August 6, 2009

MEMORANDUM TO: Eileen McKenna, Branch Chief
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Division of New Reactor Licensing
Office of New Reactors

FROM: John Segala, Branch Chief ***/RA/***
Balance of Plant Branch 1
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SUBJECT: AUDIT REPORT FROM JUNE 25, 2009 TO REVIEW AP1000 REVISION 16 AND 17 AND RTNSS/COLD SHUTDOWN ISSUES FOR CHAPTER 9

Attached is the staff's audit report for selected areas related to the Docket No. 52-006 and AP1000 Design Control Documents (DCD) Section 9.2, "Water System." Westinghouse submitted to the U.S. Nuclear Regulatory Commission (NRC) DCD Revision 16 and 17 for its AP1000 application in May, 2007 and September, 2008, respectively. After conducting a comprehensive review of DCD Revision 16 and 17, the staff concluded that additional information is needed from the applicant to support the staff's safety evaluation. The audit was conducted on June 25, 2009 between Westinghouse and the NRC staff. This audit report documents the staff's discussion with Westinghouse to resolve open items related to the service water system (Section 9.2.1), reactor component cooling water system (Section 9.2.2) and nuclear island chilled water subsystem (Section 9.2.7). The audit was primarily focused on the review of these systems with regard to the regulatory treatment of non-safety systems (RTNSS) and the ability to support cold shutdown operations.

Enclosure: As Stated

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Introduction

A one day audit was conducted by the NRC/NRO AP1000 project team at the Westinghouse (W) office in Twin Brooks, Md. on June 25, 2009. The focus of the audit was to review selected areas related Docket No. 52-006 and AP1000 Design Control Document (DCD), Section 9.2, "Water Systems."

Westinghouse submitted to the U.S. Nuclear Regulatory Commission (NRC) DCD Revision 16 and 17 for its AP1000 application in May, 2007 and September, 2008, respectively. The audit was necessary in order to expedite the review process particularly in areas for which additional information was required. The audit primarily focused on the regulatory treatment of non-safety systems (RTNSS) and the ability to support cold shutdown operations.

The purpose of this audit is to review additional Westinghouse documents that contain information not currently in the DCD that are related to the plant service water system (Section 9.2.1), component cooling water system (Section 9.2.2) and central chilled water system (Section 9.2.7). The audit is primarily focussed on the review of these systems with regard to the regulatory treatment of non-safety systems (RTNSS) and the ability to support cold shutdown operations.

During the audit, the staff reviewed Westinghouse documentation and conducted interviews with Westinghouse SME's to determine if the subject systems are considered highly reliable and that no single active failure would result in the inability to terminate use of passive safety grade systems and achieve cold shutdown. The conclusions of each audit item determined if additional information would be needed to be added to the DCD.

During this audit, the staff facilitated a table top discussion of the audit items identified in the Audit Plan, dated June 22, 2009. The following audit report summarizes the discussion that took place and any conclusions that were identified.

Audit Team

Chang Li (NRC/NRO Audit Team Leader
Larry Wheeler (NRC/NRO)
Cliff Marks (NRC Contractor)

Service Water System (SWS)
Audit Item 1

In request for additional information (RAI)-SRP 9.2.1-SBPA-01, Westinghouse was asked to provide a more detailed description of the basis for the proposed changes relative to SWS flow rate and cooling tower performance in Tier 2 of the DCD. In response, Westinghouse referred to information in the application that was considered by the staff when preparing this question, but a more detailed description was not provided. Westinghouse also provided information to explain how cooling tower performance and SWS flow rates would be maintained over time and while this information is useful, no provisions were established to assure implementation by COL applicants. The response did not adequately address the staff's request for additional information.

Determine what needs to be included in the DCD

Audit Findings/Comments/Conclusion to Item 1

With respect to margins for SWS flow and cooling tower performance, the staff asked Westinghouse about whether the system will be maintained over time for a 60 year certification and what operating experiences (OE), for example Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," have been incorporated into the design.

