. Westinghouse agreed to add a description to the Tech Spec Bases for SR 3.7.9.4, and will incorporate this change into Revision 19 of the DCD. The corresponding DCD mark-ups are attached in Enclosure 2.

8. On Page B 3.7.9-1, 4th Paragraph, 1st Sentence, the phrase "below 4.6 MWt" should be "below 4.7 MWt."

   Westinghouse Response (Item #8):
   All references to the maximum decay heat in the SFP without the use of the CWP or CLP should be 4.7MWt. However, to be correct as possible, the inequality signs or wording that precedes the spent fuel pool decay heat values in Chapters 16 and 9 needs to be revised to be consistent with the calculation, APP-SFS-M3C-012 Rev.4. This calculation has been reviewed by the Chapter 9 NRC staff and approved. During the NRC Chapter 16 phone call, Westinghouse proposed revising SFP decay heat values and wording in Chapter 9 and 16 to be consistent with the calculation, APP-SFS-M3C-012 Rev. 4. By revising these values to be consistent between Chapter 9 and 16, Westinghouse will also resolve issues raised by the NRC during their review of Confirmatory Item 23-18, and Confirmatory Item 23-18 should be closed out upon incorporation of these proposed changes. This proposed resolution was agreed to by the NRC during the phone call, and will be incorporated into Revision 19 of the DCD. The corresponding DCD mark-ups of this change are attached in Enclosure 2.

NEW CTSB Issues not addressed in the Change Packages:

N1. Page B 3.3.2-11: In the discussion of Function 1.b, Revision 18 only incorporates changes proposed for DCP 64. This incorporation may be in conflict with proposed changes from RAI for the Setpoint Control Program. This comment also applies to the discussion of Function 4.b on Page B 3.3.2-18, and Function 12.b on Page B 3.3.2-33.

Westinghouse Response (Item #N1):

Westinghouse also discovered this conflict between Change No. 64 and RAI-SRP16.3-CTSB-SCP-1, R1 during internal reviews of Revision 18. This issue went to Westinghouse management and became management issue item #CR31 on the management issues list. Proposed DCD mark-ups for Change No. 64 were issued to the NRC in formal letter DCP_NRC_002879 sent to the NRC on May 25th, 2010. While R1 of RAI-SRP16.3-CTSB-SCP-1 was sent to the NRC on May 6th, 2010, the proposed changes from the RAI in conflict with Change No. 64 were also included in R0 of the RAI which was sent at a much earlier date, on February 19, 2010. Thus, the RAI did not incorporate the latest AP1000 design changes as was done in Change No. 64. It was also noted that the application of uncertainties is covered in the set point methodology. On these bases, Westinghouse management decided that the newer revisions from Change No. 64 superseded revisions originally proposed in RAI-SRP16.3-CTSB-SCP-1. This decision to have the newer proposed changes supersede older proposed changes is consistent in regards to decisions made about other RAIs in conflict with each other. Westinghouse explained this position during the NRC Chapter 16 phone call, and the NRC agreed that Change No. 64 superseded the RAI. No DCD mark-up is included for this resolution as the agreed upon revision was properly incorporated into Revision 18.

N2. This question refers to Actions B.1 and B.2 from AP1000 TS B3.4.13
If one required ADS stage 4 flow path is closed and inoperable, TS state, “the required vent area may be restored by opening an alternate vent path with an equivalent area”. There are few RCS vent paths as large as the 14 inch stage 4 ADS valve. Two come to mind, the pressurizer manway and the steam generator manways.

I am concerned that using a pressurizer manway as a substitute for an ADS stage 4 valve may fail gravity injection from the IRWST. Following a loss of RNS during midloop with high decay heat, the steam generation rate can be very high. RCS venting via the pressurizer can result in hotleg inventory being swept into the pressurizer and being entrained due to high steam generation rates combined with frictional losses in the surge line. This condition can negate the IRWST elevation head necessary for successful gravity injection. Therefore, a pressurizer manway may not be an adequate “equivalent vent path” for an inoperable stage 4 ADS valve.

Since the steam generator man ways are low elevation RCS vents compared to the pressurizer, this pressurizer surge line flooding phenomena cannot occur and should be an acceptable vent path.

