PMSummerColpEM Resource

From: Sebrosky, Joseph
Sent: Thursday, June 24, 2010 4:05 PM
To: 'amonroe@scana.com'; 'jmgiles@scana.com'
Cc: Habib, Donald; PMSummerColpEM Resource
Subject: FW: info: summary of action items from June 23, 2010, meeting to discuss VC Summer wet bulb temperature exemption request

Amy, and Julie,

I intend to add the item 1d per the discussion below to the list of action items from the meeting. The addition of the item is based on feedback from Shie-Jeng Peng, who is a reviewer looking at the control room habitability aspects of the increase in the maximum safety wet bulb temperature. If I receive any more comments on the action items or a list of additional observations from the staff I will provide them to you.

Please let me know if you have any questions.

Sincerely,

Joe Sebrosky
Project Manager
Office of New Reactors
AP1000 Projects Branch 1
301-415-1132

From: Habib, Donald
Sent: Thursday, June 24, 2010 3:35 PM
To: Sebrosky, Joseph
Cc: Peng, Shie-Jeng; McKirgan, John
Subject: RE: info: summary of action items from June 23, 2010, meeting to discuss VC Summer wet bulb temperature exemption request

Joe –

I discussed this issue with Peng. At this point, I would recommend that you add an item 1.d that captures his comment separately. His wording is below:

The technical report section in the draft response titled “Nuclear Island Non-Radioactive Ventilation System Design and Performance,” will be revised to include a discussion or calculation that the conditions (temperature and humidity) for the control room habitability (e.g. heat stress level) post-accident (e.g. station blackout) are not affected by the increased maximum safety wet bulb temperature and associated humidity.

This additional item may appear to partiallyh overlap with 1.a and 1.c, but covers an additional question as well, essentially similar to question 12 resulting from the audit. Summer/Westinghouse may be under the impression that they have already addressed this question in the 6/22 document, albeit indirectly, and I think Peng is looking for a more direct and explicit response.

Don

Donald C. Habib
NRO/DNRL
AP1000 Projects Branch 1
301-415-1035

From: Sebrosky, Joseph
Sent: Wednesday, June 23, 2010 3:28 PM
To: Galletta, Thomas; Wheeler, Larry; Budzynski, John; Peng, Shie-Jeng; Hayes(NRO), Michelle; Habib, Donald; Cruz, Jeffrey; McKirgan, John; Lee, Samuel; Segala, John; Simms, Tanya; Goetz, Sujata; Tatum, James; Wentzel, Michael; Martin, Jody
Cc: 'amonroe@scana.com'; 'jmgiles@scana.com'; SummerCOL Resource
Subject: info: summary of action items from June 23, 2010, meeting to discuss VC Summer wet bulb temperature exemption request

To all,

The purpose of this email is to allow you the opportunity to comment on the action items from today's meeting that I intend to capture in the meeting summary. Please let me know if you have any comments on the action item list by noon on Friday (6/25).

Thanks,

Joe

>>>>>>>>>>>Summary of action items from June 23, 2010, meeting to discuss VC Summer wetbulb temperature exemption request>>

The purpose of the meeting was to discuss the attached draft response to two questions associated with Summer's maximum safety wetbulb temperature exemption request. The action items below were identified during the meeting.

Wet Bulb Draft to NRC.DOC

NRC Actions

1. Provide any additional comments regarding the draft response to South Carolina Electric and Gas (SCE&G) by 6/25/2010

2. Identify whether the NRC would like to review additional calculation packages that are referenced in the draft response. For example, calculation package APP-SWS-M3C009 is referenced in the draft response. The staff has not previously audited this calculation package. The staff will provide a list of the calculation packages that it wishes to review by 6/25/10 so that SCE&G can make them available to the staff the week of June 28, 2010.

SCE&G Actions

1. Regarding responding to the question about the affect the increase in the maximum safety wet bulb temperature has on control room habitability, SCE&G took the following actions:

   a. The technical report section in the draft response titled "Nuclear Island Non-Radioactive Ventilation System Design and Performance," will be revised to include a discussion that the initial conditions for the control room habitability accident analysis are not affected by the increased maximum safety wet bulb temperature.
   b. The technical report section titled, "Safety System Design Basis," will be revised to include a discussion of increased humidity from the increase in the maximum safety wet bulb temperature. Any issues associated with the increased humidity on control room habitability will be addressed.
   c. The response will be revised to add a revision to section 6.4 of the Summer FSAR that will note the increased maximum safety wet bulb temperature and that it was reviewed relative to the control room habitability analysis.

2. The draft response will be revised to include an attachment that addresses RAI 6.2.1-1 and 9.2.2-1. The attachment will include the information provided in a previous draft response to RAI 6.2.1-1 (See ML101410204).