During the discussion, Westinghouse said that they have calculation notes that can discuss margins over time. The calculation notes are reflected in drawings where appropriate. Westinghouse further stated that cooling towers are sized for a large heat load with conservative assumptions about the expected heat load. Further, Westinghouse added all the component cooling system (CCS) heat loads in the AP1000 SWS cooling tower calculations. Finally, Westinghouse stated that SWS flow is such that return temp is < 120F°, however, the tower sizing is based on 140°F (limited to fill materials), which is conservative.

The staff asked how it can be assured that adequate margin exists in the cooling tower design and where is that assurance reflected in the DCD (including longevity with OE considerations)?

Westinghouse stated that the SWS pumps have a built in 7% design margin (which is a Long Term Westinghouse Standard Practice) in the pump's head to allow for the degradation over 60 years. Further, with respect to heat exchanger performance, Westinghouse stated that the CCS heat exchangers are going to be plate type heat exchangers with expandable capacity (by the addition of plates), if found to be necessary through plant experience.

The staff and Westinghouse discussed how and where this information should be presented, and whether a DCD revision would be required to briefly describe the RAI responses (without detail).

Conclusion to Item 1

Westinghouse stated that they will provide an augmenting RAI response to explain the margin in greater detail. In addition, Westinghouse will consider a DCD revision, revised to include a high-level discussion about the design Margins as described above; however, the DCD will not contain the details that will reside with the RAI responses.

Audit Item 2

In RAI-SRP 9.2.1-SBPA-02, the staff requested that Westinghouse identify and describe in Tier 2 of the DCD those SWS design limitations that should be adhered to and explain how adherence to these limitations by COL applicants is assured. In response, Westinghouse provided additional information about the system design margins, alarms, and capabilities, and discussed cooling tower fill material options that are available for higher temperature situations. However, the response did not adequately address the staff's request in that SWS design limitations and provisions to ensure adherence by COL applicants were not discussed. Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 2

The staff asked whether the SWS cooling tower fill material temperature limits should be in the DCD? Additionally, the staff asked as part of RAIs SBPA-01 and SBPA-02, what instrumentation is available for control room monitoring?

Westinghouse stated that they don't normally (include the cooling tower fill material temperature limits in the DCD); however, these temperature requirements are in the Vendor Specification (supplied by whichever vendor is awarded the contract to supply the cooling tower). Westinghouse added that the cooling tower procurement contract has not yet been awarded.

With respect to the alarm functions providing a warning that temperature limits are being approached, Westinghouse stated identified the parameters monitored and alarmed. Westinghouse stated that the limits include alarms with setpoints of 120°F maximum SWS temperature, low flow, hi flow, and pump discharge pressure (with automatic low pressure shutoff function to guard against pump runout) alarms. Additionally, Westinghouse explained that the heat exchanger delta pressure (DP) alarm is based on twice the system flow.

The staff asked whether SWS cooling tower basin level is included as a Class D instrument in ITAAC Instrumentation. After some discussion, Westinghouse said no, but maybe the cooling tower basin level should be included in ITAAC instrumentation. Westinghouse added that the basin has inventory in reserve to support 12 hours of inventory (and that the fire tank can for another 12 hours) for cooldown. There was further discussion about basin level indication/alarm/trending.

Conclusion to Item 2

Westinghouse will consider revision to ITAAC to include SWS cooling tower basin level instrumentation in DCD Tier 1 and Tier 2 changes.

Audit Item 3

In RAI SRP 9.2.1-SBPA-03, the staff asked that Westinghouse identify and describe in Tier 2 of the DCD the cooling tower basin water inventory requirements, the basis for this determination, and how this inventory is assured to be maintained by COL applicants. In response, Westinghouse provided information to explain the design capability of the cooling tower basin inventory. While this information is useful, specific quantitative information was not provided to verify the adequacy of design. The response did not adequately address the staff's request for additional information. Additionally, the response made reference to use of a raw water system (RWS) for providing makeup to the SWS cooling tower basin. A RWS has not been described for the AP1000 design in accordance with 10 CFR 52.47(24) requirements. Consequently, Westinghouse must revise the DCD to describe the RWS, including Tier 1 information.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 3