Westinghouse Response (Item #N2):

Westinghouse agrees that the way the current Bases is written leaves open the possibility that the pressurizer manway could be used as an alternate vent path. Westinghouse proposed adding a sentence to Section B.1 and B.2 of B 3.4.13 to exclude the use of the pressurizer manway as an alternate vent path when an ADS stage 4 flow path is inoperable. The NRC agreed to the proposed resolution during the Chapter 16 phone calls, and the proposed change will be included in Revision 19 of the DCD. The corresponding DCD mark-up of this change is attached in Enclosure 2.

Design Control Document (DCD) Revision:
DCD Mark-Ups of Revision 18 are attached in Enclosure 2.

PRA Revision:
None

Technical Report (TR) Revision:
None

ENCLOSURE 2

Markups to be incorporated into DCD Revision 19,
CI-SRP16-CTSB-38, CI-SRP16-CTSB-39, and CI-23-18

E. Internally Generated Missiles

The fuel handling area does not contain any credible sources of internally generated missiles.

Stress analyses are performed by the vendor using loads developed by the dynamic analysis. Stresses are calculated at critical sections of the rack and compared to acceptance criteria referenced in ASME Section III, Division I, Article NF3000.

9.1.1.3 Safety Evaluation

The new fuel rack, being a seismic Category I structure, is designed to withstand normal and postulated dead loads, live loads, loads resulting from thermal effects, and loads caused by the safe shutdown earthquake event.

The design of the new fuel rack is such that K_{eff} (with all biases and uncertainties) remains less than or equal to 0.95 with full density unborated water and less than or equal to 0.98 with optimum moderation and full reflection conditions.

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The criticality evaluation considers the inherent neutron absorbing effect of the materials of construction, including fixed neutron absorbing "poison" material.

The new fuel rack is located in the new fuel storage pit, which has a large cover to protect the new fuel from debris. This large cover contains smaller openings/ports that access each new fuel assembly cell and have their own individual cover. Each small cover is opened/removed sequentially during new fuel transfer operations to gain access to the affected assembly and is then replaced. Both covers typically remain closed to prevent debris and foreign materials from entering the new fuel pit, new fuel rack, and new fuel assemblies. No loads are required to be carried over the new fuel storage pit while the large cover is in place. The large cover is designed such that it will not fall and damage the new fuel or new fuel rack during a seismic event. Administrative controls are utilized when either of the covers is removed for new fuel transfer operations to limit the potential for dropped object damage.

Based on the conservative design and operation of the single failure-proof FHM hoist and associated lifting tools to handle unirradiated new fuel assemblies, dropping a new fuel assembly is deemed unlikely, poses no safety or radiological consequences, and therefore, does not require analysis. Handling equipment (cask handling crane) capable of carrying loads heavier than fuel components is prevented from traveling over the fuel storage area. The new fuel storage rack can withstand an uplift force of 4000 pounds.

Materials used in new fuel rack construction are compatible with the storage pit environment, and surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel. Structural materials are corrosion resistant and will not contaminate the fuel assemblies or storage pit environment. Neutron absorbing "poison" material used in the new fuel rack design has been qualified for the storage environment. Venting of the neutron absorbing material is considered in the detailed design of the new fuel storage rack.

The new fuel assemblies are stored dry. The rack structure is designed to maintain a safe geometric array for normal and postulated accident conditions. The fixed neutron absorbing

This water transfer method improves water clarity in the refueling cavity during refueling operations as compared to conventional pressurized water reactors that have performed this function with their residual heat removal system by flooding up through the reactor vessel into the refueling cavity.

Once the refueling cavity is flooded, the standby mechanical train is re-aligned to cool and purify the refueling cavity. This mode of operation continues as needed. If the heat load is such that both pumps and heat exchangers are needed to cool the spent fuel pool, then the spent fuel pool cooling system can be aligned for that operation.

At the completion of the refueling, the standby spent fuel pool pump is used to transfer the water in the refueling cavity back to the in-containment refueling water storage tank. Once this is complete, the standby train can be aligned to cool the spent fuel pool or may be placed in standby.

9.1.3.4.3 Abnormal Conditions

The AP1000 spent fuel pool cooling system is not required to operate to mitigate design basis events. In the event the spent fuel pool cooling system is unavailable, spent fuel cooling is provided by the heat capacity of the water in the pool. Connections to the spent fuel pool are made at an elevation to preclude the possibility of inadvertently draining the water in the pool to an unacceptable level.

