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Subject: AP1000 Response to Proposed Open Item (Chapter 9)

Westinghouse is submitting the following responses to the NRC open item (OI) on Chapter 9. These proposed open item responses are submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in these responses is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

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

OI-SRP9.1.3-SBPA-13 R1
OI-SRP9.1.4-SBPA-03 R2
OI-SRP9.1.5-SBPB-01 R2

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

Very truly yours,

Robert Sisk, Manager
Licensing and Customer Interface
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/Enclosure

1. Response to Proposed Open Item (Chapter 9)

D063
NRO

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ENCLOSURE 1

AP1000 Response to Proposed Open Item (Chapter 9)

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: OI-SRP9.1.3-SBPA-13
Revision: 1

Question: (Revision 0)

In its response [to RAI-SRP9.1.3-SBPA-13] dated August 25, 2009, the applicant described the operator actions required to makeup to the SFP, and that makeup water would be required approximately 15 hours after boiling has begun in order to prevent fuel in the SFP from being uncovered. The applicant further identified that detailed information concerning operator action time will be contained in [a revision] to calculation APP-SFS-M3C-012.The staff finds that an audit of [this revised calculation] should be performed and the corresponding DCD markup [of Table 9.1-4, "Station Blackout/Seismic Event Times"] to confirm adequate response to RAI-SRP9.1.3-SBPA-13 should be provided by the applicant. The staff has identified this as OI-SRP9.1.3-SBPA-13.

Additional Question: (Revision 1)

1. In the 2/10/10 response letter to OI-SRP 9.1.3-SBPA-13 [DCP NRC 002770, 2/10/10], Note 6 in Table 9.1-4 "Station Blackout/Seismic Event Times" states:

   "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."

   The PCS ancillary water storage tank is a RTNSS system, and as such it should not be credited for accident mitigation prior to 72 hours after the seismic event. AP1000 DCD Revision 17 added this note to the first offloading scenario, water level prior to 72 hrs.

   Crediting a RTNSS system for accident mitigation prior to 72 hrs is inconsistent with the system description provided in the DCD Section 9.1.3.4.3, "Abnormal Conditions," inconsistent with the system description provided in the TS Basis for TS 3.7.9, and inconsistent with the staff position documented in the FSER for AP600, AP1000 Rev.15, on SECY-94-084 and SECY-98-161

   DCD Section 9.1.3.4.3 states:

   "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 staff requests that the applicant reconcile the inconsistency between the system description provided in DCD Tier 2 Section 9.1.3.4.3, the TS Basis, and Table 9.1-4. The staff also requests that the applicant clarify/justify if the AP1000 design is in accordance with the established staff position, or if the design is being change to introduce a new design basis.

2. In response to OI-SRP9.1.3-SBPA-13, the applicant provided a DCD markup of Tier 2 Section 9.1.3.4.3, "Abnormal Conditions," changing the heat load values for several offload conditions and scenarios. The staff determined that the changes identified in the OI response were consistent with the revised thermal analysis report for the SFP. Heat load values are also reflected in DCD Tier 2 Section 16, "Technical Specifications," (TS) 3.7.9 and its basis.

   The staff requests that the applicant reconcile the inconsistencies between the new heat loads presented in Section 9.1.3.4.3 and the TS (and its basis).

3. Note 9 was added to Table 9.1-4 in the 2/10/10 OI response letter. The staff feels that Note 9 is not clear about the timing requirements with regard to operator action. The staff requests that the wording for Note 9 be edited so that the clarity/intent is improved.

4.

   a. DCD Table 9.1-2 lists a 'maximum normal refueling case' temperature of <140 degrees F while DCD Section 9.1.3.1.3.2 reads ⊴20 degrees F for what appears to be the same scenario. The staff requests that the applicant explain and/or reconcile the inconsistency.

   b. For the worst case scenario, does Westinghouse use the 140°F as the initial condition of the event? Or do they use 120°F, like in the other scenarios? If the thermal analysis has not been done to 140°F, Westinghouse will need to justify this.