The staff asked whether it is reasonable to have a cooling tower level requirement prior to going to mid-loop operations for regulatory treatment of non safety related systems considerations (RTNSS), Modes 5 and 6. This question resulted in discussion between Westinghouse and the staff. Westinghouse referred to Chapter 16 design reliability assurance program (D-RAP), which has requirements for Investment Protection Short-Term Availability Controls (IPSAC). This yielded further discussion about whether the cooling water basin water level Tier 1 ITAAC basin water minimum level, the Tier 2 water level, and whether low water level monitoring/alarms need to be added, for IPSAC.

Conclusion to Item 3

Westinghouse will evaluate whether to include this information in IPSAC and will provide an augmented RAI response. Within the response, the differences in water level versus useable volume (in the SWS cooling tower basins) between normal operation and RTNSS will be discussed.

Audit Item 4

In RAI SRP 9.2.1-SBPA-05 (and the supplemental response from 5/13/09 from the meeting on 3/17/09), Westinghouse did not completely explain how the SWS defense-in-depth and RTNSS functional capabilities are assured for those periods when humidity is at its maximum. There is an increased chance of plant trip during hot, humid conditions due to increased electrical demand and it is illogical to assume less humid conditions for the plant cooldown case than what can be experienced during normal power operation. The SWS should be capable of performing its defense-in-depth and RTNSS functions over the full range of postulated operating conditions, and Westinghouse has not demonstrated this to be the case. The Westinghouse response also referred to another increase that is proposed for the maximum safety wet bulb temperature in order to accommodate the Levy site.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 4

Westinghouse provided detailed explanation of the May 13, 2009 RAI response related to maximum normal wet bulb and maximum safety wet bulb temperatures. Westinghouse concluded that 80.1°F is satisfactory because cooling will be available. Note that 1% exceedance is for only 30 days out of the year.

Conclusion to Item 4

With the verbal discussion and explanation provided by Westinghouse stating that higher ambient temperatures (86.1°F vs 80.1°F) will not impact safety or investment protection and would only result in an extended time to achieve cooldown (May 13 supplement RAI response), the NRC staff will re-review the RAI response and close this item. No other action required by Westinghouse.

Audit Item 5

In RAI SRP 9.2.1-SBPA-06, the staff requested that Westinghouse identify and explain in Tier 2 of the DCD the limiting assumptions and bounding conditions that are important relative to cooling tower design, performance, and operation for assuring that the SWS is capable of and can be relied upon to perform its defense-in-depth and RTNSS functions, what provisions exist to ensure that these limiting assumptions and bounding conditions will be satisfied by COL applicants over the life of the plant, and what the potential consequences are of exceeding the maximum normal noncoincident wet bulb temperature during operating and shutdown conditions. Westinghouse responded to the staff's request in a letter dated June 26, 2008. Westinghouse explained that the defense-in-depth functions for the SWS are based on the maximum normal non-coincident wet bulb temperature for the site. The response also indicated that the SWS cooling function is not needed for maintaining the plant in a long-term safe condition. Westinghouse further indicated that that SWS flow and cooling tower performance will be monitored on a continuous basis and that licensees will perform testing at regular intervals to determine cooling tower heat transfer capability, but a COL action item does not exist and one was not established to specify this action by COL applicants. As discussed above for OI-SRP 9.2.1-SBPA-05, the defense-in-depth and RTNSS capabilities of the SWS should be assured over the complete range of plant operating conditions.

Audit Findings/Comments/Conclusion to Item 5

The staff expressed a concern regarding system reliability for RTNSS and defense-in-depth (DID) over full range of operating conditions. The staff referred to similarities to RAI SRP 9.2.1 SBPA-01 and -02 above, discussing what instruments are available to the control room for monitoring system performance.

Both the staff and Westinghouse agreed that the revised response to RAI SRP 9.2.1-SBPA-01 above can close out this one when reviewed but the new RAI response and possible DCD update needs to be expanded to include RTNSS, cooldown, and DID considerations. Further, the discussion identified that the answer to the instrumentation portion of this concern can be found as part of the response to SRP-9.2.1 SBPA-02.