In the unlikely event of an extended loss of normal spent fuel pool cooling, the water level will drop. Low spent fuel pool level alarms in the control room will indicate to the operator the need to initiate makeup water to the pool. These alarms are provided from safety-related level instrumentation in the spent fuel pool. With the use of makeup water, the pool level is maintained above the spent fuel assemblies for at least 7 days. Initial spent fuel pool water level is controlled by technical specifications. During the first 72 hours any required makeup water is supplied from safety related sources. If makeup water beyond the safety related sources is required between 72 hours and 7 days, water from the passive containment cooling system ancillary water storage tank is provided to the spent fuel pool. The amount of makeup required to provide the 7 day

capability depends on the decay heat level of the fuel in the spent fuel pool and is provided as follows:

- When the calculated decay heat level in the spent fuel pool is less than or equal to 4.7 MWt, no makeup is needed to achieve spent fuel pool cooling for at least 72 hours.
- When the calculated decay heat level in the spent fuel pool is greater than 4.7 MWt and less than or equal to 5.6 MWt, safety related makeup from the cask washdown pit is sufficient to achieve spent fuel pool cooling for at least 72 hours. A minimum level of 13.75 feet in the cask washdown pit is provided for this purpose. Availability of the makeup source is controlled by technical specifications.
- When the calculated decay heat level in the spent fuel pool is greater than 5.6 MWt and less than or equal to 7.2 MWt, safety-related makeup from the cask washdown pit and cask loading pit is sufficient to achieve spent fuel pool cooling for at least 72 hours. A minimum

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level of 13.75 feet in the cask washdown pit and 43.9 feet in the cask loading pit is provided for this purpose. Availability of the makeup sources is controlled by technical specifications.

- When calculated decay heat level in the spent fuel pool is greater than 7.2 MWt makeup from the passive containment cooling water storage tank or passive containment cooling ancillary water storage tank, or combination of the two tanks, is sufficient to achieve spent fuel pool cooling for at least 7 days.

- When the decay heat level in the reactor is at or below 6.0 MW, the passive containment cooling water storage tank is not needed for containment cooling and this water can be used for makeup to the spent fuel pool. This tank provides safety related makeup for at least 72 hours. Between 72 hours and 7 days the tank continues to provide makeup water as required until it is empty. If the passive containment cooling water storage tank empties in less than 7 days, non-safety makeup water can be provided from the passive containment cooling ancillary water storage tank.

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- When the decay heat level in the reactor is greater than 6 MW, the water in the passive containment cooling water storage tank is reserved for containment cooling. Safety related spent fuel pool cooling is provided for at least 72 hours from the pool itself and makeup water from the cask washdown pit and cask loading pit. After 72 hours, non-safety related makeup can be provided from the passive containment cooling ancillary water storage tank.

- Minimum volume in the passive containment cooling water storage tank for spent fuel pool makeup is 756,700 gallons. Availability of this makeup source for the first 72 hours is controlled by technical specifications. Minimum volume in the passive containment ancillary water storage tank for spent fuel pool makeup is 201,600 gallons.

Table 9.1-4 provides the calculated timing and spent fuel pool water levels for several limiting event scenarios which would require makeup to the spent fuel pool.

Alignment of the cask washdown pit is accomplished by positioning manual valves located in the waste monitor tank room B (12365) in the auxiliary building. Alignment of the passive containment cooling water storage tank is accomplished by positioning manual valves located in the mid annulus access room (12345) and in the passive containment cooling valve room in the upper shield building. Because these alignments are made by positioning manual valves, they are not susceptible to active failures.

Alignment of the cask loading pit is accomplished by opening the gate, shown in Figure 9.1-6, located between the cask loading pit and the spent fuel pool. The cask loading pit gate should be opened prior to exceeding 5.6 MWt in the spent fuel pool.

Gravity driven flow from the cask washdown pit to the spent fuel pool is provided as the cask washdown pit water level will follow the spent fuel pool level. Figures 9.1-5 and 9.1-6 show the connection of the cask washdown pit to the spent fuel pool.