Westinghouse Response: (Revision 0)

- This response supersedes the response to RAI-SRP9.1.3-SBPA-13 (DCP NRC 002600, August 25, 2009).
- The markup of DCD Tier 2 Table 9.1-4, "Station Blackout/Seismic Event Times" below supersedes the markup in the response to RAI-SRP9.1.3-SBPA-08 R1 (DCP NRC 002694, November 18, 2009).
- The markup of DCD Section 9.1.3.4.3, "Abnormal Conditions," below supersedes the markup in the response to RAI-SRP 9.1.3-SBPA-04 R1 (DCP NRC 002476, May 14, 2009)

Assuming that a seismic event and a loss of site power occur after a full core is transferred from the reactor to the SFP (following a resumption of power after a typical core refueling), and that the pool is occupied by a whole fresh irradiated core plus the fuel from the recent offload plus 15.0 years worth of spent fuel, the operator will need to align makeup water within 18 hours after boiling has begun in order for fuel not to be uncovered. Reference 1, Case 6 details the amount of time within which a proper valve alignment must occur to a makeup source before fuel is uncovered.

Note: In all cases in the AP1000 boiloff calculation (Ref.1) in which the cask washdown pit is used as a makeup source, it is assumed that the initial water elevation of the cask washdown pit is the same as the initial spent fuel pool water elevation. If makeup to the pool is added so that water from the cask washdown pit does not spill out of the postulated SFS suction piping break, the time for the spent fuel pool to reach the top of fuel increases.

Values recalculated in Reference 1 are provided in markups of DCD Tier 2 Table 9.1-4, "Station Blackout/Seismic Event Times," and DCD Section 9.1.3.4.3, "Abnormal Conditions" below.

Reference(s):

1. APP-SFS-M3C-012 R3, "AP1000 Spent Fuel Pool Heatup, Boiloff, and Emergency Makeup on Loss of Cooling"

2. APP-SFS-M3-001 R1, "Spent Fuel Pool Cooling System - System Specification Document"

Additional Westinghouse Response: (Revision 1)

1. The AP1000 does not require the use of any safety related makeup sources to the spent fuel pool for the first 72 hours after a design basis event. DCD Section 9.1.3.4.3 and the Tech Spec Bases are correct as written. The DCD markup included in this RAI response removes the discrepancy that references Note 6 in the second column of Table 9.1-4.

   Note 8 of Table 9.1-4 is revised on the basis that non-safety related makeup water is not needed for 72 hours after a design basis event. This markup is showing the DCD markup section.

2. The values found in Tech Specs Section 3.7.9 are conservative values; however they do not represent the latest decay heat analysis. The markup to the tech specs and their bases is provided below to reflect the latest values shown in Section 9.1.3.4.3.

3. Note 9 under Table 9.1-4 is clarified in the DCD markup section.

4.

a. The temperature values shown in Section 9.1.3.1.3.2, "Full Core Off-Load," and Table 9.1-2, "Spent Fuel Pool Cooling and Purification System Design Parameters," have different bases.

Section 9.1.3.1.3.2 lists the maximum fuel pool temperature as less than 120ºF, assuming a normal full core offload for a scheduled outage, with the assumption that both SFS cooling trains and one RNS train in operation. Table 9.1-2 lists the maximum fuel pool temperature as less than 140ºF assuming the same normal refueling case (full core offload), the difference being the assumption of only one of the SFS cooling trains and one RNS train in operation.

These two temperatures are listed in the SSD (Reference 2) in Table 3.1, "SFS Performance Summary," and reflect the design limit temperatures for the same heat removal loads for two different performance conditions.

b. All scenarios analyzed for Table 9.1-4, "Station Blackout/Seismic Event Times," are calculated with a starting temperature of 120ºF (Reference 1). Starting at this temperature, the time to saturation for this emergency full core offload scenario is 1.33 h, or approximately 80 min. The heat up rate calculated for this case is (212 - 120) / 80 = 1.15 F/min. All other conditions equal, starting the analysis at a temperature of 140 F is expected to reduce the time to saturation to a minimum value of 80 – (1.15 * (140 - 120)) = 57 min.