Both the staff and Westinghouse agreed that the revised response to RAI SRP 9.2.1-SBPA-01 above, can close out this concern when they are reviewed.

Conclusion to Item 5

The revised responses to SRP 9.2.1-SBPA-01 response will contain the specific information asked in SBPA -06 about RTNSS/DID and their bounding cases so that the response to SBPA-06 can simply reference the response to SBPA-01.

Audit Item 6

Westinghouse proposes to allow COL applicants the option of using black polyethylene piping (High Density Polyethylene or HDPE) for SWS applications. The specific criteria for allowing the use of HDPE should be specified in the DCD to ensure clarity of the plant licensing basis.

In RAI-SRP 9.2.1-SBPA-07, Westinghouse was asked to revise the DCD (Tier 1 and Tier 2 as appropriate) to address these considerations. In response Westinghouse referred to its earlier response to RAI-TR103-EMB2-02 dated February 22, 2008. Also, additional clarifying information was provided to specify that HDPE will be used for the underground portions of the auxiliary makeup line from the secondary fire water tank and for the underground portions of the SWS blowdown to the circulating water system cooling tower. However, Westinghouse did not address the specific question that was asked by the staff in RAI-SRP 9.2.1-SBPA-07.

As a separate matter, the staff also requests that Westinghouse describe how the requirements specified by 10 CFR 20.1406 are satisfied with respect to SWS considerations, including provisions that have been established for buried or inaccessible pipe.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 6

Westinghouse described the proposed use of HDPE for SWS applications, and the limitations of use in accordance with Westinghouse piping specifications. In its discussion Westinghouse stated that only American Society of Mechanical Engineers (ASME) B31.1, “Power Piping,” constructed HDPE, would be used in underground applications where there would be no potential for impact damage. Also, Westinghouse stated that its use would be limited to low pressure and low temperature applications. Further, Westinghouse clarified that although the DCD states “nonmetallic piping,” the only nonmetallic piping approved by Westinghouse for use is HDPE. Westinghouse also stated that HDPE will not be used in the main headers of the SWS. Further, Westinghouse recommended that the staff review RAI-TR-103-EMB2-02 latest revision, newer than 2/22/08 which contains more detail on the use of the HDPE material.

With respect to the requirements specified by 10 CFR 20.1406, Westinghouse stated that this issue was covered under a generic RAI. The staff will take the action of reviewing the response to the RAI.

Conclusion to Item 6

There will be a possible DCD change clarifying that HDPE is the only specified nonmetallic piping and will only be used in underground applications. Further, the potential DCD change would specify that HDPE will not be used in the main headers of the SWS.

Audit Item 7

In RAI-SRP 9.2.1-SBPA-08, Westinghouse was asked to explain how the defense-in-depth capability of the SWS will be tested to assure performance for the most limiting situations such that system reliability and availability assumptions are valid. Include a detailed explanation for how this testing will verify adequate performance of the SWS (including cooling towers and cooling tower makeup) for the most limiting situations. Also, explain how COL applicants will assure that the defense-in-depth capability of the SWS (including cooling towers and cooling tower makeup) is adequately maintained over time. In response, Westinghouse referred the staff to Tier 2 Section 14.2.9.2.6 of the DCD. Westinghouse also provided additional information concerning the nature and extent of testing that would be performed. However, much of the information was not reflected in Tier 2 of the DCD, and the stated purpose of the test continues to be very narrowly focused on demonstrating the capability of the component cooling system (CCS) heat exchangers to transfer heat to the environment. Furthermore, Westinghouse credits COL applicants for performing ongoing surveillance and testing, but there are not COL action items to this effect. Westinghouse did not address the specific question that was asked by the staff and will need to.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 7

During the discussion, both the staff and Westinghouse agreed that the revised response to RAI SRP 9.2.1-SBPA-01, above can close out this RAI when reviewed. Further, the response to RAI SRP-9.2.1-SBPA-01 will state that normal system operation will confirm the RTNSS function. Additionally, Westinghouse stated that adequate NPSH will also be verified by the basin level. Westinghouse stated that the 'Lo Level' identified in Tier 1 confirms adequate NPSH (see also RAI SRP 9.2.1-SBPA-01). Finally, the RAI response will discuss a Loss of Offsite Power (reference DCD Section 9.2.1.2.3.6 and Section 14.2.9.2.6).