Gravity driven flow from the passive containment cooling water storage tank is controlled by a manual throttle valve with local flow indication which is set to achieve the desired flow when the

Table 9.1-4

STATION BLACKOUT/SEISMIC EVENT TIMES(1)(9)

Event	Time to Saturation(1) (hours)	Height of Water Above Fuel at 72 Hours(4) (feet)	Height of Water Above Fuel at 7 Days(4) (feet)
Seismic Event(2) – Power Operation Immediately Following a Refueling(7)	7.38	1.4(6)	1.4(6)
Seismic Event(8) – Refueling, Immediately Following Spent Fuel Region Offload(3)(7)	5.59	4.2(5)	4.2(5)
Seismic Event(8) – Refueling, Emergency Full Core Off-Load(3) Immediately Following Refueling(7)	2.33	8.0(5)	8.0(6)

Notes:

1. Times calculated neglect heat losses to the passive heat sinks in the fuel area of the auxiliary building.
2. Seismic event assumes water in the pool is initially drained to the level of the spent fuel pool cooling system connection simultaneous with a station blackout. Fuel cooling water sources are spent fuel pool, fuel transfer canal (including gate), and cask washdown pit for 72 hours. Between 72 hours and 7 days fuel cooling water provided from passive containment cooling system ancillary water storage tank.
3. Fuel movement complete, 150 hours after shutdown.
4. See subsection 9.1.3.5 for minimum water level.
5. Alignment of PCS water storage for supply of makeup water permits maintaining pool level at this elevation. Decay heat in reactor vessel is at or below 6.0 MW, thus no PCS water is required for containment cooling.
6. Alignment of the PCS ancillary water storage tank and initiation of PCS recirculation pumps provide a makeup water supply to maintain this pool level or higher above the top of the fuel.
7. The number of fuel assemblies refueled has been conservatively established to include the worst case between an 18-month fuel cycle plus 5 defective fuel assemblies (69 total assemblies or 44% of the core) and a 24-month fuel cycle plus 5 defective fuel assemblies (77 total assemblies or 49% of the core).
8. Seismic event assumes water in the pool is initially drained to the level of the spent fuel pool cooling system connection simultaneous with a station blackout. Fuel cooling water sources are spent fuel pool, fuel transfer canal (including gate), cask washdown pit, cask loading pit, and passive containment cooling system water storage tank for 72 hours.
9. A minimum of 18 hours is available for operator action to align makeup water to the spent fuel pool after a seismic event.

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SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.9.1	- NOTE - Only required to be performed when spent fuel storage pool calculated decay heat is > 7.2 MWt.	
	Verify one passive containment cooling system, motor-operated valve in each flow path is closed and locked, sealed, or otherwise secured in position.	7 days
SR 3.7.9.2	- NOTE - Only required to be performed when spent fuel storage pool calculated decay heat is > 7.2 MWt.	
	Verify the PCCWST volume is ≥756,700 gallons.	7 days
SR 3.7.9.3	- NOTE - Only required to be performed when spent fuel storage pool calculated decay heat is ≤7.2 MWt.	
	Verify the water level in the cask washdown pit is ≥13.75 ft.	31 days
SR 3.7.9.4	- NOTE - Only required to be performed when spent fuel storage pool calculated decay heat is > 5.6 MWt and ≤7.2 MWt.	
	Verify the water level in the cask loading pit is ≥43.9 ft. and in communication with the spent fuel storage pool.	31 days

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Table B 3.0-1 (page 1 of 1)
Passive Systems Shutdown MODE Matrix