In an emergency full core offload scenario with power available, the spent fuel pool heat exchangers along with a train of RNS cooling is capable of maintaining the temperature below 140ºF, as shown in DCD Table 9.1-2. In the event the spent fuel pool is at 140ºF and cooling ceases as the last fuel assembly is lowered into its rack position, Westinghouse believes that the current calculation contains significant margin with respect to the conservative method, initial conditions, and heat loss assumptions. Together with a sufficient amount of makeup water available in the PCCWST, the reduction in calculated time to saturation will not adversely affect the safe cooling of the SFP. The time for operator response shown in Note 9 of Table 9.1-4 will not be affected.

Design Control Document (DCD) Revision: (Revision 0, 1)

Revise DCD Tier 2 Table 9.1-4 as follows:

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)	6.38~~6.50~~	1.0 ~~1.6(6)~~	1.0 ~~1.6~~(6)
Seismic Event(8) – Refueling, Immediately Following Spent Fuel Region Offload(3)(7)	4.58~~4.68~~	8.0 ~~8.3~~(5)	8.0 ~~8.3~~(5)
Seismic Event(8) – Refueling, Emergency Full Core Off-Load(3) Immediately Following Refueling(7)	1.33~~1.37~~	8.0 ~~8.3~~(5)	8.0 ~~8.3~~(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 less that 9 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, and passive containment cooling system water storage tank for ~~7 days~~ 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.

DCD Section 9.1.3.4.3, "Abnormal Conditions," is revised as follows:

(Two paragraphs unchanged)

- When the calculated decay heat level in the spent fuel pool is less than ~~4.6~~ 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 or equal to ~~4.6~~ 4.7 MWt and less than or equal to ~~5.4~~ 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 calculated decay heat level in the spent fuel pool is greater than ~~5.4~~ 5.6 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.

Revise DCD Tier 2 Tech Spec and Bases 3.7.9 as follows:

3.7.9 Fuel Storage Pool Makeup Water Sources

LCO 3.7.9 Fuel storage pool makeup water source shall be OPERABLE.

- NOTES -

1. OPERABILITY of the cask washdown pit is required when the calculated fuel storage pool decay heat ≥4.7 ~~4.6~~ MWt and ≤~~5.4~~ 5.6 MWt, and with the calculated reactor decay heat > 9 MWt.
2. OPERABILITY of the passive containment cooling water source is required when the calculated fuel storage pool decay heat > ~~5.4~~ 5.6 MWt.

APPLICABILITY: During storage of fuel in the fuel storage pool with a calculated decay heat ≥~~4.6~~ 4.7 MWt.

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.

Two 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. The containment cooling system water storage tank provides makeup water when pool decay heat is > ~~5.4~~ 5.6 MWt and the decay heat in the reactor is less than 9.0 MWt. The cask washdown pit provides makeup water when decay heat in the pool is ≥~~4.6~~ 4.7 MWt and ≤~~5.4~~ 5.6 MWt. Additional on-site makeup water sources are available to provide fuel pool cooling between 3 and 7 days.

The containment cooling system water storage tank 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 fuel pool is reduced to below ~~4.6~~ 4.7 MWt, the spent fuel storage pool water inventory is sufficient, without makeup, to maintain spent fuel storage pool for 72 hours. When the spent fuel storage pool decay heat load is reduced below ~~4.6~~ 4.7 MWt, the cask washdown pit may be drained and returned to use for shipping cask cleaning operations.

A general description of the 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).