Conclusion to Item 7

Westinghouse will review and possibly revise RAI response to this item and may include this discussion with RAI SRP 9.2.1-SBPA-01.

Central Chilled Water System (VWS)

Audit Item 8

In RAI-SRP 9.2.2-SBPA-02, Westinghouse was asked to provide clarification as necessary in the AP1000 DCD to better explain the defense-in-depth and investment protection functions of the central chilled water system (VWS), as well as to explain why Investment Protection Short-Term Availability Controls (IPSAC) was not deemed to be necessary recognizing that VWS is needed to support other defense-in-depth non-safety systems. In response Westinghouse provided additional (very limited) information concerning the defense-in-depth and investment protection functions provided by the VWS, and similarly for IPSAC considerations. Not only is the additional information considered to be incomplete and inadequate, Tier 2 of the DCD was not revised to fully explain the VWM design basis relative to defense-in-depth and investment protection considerations.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 8

Westinghouse provided a discussion for the VWS which is broken down into two sub-systems, low capacity and high capacity. The low capacity system which is shown in Tier 1, Figure 2.7.2-1 in part (air cooled chillers and pumps) are within the scope of D-RAP (reference Table 17.4-1). Westinghouse discussed the reasons why the VWS is not RTNSS and not listed under IPSAC because the systems it protects have their own IPSACs. The low capacity system is in D-RAP for the CVS makeup pump room.

Westinghouse will provide completed drawings including the high capacity VWS system drawings in addition to the low capacity subsystem.

Generic issue: Also, Westinghouse will consider revising the DCD to include Pointers or References to D-RAP Chapter 17 systems from their own DCD Sections. The value added would be to ease the review process.

Conclusion to Item 8

The staff will close out RAI-SRP 9.2.2-SBPA-02 since part of the low capacity system is within the scope of D-RAP and is not directly related to IPSAC. Westinghouse is to review generic issue with adding pointers. Westinghouse is to provide completed drawings for the VWS.

Component Cooling System (CCS)
Audit Item 9

In RAI-SRP 9.2.2-SBPA-03, Westinghouse was asked to include additional information in Section 9.2.2 to better explain the defense-in-depth, investment protection, and RTNSS design basis for the CCS (also see test considerations referred to below in Section 9.2.2.2.7). In response Westinghouse indicated that the information provided for the CCS is similar to what was provided for the SWS and other defense-in-depth systems. The staff confirmed that the Tier 2 information for the CCS is similar to what

was provided for other systems of this nature, with no description of the defense-in-depth, investment protection, or RTNSS design basis for these systems.
The information in Tier 2 of the DCD does not adequately describe the design bases of non-safety-related systems relative to defense-in-depth, investment protection, and RTNSS considerations and such information was not provided in response to the RAI.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 9

The discussion included identifying the functions that would cause a system to be designated a RTNSS system. The staff suggested that Westinghouse put pointers or a roadmap to the RTNSS DRAP and IPSAC functions from the appropriate DCD Sections to aid in subsequent reviews.

Conclusion to Item 9

Westinghouse will consider revising the DCD to add references to RTNSS, DRAP, and IPSAC functions where appropriate.

Audit Item 10

In RAI-SRP 9.2.2-SBPA-06 the staff stated that DCD Section 9.2.2 needs to identify what the minimum CCS pump flow requirements are for the three categories of heat loads that are listed in the proposed Table 2.3.1-2 ITAAC acceptance criteria, how much excess margin is available for each one, the basis for this determination, and how the specified flow balance will be maintained over time.