LCO Applicability	Automatic Depressurization System	Core Makeup Tank	Passive RHR	IRWST	Containment	Containment Cooling[1]
MODE 5 RCS pressure boundary intact	9 of 10 paths OPERABLE All paths closed LCO 3.4.12	One CMT OPERABLE LCO 3.5.3	System OPERABLE LCO 3.5.5	One injection flow path and one recirculation sump flow path OPERABLE LCO 3.5.7	Closure capability LCO 3.6.8	Three water flow paths OPERABLE LCO 3.6.7
Required End State	MODE 5 RCS pressure boundary open, ≥20% pressurizer level	MODE 5 RCS pressure boundary open, ≥20% pressurizer level	MODE 5 RCS pressure boundary open, ≥20% pressurizer level	MODE 5 RCS pressure boundary intact, ≥20% pressurizer level	MODE 5 RCS pressure boundary intact, ≥20% pressurizer level	MODE 5 RCS pressure boundary intact, ≥20% pressurizer level
MODE 5 RCS pressure boundary open or pressurizer level < 20%	Stages 1, 2, and 3 open 2 stage 4 valves OPERABLE LCO 3.4.13	None	None	One injection flow path and one recirculation sump flow path OPERABLE LCO 3.5.7	Closure capability LCO 3.6.8	Three water flow paths OPERABLE LCO 3.6.7
Required End State	MODE 5 RCS pressure boundary open, ≥20% pressurizer level			MODE 5 RCS pressure boundary intact, ≥20% pressurizer level	MODE 5 RCS pressure boundary intact, ≥20% pressurizer level	MODE 5 RCS pressure boundary intact, ≥20% pressurizer level
MODE 6 Upper internals in place	Stages 1, 2, and 3 open 2 stage 4 valves OPERABLE LCO 3.4.13	None	None	One injection flow path and one recirculation sump flow path OPERABLE LCO 3.5.8	Closure capability LCO 3.6.8	Three water flow paths OPERABLE LCO 3.6.7
Required End State	MODE 6 Upper internals removed			MODE 6 Refueling cavity full	MODE 6 Refueling cavity full	MODE 6 Refueling cavity full
MODE 6 Upper internals removed	None	None	None	One injection flow path and one recirculation sump flow path OPERABLE LCO 3.5.8	Closure capability LCO 3.6.8	Three water flow paths OPERABLE LCO 3.6.7
Required End State				MODE 6 Refueling cavity full	MODE 6 Refueling cavity full	MODE 6 Refueling cavity full

(1) Containment cooling via PCS is not required when core decay heat ≤6.0 MWt.

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ACTIONS

A.1 and A.2

If one required ADS stage 1, 2, or 3 flow path is closed, action must be taken to open the affected path or establish an alternative flow path within 72 hours. In this Condition the remaining open ADS stage 1, 2, and 3 flow paths and the OPERABLE ADS stage 4 flow paths are adequate to perform the required safety function without an additional single failure. The stage 4 valves would have to be opened by the operator in case of an event in this MODE. The required vent area may be restored by opening the affected ADS flow path or an alternate vent path with an equivalent area. Considering that the required function is available in this Condition a Completion Time of 72 hours is acceptable.

B.1 and B.2

If one required ADS stage 4 flow path is closed and inoperable, action must be taken to establish an alternative flow path, or restore at least two stage 4 flow paths to OPERABLE status within 36 hours. In this Condition the remaining open ADS stage 1, 2, and 3 flow paths and the one OPERABLE ADS stage 4 flow path are adequate to perform the required safety function without an additional single failure. The required vent area may be restored by opening an alternate vent path with an equivalent area. Acceptable alternate vent paths exclude the use of the pressurizer manway as pressurizer surge line flooding phenomena can negate the IRWST elevation head necessary for successful gravity injection. Alternatively, two stage 4 flow paths may be restored to OPERABLE status. Therefore a Completion Time of 36 hours is considered acceptable.

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C.1 and C.2

If the Required Actions and associated Completion Times are not met or the requirements of LCO 3.4.13 are not met for reasons other than Conditions A or B while in MODE 5, the plant must be placed in a condition which minimizes the potential for requiring ADS venting and IRWST injection. The time to RCS boiling is maximized by increasing RCS inventory to ≥20% pressurizer level and maintaining RCS temperature as low as practical.

Additionally, action to suspend positive reactivity additions is required to ensure that the SDM is maintained. Sources of positive reactivity addition include boron dilution, withdrawal of reactivity control assemblies, and excessive cooling of the RCS.

BASES

APPLICABILITY

OPERABILITY of the PCS is required in either MODE 5 or 6 with the calculated reactor decay heat greater than 6 MWt for heat removal in the event of a loss of nonsafety decay heat removal capabilities.

With the decay heat at or below 6.0 MWt, the decay heat can be removed from containment with air cooling alone. Confirmation of decay heat levels may be determined consistent with the assumptions and analysis basis of ANS 1979 plus 2 sigma or via an energy balance of the reactor coolant system.

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The PCS requirements in MODES 1, 2, 3, and 4 are specified in LCO 3.6.6, "Passive Containment Cooling System (PCS) – Operating."