BASES

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 > ~~5.4~~ 5.6 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 passive containment cooling water storage tank. 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 decay heat > 9.0 MWt. LCOs 3.6.6 and 3.6.7 require availability of the containment cooling water tank for containment heat removal. Below 9.0 MWt decay heat, containment air cooling is adequate. Since there are no design conditions which result in both reactor decay heat > 9.0 MWt and spent fuel storage pool decay heat > ~~5.4~~ 5.6 MWt, the applicability for LCOs 3.6.6/3.6.7 and for LCO 3.7.9 are mutually exclusive. Since none of the Chapter 15 Design Basis Accident analyses assume availability of the containment cooling water tank or the cask washdown pit for spent fuel storage pool makeup, the 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).
LCO	The fuel storage pool makeup water sources, the cask washdown pit, and the containment cooling water tank are required to contain 13.75 ft and 400,000 gallons of water, respectively. 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 containment cooling ancillary water storage tank. These makeup sources assure spent fuel cooling for at least 7 days. Note 1 specifies that either the cask washdown pit or the passive containment cooling water storage tank is required to be OPERABLE when the spent fuel storage pool decay heat ≥~~4.6~~ 4.7 MWt and ≤~~5.4~~ 5.6 MWt. Note 2 specifies that the passive containment cooling water storage tank source is required to be OPERABLE when the spent fuel storage pool decay heat is > ~~5.4~~ 5.6 MWt, which is normal following a full core off load. The larger makeup source is necessary for the higher decay heat load.
LCO (continued)	When a portion of the fuel is returned to the reactor vessel in preparation for startup, the pool decay heat is reduced to ≤~~5.4~~ 5.6 MWt and makeup from the cask washdown pit is sufficient.
APPLICABILITY	This LCO applies during storage of fuel in the fuel storage pool with a calculated decay heat ≥~~4.6~~ 4.7 MWt. With decay heat < ~~4.6~~ 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.

BASES

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 passive containment cooling water storage tank (with decay heat > ~~5.4~~ 5.6 MWt) and/or the cask washdown pit (with decay heat ≥~~4.6~~ 4.7 and ≤~~5.4~~ 5.6 MWt) is inoperable, Action must be initiated 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.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR verifies sufficient passive containment cooling system water storage tank volume is available in the event of a loss of spent fuel cooling.

The 7 day Frequency is appropriate because the volume in the passive containment cooling system water storage tank is normally stable and water level changes are controlled by plant procedures.

SR 3.7.9.2

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 ≥~~4.6~~ 4.7 and ≤~~5.4~~ 5.6 MWt.

The 30 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.

SR 3.7.9.3

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-

BASES

V051, isolate the makeup flow path from the passive containment cooling system water storage tank. 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.

PRA Revision: None

Technical Report (TR) Revision: None

RAI Response Number: OI-SRP9.1.4-SBPA-03
Revision: 2

Question: (Revision 1)

In the June 26, 2008 response to RAI-SRP9.1.4-SBPB-04, the applicant stated that a single failure proof hoist and the new fuel handling tool will be used to handle new fuel and a non single failure proof hoist and the spent fuel handling tool will be used to handle spent fuel. The applicant also stated that the single failure proof hoist may also handle spent fuel, but it would not have access to all spent fuel handling/storage locations. In a March 18, 2009 meeting between the staff and the applicant, the use of the FHM single failure proof hoist and non-single failure proof hoist was discussed in detail.

The applicant stated that the new FHM will handle new fuel and spent fuel. In the June 26, 2008 response to RAI-SRP 9.1.4-SBPB-03, the applicant also stated, "The fuel handling machine is restricted to raising a fuel assembly to a height at which the water provides a safe radiation shield," and in response to RAI-SRP 9.1.4-SBPB-04 the applicant stated that "each FHM hoist will have a mechanical limit based on maximum hoist up travel and spent fuel handling tool length." Since the new FHM will be moving both new fuel and spent fuel, and new fuel is handled above deck level when it is transferred to the new fuel racks and transferred from the new fuel storage vault into the spent fuel pool, the applicant did not state in the DCD how the same cranes that are restricted in hoist up travel can handle new fuel above deck level. Use of the FHM hoist for new fuel also apparently conflicts with the revised Table 2.1.1-1 item 5 of ITAAC, which states, "FHM hoists are limited such that the minimum required depth of water shielding is maintained."