In response, Westinghouse provided additional information primarily related to CCS heat exchanger design and made reference to Technical Report (TR) 111, “Component Cooling System and Service Water System Changes Required for Increase Heat Loads,” for additional discussion. However, the Westinghouse response did not address the specific question that was asked by the staff.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 10

Discussion for LOOP and EDG start with respect to CCS pump flow requirements took place. Westinghouse stated that in Table 2.3.1-2, although the minimum design flow is identified, the calculated available flow is much greater. Further, Westinghouse stated that these are stated in DCD Section 9.2.2 as minimum flows.

Conclusion to Item 10

Westinghouse agreed to revise the RAI response to clarify that ITAAC is for RTNSS flows. They will add this information to Table 2.3.1-2 Tier 1 information. Further, Westinghouse stated that there is approximately 5% flow margin but analysis is still in progress. Westinghouse stated that it uses a 7% margin to address system degradation calculation.

Audit Item 11

In RAI SRP 9.2.2-SBPA-07 the staff stated that Westinghouse needs to identify how the proposed CCS heat exchanger coefficient of heat transfer (U) and required heat-transfer area (A) values were determined and how much margin is available to address operational considerations, on what basis this determination is appropriate and justified, and how the specified CCS heat transfer capability will be maintained over time. In response Westinghouse provided additional information primarily related to CCS heat exchanger design and made reference to TR-111 for additional discussion. However, the Westinghouse response did not address the specific question that was asked by the staff.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 11

The staff and Westinghouse agreed that the response to RAI-SRP 9.2.2-SBPA-06 will address the margins (geared towards RTNSS and Cooldown) for heat exchangers.

Conclusion to Item 11

Westinghouse will revise SBPA-06 response to address RTNSS and cooldown design margins and basis. Westinghouse is to consider Tier 1 changes (Table 2.3.1-2) related to RTNSS and cooldown required flow rates.

Audit Item 12

In RAI-SRP 9.2.2-SBPA-08 requested that Westinghouse provide the bases for the proposed changes to the CCS pump design capacity and total developed head (TDH) and also the bases for proposed changes to the CCS heat exchanger design duty, design UA, and design flow rate (CCS side).

In response, Westinghouse indicated that the increased CCS pump design capacity is primarily due to increased cooling water flow requirements for the reactor coolant pumps. The total developed head requirement for the CCS pumps was reduced substantially by increasing the diameter of several of the CCS main supply and return headers to minimize dynamic losses in the system that would otherwise result from the increase in CCS flow rate. The staff agrees that these particular changes are appropriate and justified for the reasons stated. However, the Westinghouse response did not adequately address and justify the proposed changes to the CCS heat exchanger design parameters (related to RAI-SRP 9.2.2-SBPA-07).

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 12

Westinghouse stated that the bases of the proposed CCS changes were discussed in TR-111. Westinghouse provided as an example, the reduction in the total TDH requirements for the CCS is address in TR-111.

Further, Westinghouse discussed that other CCS changes (including lower CCS pump TDH, increasing piping sizes, and the reduction in flow velocities), were provided in TR-111. The staff will re-review the RAI responses and close RAI-SRP 9.2.2-SBPA-08 with no further information required.

Conclusion to Item 12

The staff agreed to closeout RAI-SRP 9.2.2-SBPA-08. Westinghouse has no further action.

Audit Item 13

In RAI-SRP 9.2.2-SBPA-09 the staff requested that Westinghouse explain how the maximum CCS supply temperature increase in Section 9.2.2.1.2.1, from 35 °C (95 °F) to 37.2 °C (99 °F) during normal plant operations, was determined and justified.