ACTIONS

A.1

With one passive containment cooling water flow path inoperable, the affected flow path must be restored within 7 days. In this degraded condition, the remaining flow paths are capable of providing greater than 100% of the heat removal needs after an accident, even considering the worst single failure. The 7 day Completion Time was chosen in light of the remaining heat removal capability and the low probability of a DBA occurring during this period.

B.1

With two passive containment cooling water flow paths inoperable, at least one affected flow path must be restored to OPERABLE status within 72 hours. In this degraded condition, the remaining flow path is capable of providing greater than 100% of the heat removal needs after an accident. The 72 hour Completion Time was chosen in light of the remaining heat removal capability and the low probability of an event occurring during this period.

C.1

If the cooling water tank is inoperable, it must be restored to OPERABLE status within 8 hours. The tank may be declared inoperable due to low water volume or temperature out of limits. The 8 hour Completion Time is reasonable based on the remaining heat removal capability of the system and the availability of cooling water from alternate sources.

D.1.1, D.1.2, and D.2

Action must be initiated if any of the Required Actions and associated Completion Times are not met, or if the LCO is not met for reasons other than Condition A, B, or C. If in MODE 5 with the RCS pressure boundary

B 3.7 PLANT SYSTEMS

B 3.7.9 Fuel Storage Pool Makeup Water Sources

BASES

BACKGROUND

The spent fuel storage pool is normally cooled by the nonsafety spent fuel pool cooling system. In the event the normal cooling system is unavailable, the spent fuel storage pool can be cooled by the normal residual heat removal system. Alternatively, the spent fuel storage pool contains sufficient water inventory for decay heat removal by boiling. To support extended periods of loss of normal pool cooling, makeup water is required to provide additional cooling by boiling. Both safety and non-safety makeup water sources are available on-site.

Three safety-related, gravity fed sources of makeup water are provided to the spent fuel storage pool. These makeup water sources contain sufficient water to maintain spent fuel storage pool cooling for 72 hours. When the spent fuel storage pool decay heat is > 4.7 MWt and ≤7.2 MWt, the cask washdown pit must be available to provide makeup to the spent fuel storage pool. When the spent fuel storage pool decay heat is > 5.6 MWt and ≤7.2 MWt both the cask washdown pit and the cask loading pit must be available to provide makeup to the spent fuel storage pool.. When the spent fuel storage pool decay heat is > 7.2 MWt and the reactor decay heat is ≤6.0 MWt, the Passive Containment Cooling Water Storage Tank (PCCWST) must be available to provide makeup water to the spent fuel storage pool (when the tank is no longer required for containment cooling purposes). Additional on-site makeup water sources are available to provide spent fuel storage pool cooling between 3 and 7 days.

The PCCWST is isolated by two normally closed valves. The normally closed valves will be opened only to provide emergency makeup to the spent fuel storage pool. A third downstream valve permits the operator to regulate addition of water to the spent fuel storage pool as required to maintain the cooling water inventory.

Once decay heat in the spent fuel storage pool is reduced to at or below 4.7 MWt, the spent fuel storage pool water inventory is sufficient, without makeup, to maintain the spent fuel storage pool for 72 hours. When the spent fuel storage pool decay heat load is ≤5.6 MWt for the cask loading pit and ≤4.7 MWt for the cask washdown pit, the pits are no longer required to be OPERABLE for spent fuel storage pool makeup.

A general description of the spent fuel storage pool design is given in Section 9.1.2 (Ref. 1). A description of the Spent Fuel Pool Cooling and Cleanup System is given in Section 9.1.3 (Ref. 2).

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APPLICABLE SAFETY ANALYSES

In the event the normal spent fuel storage pool cooling system is unavailable, the spent fuel cooling is provided by the heat capacity of the water in the pool. The worst case decay heat load (decay heat > 7.2 MWt) is produced by an emergency full core off-load following a refueling plus ten years of spent fuel. For this case the spent fuel storage pool inventory provided by the water over the stored fuel and below the pump suction connection is capable of cooling the spent fuel storage pool without boiling for at least 2.5 hours, following a loss of normal spent fuel storage pool cooling. After boiling starts, makeup water may be required to replace water lost by boiling and is available, without offsite support, via the PCCWST.