The applicant provided the staff with Revision 1 to its response to RAI-SRP 9.1.4-SBPB-04 in a letter dated May 20, 2009 and Revision 1 to its response to RAI-SRP 9.1.4-SBPB-03 in a letter dated June 4, 2009. Both of the applicant's revised RAI responses contain the same additional paragraph which states that spent fuel handling is restricted to using the non-single failure proof hoist of the FHM. The single failure proof hoist of the FHM is used for handling new fuel and other loads, with the exception of spent fuel, throughout the fuel handling area. The single failure proof hoist in conjunction with the spent fuel handling tool is not capable of raising spent fuel to a height that clears the spent fuel racks, fuel transfer system fuel basket, spent fuel shipping cask, or the new fuel elevator. The staff finds that the applicant's Revision 1 responses to RAI-SRP 9.1.4-SBPB-03 and 04 still do not adequately address how the single failure proof crane of the FHM with hoist up travel restrictions can handle new fuel above the deck level. **This is identified as OI-SRP 9.1.4-SBPA-03**. To close out this item a description of the fuel movement (new and spent) process for both FHM hoists using their handling tools, and a discussion of their interlocks need to be provided by the applicant. Currently, the proposed lift height ITAAC for FHM is inconsistent with allowing the use of FHM to move new fuel.

Additional Question: (Revision 2)

Westinghouse indicates that in the past the operators were required to verify hoist up limits, indicating lights, etc…prior to translating, which is acceptable while using the correct hoist. However by using the incorrect crane, even with the hoist up limits or indicating lights, will allow inadvertently traversing (translating) of the hoists in the configuration where the bottom of a fuel assembly does not have adequate clearance from the spent fuel racks. This could result in fuel damage if traversing movement is allowed.

1. How does Westinghouse intend to address the issue above?
2. Elaborate on the comment, "[(from a previous W email discussion) Past fuel handling procedures require operators to verify hoist up limits via hoist position, indicating lights, etc., prior to clearing bridge-trolley interlocks and translating with a fuel assembly.] Being that there is approximately 20" difference between the two hook up limits, this condition should be detected by the operator." It is not clear to the staff how the operator would detect this.
3. What is their intended use of single and non-single failure proof hoists?
4. Which crane will carry what over the SFP and in fuel handling areas?

Westinghouse Response: (Revision 1)

(The above question is from the Chapter 9 SER with Open Items received 10/19/09. Westinghouse initially answered this Open Item with the RAI-SRP9.1.4-SBPB-03 R2 response, and considers this the Revision 1 OI response for tracking purposes.)

Additional questions were provided by phone conversation with the staff on 8/12/09. Westinghouse provided the RAI-SRP9.1.4-SBPB-03 R2 response via letter DCP/NRC2505 on 10/15/09, and also supported additional phone discussions to date with the staff. The topics requested in the OI have been covered, including intended use of each FHM hoist, safety interlocks, and fuel handling tools.

Westinghouse also received a email request from the staff on 2/2/10. It requested that Westinghouse incorporate into the DCD the additional paragraph mentioned above that was previously provided in the RAI responses. To close this issue, a DCD markup making this change is shown below.

Westinghouse Additional Response: (Revision 2)

1. The control console for the fuel handling machine has a selector switch that is positioned to select either the South Hoist (Single Failure Proof) or North Hoist (non-Single Failure Proof). With North Hoist selected, the single failure proof hoist is locked out, incapable of movement. Warnings requiring operator acknowledgement will be built in to the fuel handling machine software such that if a load was suspended from the single failure proof hoist and bridge movement approached the spent fuel racks, the operator would be alerted that spent fuel is not to be raised using the spent fuel handling tool. Operating procedures will also be prepared with this precaution.

2. In the event that an operator set the abovementioned selector switch to South Hoist (Single Failure Proof), picked up the spent fuel handling tool with the single failure proof hoist and raised the hoist to the uplimit, the digital hoist position indication would not meet the predetermined setpoint for the hoist up limit for handling spent fuel. (The bail on the handling tool would not have been at the expected elevation either.) Even though the hoist up limit light would be activated, the error in hoist position would be identified administratively by the verification of proper hoist up digital position readout. Operating procedures will be prepared with this requirement.