In response Westinghouse explained that the increased CCS supply temperature was due to the proposed increase in the maximum safety non-coincident wet bulb temperature and Westinghouse referenced Page 11 of TR-108, "AP1000 Site Interface Temperature Limits," for additional explanation. Westinghouse also provided information regarding a not yet submitted, additional increase of the maximum safety non-coincident wet bulb temperature that was being made to accommodate the Levy site parameters. This information could not/was not included within the scope of this evaluation. Westinghouse explains, to some extent, how the maximum service water supply temperature is achieved, but does not explain how the maximum CCS supply temperature was determined and justified. The staff also noted that the use of non-conservative temperature assumptions for the plant shutdown and refueling heat transfer analyses was not explained and justified. Furthermore, this approach does not appear to be consistent with the information provided in Tier 2 Section 5.4.7.1.2.3, "In-Containment Refueling Water Storage Tank Cooling," which indicates that the maximum safety non-coincident wet bulb temperature is assumed for normal conditions and transients that start at normal conditions.

Determine what needs to be included in the DCD.

Audit Findings/Comments/Conclusion to Item 13

With the verbal discussion and explanation provided by Westinghouse stating that the normal wet bulb is a realistic value for evaluating DID on investment protection. The max safety wet bulb temp of 86.1°F is applicable for full power operations, see May 7, 2009 and May 13, 2009 supplemental RAI responses. The NRC staff will re-review the RAI responses and close this item. No other action required by Westinghouse.

Conclusion to Item 13

The staff agreed to closeout RAI-SRP 9.2.2-SBPA-09. Westinghouse has no further action.

Audit Item 14

In RAI-SRP 9.2.2-SBPA-10 the staff requested that Westinghouse explain why the proposed maximum safety (noncoincident) wet bulb temperature is specified for normal operation and the maximum normal wet bulb temperature is specified for the other cases. Additional DCD explanation was requested as to why the maximum safety limit does not apply for the CCS defense-in-depth and RTNSS functions to assure that this is the intended approach and to clearly describe what the plant design basis is in this regard.

In response, Westinghouse explained that the maximum safety non-coincident wet bulb temperature does not apply to RTNSS and Investment Protection functions because they are not functions required to guarantee the safety of the plant. However, contrary to this logic, Westinghouse also explained that the maximum safety non-coincident wet bulb temperature is used in determining CCS and service water system performance for power operation since the peak ambient wet bulb temperature has a relatively high likelihood of occurrence during the operating portion of a refueling cycle. Westinghouse failed to recognize that elevated temperature conditions end to increase the likelihood of plant trips and transients due to grid instability. Assurance needs to be provided that defense-in-depth and RTNSS SSCs are capable of performing their functions whenever the maximum normal wet bulb temperature is exceeded. The Westinghouse response did not address the staff's concern in this regard.

Audit Findings/Comments/Conclusion to Item 14

Discussion included the 80.1 °F wet bulb for RTNSS. For normal cooldown within 96 hours, Westinghouse stated that it can be accomplished with 86.1 °F wet bulb, but it takes longer. Further, Westinghouse stated that all the limits have margins. Westinghouse explained that passive safety systems are not needed (RTNSS).

With the verbal discussion and explanation provided by Westinghouse stating that the normal wet bulb is a realistic value for evaluating DID on investment protection. The max safety wet bulb temp of 86.1°F is applicable for full power operations, (see May 7 supplement RAI response). The NRC staff will re-review the RAI response and close this item. No other action required by Westinghouse.

Conclusion to Item 14

The staff agreed to closeout RAI-SRP 9.2.2-SBPA-10 with the information provided in the response.

Audit Item 15

In RAI-SRP 9.2.2-SBPA-11, Westinghouse was asked to revise the DCD (Tier 1 and Tier 2 as appropriate) to address the impact of using HDPE on SWS reliability and availability (seismic) assumptions. Also, the potential consequences of pipe failure (including flooding) should be evaluated assuming the complete failure of all HDPE piping during seismic events coincident with metallic pipe failures that are postulated and other considerations that are specified by Standard Review Plan (SRP) 3.6.1. Finally, the specific criteria for allowing the use of HDPE should be specified in the DCD to ensure clarity of the plant licensing basis.

In response, Westinghouse referred to its earlier response to RAI-TR103-EMB2-02 (2/22/2008). Westinghouse also indicated that HDPE is not used in the AP1000 CCS design and that there are no current plans to use HDPE in this system. However, because use of HDPE is proposed as an option for COL applicants, its use needs to be fully evaluated and justified by Westinghouse. The response that was provided by Westinghouse did not provide the information that was requested in RAI-SRP 9.2.2-SBPA-11.