The requirements of LCO 3.6.6, "Passive Containment Cooling System – Operating," are applicable in MODES 1, 2, 3, and 4 and LCO 3.6.7, "Passive Containment Cooling System – Shutdown," are applicable in MODES 5 and 6 with reactor decay heat > 6.0 MWt. LCOs 3.6.6 and 3.6.7 require availability of the containment cooling water tank for containment heat removal. At or below 6.0 MWt reactor decay heat, containment air cooling is adequate.

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Since none of the Chapter 15 Design Basis Accident analyses assume availability of the PCCWST, the cask washdown pit, or the cask loading pit for spent fuel storage pool makeup, the spent fuel storage pool makeup water sources specification does not satisfy any of the 10 CFR 50.36(c)(2)(ii) criteria. This LCO is included in accordance with NRC guidance provided in an NRC letter (Reference 3).

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LCO

The spent fuel storage pool makeup water sources are required to contain the following amount of water to be considered OPERABLE:

- Cask washdown pit water level must be ≥13.75 ft.
- Cask loading pit water level must be ≥43.9 ft.
- PCCWST is required to contain 756,700 gallons of water.

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An OPERABLE flow path from the required makeup source assures spent fuel cooling for at least 72 hours. Several additional makeup sources are available, including the ground level PCCAWST. These makeup sources assure spent fuel cooling for at least 7 days.

Note 1 specifies that the cask washdown pit is required to be OPERABLE when the spent fuel storage pool decay heat is ≥ 4.7 MWt and ≤7.2 MWt.

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LCO (continued)

Note 2 specifies that the cask loading pit is required to be OPERABLE when the spent fuel storage pool decay heat is > 5.6 MWt and ≤7.2 MWt.

Note 3 specifies that the PCCWST is required to be OPERABLE when the spent fuel storage pool decay heat is > 7.2 MWt, which is normal following a full core off load. The larger makeup source is necessary for the higher decay heat load. In MODE 5 and 6, with the calculated reactor decay heat > 6.0 MWt, the PCCWST is reserved for containment cooling in accordance with LCO 3.6.7, Passive Containment Cooling System (PCS) – Shutdown. Thus, fuel movement from the reactor to the spent fuel storage pool must be suspended until reactor decay heat is ≤6.0 MWt if the fuel movement will increase the spent fuel storage pool decay heat to > 7.2 MWt.

When a portion of the fuel is returned to the reactor vessel in preparation for startup, the pool decay heat is reduced to ≤5.6 MWt and makeup from the cask washdown pit is sufficient.

APPLICABILITY

This LCO applies during storage of fuel in the spent fuel storage pool with a calculated decay heat > 4.7 MWt. With decay heat ≤ 4.7 MWt, the assumed spent fuel storage pool water inventory (i.e., level below the pump suction connection to the pool) provides for 3 days of cooling without makeup.

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ACTIONS

LCO 3.0.3 is applicable while in MODE 1, 2, 3, or 4. Since spent fuel pool cooling requirements apply at all times, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. Spent fuel pool cooling requirements are independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily.

LCO 3.0.8 is applicable while in MODE 5 or 6. Since spent fuel pool cooling requirements apply at all times, the ACTIONS have been modified by a Note stating that LCO 3.0.8 is not applicable. Spent fuel pool cooling requirements are independent of shutdown reactor operations. Entering LCO 3.0.8 while in MODE 5 or 6 would require the optimization of plant safety, unnecessarily.

A.1

If the cask washdown pit (with spent fuel storage pool decay heat > 4.7 and ≤7.2 MWt), the cask loading pit (with spent fuel storage pool decay heat > 5.6 MWt and ≤7.2 MWt) or the PCCWST (with spent fuel storage pool decay heat > 7.2 MWt) is inoperable, Action must be initiated

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ACTIONS (continued)

immediately to restore the makeup source or its associated flow path to OPERABLE status.

Additionally, in order to provide the maximum cooling capability, the spent fuel pool should be filled to its maximum level. Nonsafety related makeup sources can be used to fill the pool. This action is not specified in the specification, since the benefit of adding approximately 6 inches of water to the pool is less than a 5% improvement in cooling capability.

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR verifies that the three flow paths from the PCCWST to the containment vessel are isolated and secured to prevent inadvertent opening and loss of required tank volume. The verification is required to be performed prior to declaring the PCCWST OPERABLE for spent fuel storage pool usage.