3. The single failure proof hoist will be used for;

   - primarily handling new fuel
   - the movement of loads <4000 lbs in the fuel handling area of the auxiliary building
   - a redundant hoist over the spent fuel pool for the handling of control components

   The non-single failure proof hoist will be used for;

   - handling fuel and control components in the spent fuel pool
   - the hoist shall be restricted from handling a load above the operating floor within 15 ft. of the spent fuel pool unless supported by future analysis

4. The non-single failure proof hoist is primarily used for submerged handling activities. However, there are areas in the fuel handling area of the auxiliary building that the single failure proof hoist is not capable of accessing due to travel limitations. Therefore it is necessary for the non-single failure proof hoist to be used in areas other than the spent fuel pool. As mentioned above, the non-single failure proof hoist will be restricted from handling a load above the operating floor within 15 ft. of the spent fuel pool unless supported by future analysis.

   The single failure proof hoist will be capable of handling loads in the new fuel handling area and the spent fuel handling area with operator warnings associated with the handling of spent fuel.

   The previously supplied DCD markup wording is revised below to reflect the above answers.

Design Control Document (DCD) Revision: (Revision 1, 2)

Modify DCD Section 9.1.4.2.4, "Component Description," as follows:

9.1.4.2.4 Component Description

A. Fuel Transfer Tube

The fuel transfer tube penetrates the containment and spent fuel area and provides a passageway for the conveyor car during refueling. During reactor operation, the fuel transfer tube is sealed at the containment end and acts as part of the containment pressure boundary. See subsection 3.8.2.1.5 for discussion of the fuel transfer penetration.

B. Fuel Handling Machine

The fuel handling machine performs fuel handling operations in the new and spent fuel handling area. It also provides a means of tool support and operator access for long tools used in various services and handling functions. The fuel handling machine is equipped with two 2-ton hoists, one of which is single failure proof.

The non-single failure proof hoist is primarily used for submerged handling activities. However, there are areas in the fuel handling area of the auxiliary building that the single failure proof hoist is not capable of accessing due to travel limitations. Therefore it is necessary for the non-single failure proof hoist to be used in areas other than the spent fuel pool. The non-single failure proof hoist will be restricted from handling a load above the operating floor within 15 ft. of the spent fuel pool unless supported by future analysis.

The single failure proof hoist will be capable of handling loads in the new fuel handling area and the spent fuel handling area with operator warnings associated with the handling of spent fuel.

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to SER Open Item (OI)

OI Response Number: OI-SRP9.1.5-SBPB-01
Revision: 2

Additional Question: (Revision 1)

This question is an additional concern regarding the 11/11/09 OI/RAI response [DCP NRC 002690, RAI-SRP9.1.5-SBPB-01 R2] that described the equipment hatch hoist as 'foot mounted on a platform supported by the containment structure.' There appears to be nothing in the DCD that would explain how the structural load on containment from the hoist was evaluated - though a seismic event could result in additional loading on the containment structure, based on the load being held in place.

Westinghouse should describe the design load combinations and acceptance criteria for the containment structure when the hoist is holding the critical load. Please identify the Westinghouse document containing the analysis.

Additional Question (Revision 2)

a. (NRC Staff) The [OI-9.1.5-SBPB-01 R1] 3/31/10 response letter stated that final hatch hoist seismic analyses have not been completed at this time. Westinghouse will identify the applicable document(s) containing these analyses in a revised OI response.

b. (Westinghouse additional) – Vendor load attachment design - See below.

Westinghouse Response: (Revision 1)

(Westinghouse initially answered this Open Item with the RAI-SRP9.1.5-SBPB-01 R2 response, and considers this the Revision 1 OI response for tracking purposes.)

The equipment hatch hoist moves each equipment hatch (EH) between alternate supported positions. Each hatch is bolted to the CV when closed, and is supported by hanging hooks while open. These hooks are either supported directly by the vessel (Lower EH) or attached to the internal stiffener (Upper EH). Loads on the CV from the hatch cover in the open position on these hooks have been generated for Service Levels A, C, and D. These loads are incorporated into the CV Design Specification, and are under evaluation by the CV Supplier for these service levels.