As a separate matter, the staff also requests that Westinghouse describe how the requirements specified by 10 CFR 20.1406 are satisfied with respect to CCS considerations, including provisions that have been established for buried or inaccessible pipe.

Audit Findings/Comments/Conclusion to Item 15

The staff noted that this discussion is similar to RAI-SRP 9.2.1-SBPA-07, above. Westinghouse stated that although the DCD allows nonmetallic piping, HDPE is precluded from use by code temperature and pressure for this system.

With respect to the requirements specified by 10 CFR 20.1406, Westinghouse stated that this issue was covered under a generic RAI.

Conclusion to Item 15

Westinghouse will consider revising DCD (Section 9.2.2.3.5) to state the pressure and temperature limitations for HDPE usage. Information will be provided in revised RAI response.

New RAIs Resulting From DCD Revision 17 Change Review

The following RAIs were previewed with Westinghouse to determine whether there should have been enough information available in the DCD for the staff to complete its review.

Central Chilled Water System (DCD Section 9.2.7)

In RAI SRP 9.2.2-SBPA-xx for the VWS, the staff asked about the change in design temperature for the CCWS piping inside containment which in DCD Revision 17, was lowered from 320°F to 200°F. At the June 25, 2009 audit, Westinghouse explained that although the design temperature of the system is less, the actual piping is going to be the same size, material, and specifications as previously identified. The temperature change is due to the changes in the low-capacity subsystem which operates at a lower temperature and is not capable of the higher temperature previously stated.

Component Cooling Water Systems (DCD Section 9.2.2)

In RAI SRP 9.2.2-SBPA-XX for the component cooling system, the staff asked about the apparent discrepancy between APP-GW-GLE-036 and DCD Revision Rev. 17 Table 5.4-1 limiting component cooling water temperature. APP-GW-GLE-036 provides a 6 hour acceptable temperature of 100°F, while DCD Rev. 17 states that the 6 hour elevated temperature of 110 F is acceptable.

During its discussion at the June 25, 2009 audit, Westinghouse will respond to this RAI by revising the DCD to the more limiting temperature of 100°F. At the audit, the staff asked about the most limiting component subject to the maximum CCS temperature, to which Westinghouse answered that it is the reactor coolant pump (RCP) motor stator cooler.

Conclusion
Westinghouse stated that it understood the issues and can respond to formal RAIs.

MEMORANDUM TO: Eileen McKenna, Branch Chief
AP1000 Projects Branch 2
Division of New Reactor Licensing
Office of New Reactors

FROM: John Segala, Branch Chief ***/RA/***
Balance of Plant Branch 1
Division of Safety Systems and Risk Assessment
Office of New Reactors

SUBJECT: AUDIT REPORT FROM JUNE 25, 2009 TO REVIEW AP1000 REVISION 16 AND 17 AND RTNSS/COLD SHUTDOWN ISSUES FOR CHAPTER 9

Attached is the staff's audit report for selected areas related to the Docket No. 52-006 and AP1000 Design Control Documents (DCD) Section 9.2, "Water System." Westinghouse submitted to the U.S. Nuclear Regulatory Commission (NRC) DCD Revision 16 and 17 for its AP1000 application in May, 2007 and September, 2008, respectively. After conducting a comprehensive review of DCD Revision 16 and 17, the staff concluded that additional information is needed from the applicant to support the staff's safety evaluation. The audit was conducted on June 25, 2009 between Westinghouse and the NRC staff. This audit report documents the staff's discussion with Westinghouse to resolve open items related to the service water system (Section 9.2.1), reactor component cooling water system (Section 9.2.2) and nuclear island chilled water subsystem (Section 9.2.7). The audit was primarily focused on the review of these systems with regard to the regulatory treatment of non-safety systems (RTNSS) and the ability to support cold shutdown operations.

Enclosure: As Stated

Distribution: JSegala LWheeler CLi PBuckberg CMarks

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