The 7 day Frequency is appropriate because the valves in the passive containment cooling system are controlled by plant procedures.

SR 3.7.9.2

This SR verifies sufficient PCCWST volume is available in the event of a loss of spent fuel cooling prior to declaring the tank OPERABLE for spent fuel storage pool usage.

The 7 day Frequency is appropriate because the volume in the PCCWST is normally stable and water level changes are controlled by plant procedures.

SR 3.7.9.3

This SR verifies sufficient cask washdown pit water volume is available in the event of a loss of spent fuel cooling. The 13.75 ft level specified provides makeup water for stored fuel with decay heat > 4.7 and ≤7.2 MWt. The cask washdown pit is no longer required when the PCCWST is OPERABLE for spent fuel storage pool usage.

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The 31 day Frequency is appropriate because the cask washdown pit has only one drain line which is isolated by series manual valves which are only operated in accordance with plant procedures, thus providing assurance that inadvertent level reduction is not likely.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.9.4

This SR verifies sufficient cask loading pit water volume is available and connected to the spent fuel pool such that no action is required in the fuel handling area, in the event of a loss of spent fuel cooling. The 43.9 foot level specified provides makeup water for stored fuel with decay heat > 5.6 and ≤7.2 MWt. The cask loading pit is no longer required when the PCCWST is OPERABLE for spent fuel storage pool usage.

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The 31 day Frequency is appropriate because the cask loading pit has only one drain line, which is isolated by series manual valves, which are operated only in accordance with plant procedures. This provides assurance that inadvertent level reduction is not likely.

SR 3.7.9.5

This SR requires verification of the OPERABILITY of the manual makeup water source isolation valves in accordance with the requirements and Frequency specified in the Inservice Testing Program. Manual valves PCS-PL-V009, PCS-PL-V045, PCS-PL-V051, isolate the makeup flow path from the PCCWST. Manual valves SFS-PL-V042, SFS-PL-V045, SFS-PL-V049, SFS-PL-V066, and SFS-PL-V068 isolate the makeup flow path from the cask washdown pit.

REFERENCES

1. Section 9.1.2, "Spent Fuel Storage."
2. Section 9.1.3, "Spent Fuel Pool Cooling System."
3. NRC letter, William C. Huffman to Westinghouse Electric Corporation, "Summary of Telephone Conference with Westinghouse to Discuss Proposed Design Changes to the AP600 Main Control Room Habitability System," dated September 11, 1997.

Table 16.3-2 (Cont.)

INVESTMENT PROTECTION SHORT-TERM AVAILABILITY CONTROLS

2.0 Plant Systems

2.5 PCCWST and Spent Fuel Pool Makeup - Long Term Shutdown

BASES:

The PCS recirculation pumps provide long-term shutdown support by transferring water from the PCS ancillary tank to the PCCWST and the spent fuel pool. The specified PCS ancillary water tank volume is sufficient to maintain PCS and Spent Fuel Pool cooling during the 3 to 7 day time period following an accident. After 7 days, water brought in from offsite allows the PCCWST to continue to provide PCS cooling and makeup to the spent fuel pit. This PCCWST makeup function is important because it supports long-term shutdown operation. A minimum availability of 90% is assumed for this function during the MODES of applicability, considering both maintenance unavailability and failures to operate.

The PCCWST makeup function involves the use of one PCS recirculation pump, the PCS ancillary tank and the line connecting the PCS ancillary tank with the PCCWST and spent fuel pool. One PCS recirculation pump normally operates to recirculate the PCCWST. DCD subsections 6.2.2 and 9.1.3 contain additional information on the PCCWST and spent fuel pool makeup function.

The PCCWST makeup function should be available during MODES of operation when PCS and spent fuel pool cooling is required; one PCS recirculation pump and PCS ancillary tank should be available during all MODES.

Planned maintenance should be performed on the redundant pump (ie the pump not required to be available). Planned maintenance affecting the PCS ancillary tank that requires less than 72 hours to perform can be performed in any MODE of operation. Planned maintenance requiring more than 72 hours should be performed in MODES 5 or 6 when the calculated core decay heat is ≤ 6.0 MWt. The bases for this recommendation is that the long-term PCS makeup is not required in this condition, and in most cases, the PCCWST can provide the required makeup to the spent fuel pool.

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