The hatch hoist itself is analyzed and designed to the following requirements: The load combinations and allowable stress for the hoist are per ASME NOG-1 for seismic loading, using load combinations for Type 1 cranes. Seismic and abnormal events load cases and load combinations are based on ASME NOG-1, Sections 4136, 4140, and 5480 applicable to the

Hatch Hoist, and allowable seismic stress is per Table NOG-4311-1, extreme environmental loading condition.

The equipment hatch hoist supports the equipment hatch during movement between the open and closed positions. CV Loads resulting from the hatch hoist while supporting the equipment hatch are being generated for Service Levels A, C, and D. These loads are to be incorporated into the CV Design Specification, and are to be evaluated by the CV Supplier for these service levels.

The acceptance criteria are that, after a seismic event occurs while the hoist is holding the critical load, the containment vessel will continue to perform its intended safety functions.

These final seismic analyses regarding the hatch hoist have not been completed at this time. Westinghouse will identify the applicable document(s) containing these analyses in a revised OI response.

Additional Westinghouse Response: (Revision 2)

a. To clarify, during the final design of the equipment hatch hoist and platform, Westinghouse is adjusting the equipment support points so that the resulting loaded hoist CV loads do not exceed the established CV load limits. The final loads are expected to be bounded by the current CV Design Specification. Westinghouse will identify the loaded hoist load calculations after their expected completion in July of 2010,

b. The AP1000 equipment hatch hoist vendor has simplified the load attachment design. The current design has a hook attached to the lower block of the hoist, and the hook is attached to a shackle. The shackle pin attaches to the hatch cover so it can be lifted.

   The vendor has removed the hook and shackle, and now attaches the lower block of the hoist directly to the hatch cover with a pin. This would remove two items in the load path. The DCD markup initially supplied in RAI-SRP9.1.5-SBPB-01 R2 is revised below to incorporate the use of this lifting pin.

Design Control Document (DCD) Revision: ~~None~~

The DCD markup shown in RAI-SRP9.1.5-SBPB-01 R2 is revised as follows:

A new Section 9.1.5.2.3 was added in the response to RAI-SRP9.1.5-SBPB-01 R2. The following markup is made to the added text as shown:

9.1.5.2.3 Equipment Hatch Hoist General Description

The equipment hatch hoist is a hoist that is foot mounted on a platform supported by the containment structure.

The hoist is electrically powered and raises and lowers loads by reeving wire rope through sheaves that are an integral part of the load block. ~~A hook or lifting lug is attached to the load block.~~ The load block is equipped with a hook or lifting device.

A new Section 9.1.5.2.3.2 was added in the response to RAI-SRP9.1.5-SBPB-01 R2. The following markup is made to the added text as shown:

9.1.5.2.3.2 Component Descriptions

(Two paragraphs unchanged)

Two separate, redundant reeving systems are used, so that a single rope failure will not result in the dropping of the load. Two wire ropes are reeved side-by-side through the sheave blocks. Each rope connects to an equalizer that adjusts for unequal rope length. The equalizer is also a load transfer safety system, eliminating sudden load displacement and shock to the hoist in the unlikely event of a rope break. Overtravel protection is provided (see subsection 9.1.5.2.3.3); however, even in the event of ~~hook~~ overtravel in the raising direction to the point the load block contacts the hoist structure, the ropes cannot be cut or crushed.

A new Table 9.1.5-4 was added in the response to RAI-SRP9.1.5-SBPB-01 R2. The following markup is made to the added table text as shown:

Table 9.1.5-4

EQUIPMENT HATCH HOIST COMPONENT DATA

Hoist	
Approximate capacity	See Table 9.1-5.
~~Hook~~ Hoist speed	See Note 1.
Approximate ~~hook~~ load block travel (elevation)	To hatch (lowered position)

Main hoist braking system (diverse systems)	
Control brakes (type and number)	Hoist motor regenerative braking
Holding brakes (type and number)	Friction (two)
Emergency drum brake (type and number)	Friction (one)

<u>Note:</u>

1. Hoist speed is within the recommended range of ASME NOG-1.

PRA Revision: None

Technical Report (TR) Revision: None