3. SCE&G will provide a reference in the appropriate FSAR sections to technical report VCS-GW-GLE-XXX that is provided in the draft response. Currently the proposed changes to the FSAR do not include listing this report as a reference.

4. VCS-GW-GLE-XXX (the technical report provided in the draft response) will be revised such that it's reference to other technical reports will be provided including the technical report title, revision and date so that future retrieval of these reports, if needed, is made easier.

5. The technical report section in the draft response titled, "Component Cooling System and Service Water System Design and Performance," will be revised to include a discussion of calculation package TPG-SWS-M3C001 which discusses a service water system temperature change from 91.4 F to 91.8 F.

6. Regarding the discussion of the temperature of the component cooling water supplied to the reactor coolant pumps contained in "Component Cooling System and Service Water System Design and Performance," of the technical report, SCE&G will include a discussion of the more important parameters that are monitored (e.g., reactor coolant pump stator temperatures) relative to reactor coolant pump operation.

7. SCE&G will determine if there are any departures in the instrumentation and control system for the higher component cooling water temperatures associated with the increased maximum safety wet bulb temperature.

8. Regarding the discussion contained in the section of the technical report titled, "Nuclear Island Non-Radioactive Ventilation System Design and Performance," SCE&G will do the following:
   a. Check that the 35% number quoted as the margin is accurate and add a discussion for the margin at the Summer site given the higher maximum safety wet bulb temperature.
   b. Add a sentence or two to the discussion that notes the results of the analysis contained in APP-GW-MIC-002 apply to Summer for the low capacity chiller system but do not apply to the hi-capacity chiller system at Summer. The APP-GW-MIC-002 calculation was performed for Turkey Point which had a change to the maximum normal wet bulb temperature in addition to a change in the maximum safety wet bulb temperature. Because the hi-capacity chiller system changes in the technical report are driven by the change to maximum normal wet bulb temperature they are not applicable to Summer.

9. Page 8 of the enclosure includes typos. In some cases the values should by 97.6 F instead of 97.3. These typos will be corrected.

10. SCE&G will review the AP1000 DCD and let the staff know if there is a discussion about the low capacity chiller design. The staff could not find such a discussion.

Hearing Identifier: VCSummer_COL_Public
Email Number: 305

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Subject: FW: info: summary of action items from June 23, 2010, meeting to discuss VC Summer wet bulb temperature exemption request
Sent Date: 6/24/2010 4:04:44 PM
Received Date: 6/24/2010 4:04:46 PM
From: Sebrosky, Joseph

Created By: Joseph.Sebrosky@nrc.gov

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MESSAGE	7708	6/24/2010 4:04:46 PM
Wet Bulb Draft to NRC.DOC	95298	

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Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

June 24, 2010
NND-10-xxxx

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

ATTN: Document Control Desk

Subject: Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3 Combined License Application (COLA) - Docket Numbers 52-027 and 52-028 Responses to NRC Request for Additional Information (RAI) Letter No. 081 Related to SRP Section 9.2.2and Letter No. 079 Related to SRP Section 6.2.1

References: 1. Letter from Tanya Simms (NRC) to Alfred M. Paglia (SCE&G), Request for Additional Information Letter No. 081 Related to SRP Section 9.2.2 for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application, dated April 20, 2010.

2. Letter from Joseph M. Sebrosky (NRC) to Alfred M. Paglia (SCE&G), Request for Additional Information Letter No. 079 Related to SRP Section 6.2.1 for the Virgil C. Summer Nuclear Station Units 2 and 3 Combined License Application, dated March 30, 2010.

The enclosure to this letter provides the South Carolina Electric & Gas Company (SCE&G) response to the RAI items included in the above referenced letters. The enclosure also identifies associated changes that will be incorporated in a future revision of the VCSNS Units 2 and 3 COLA.

Should you have any questions, please contact Mr. Al Paglia by telephone at (803) 345-4191, or by email at apaglia@scana.com.

DRAFT

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this ___ day of ___________, 2010.

Sincerely,

Ronald B. Clary
Vice President
New Nuclear Deployment

AMM/RBC/am

Enclosure

c:

Luis A. Reyes
Joe Sebrosky
Michael Wentzel
Tanya Simms
John Zeiler
Stephen A. Byrne
Jeffrey B. Archie
Ronald B. Clary
Bill McCall
William M. Cherry
Randolph R. Mahan
Kathryn M. Sutton
Amy M. Monroe
Dam Patton
Fredrick P. Hughes
William Hutchins
William A. Fox
Grayson Young
FileNet

NRC RAI Letter No. 079 Dated March 30, 2010

SRP Section: 6.2.1 – Containment Functional Design

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

NRC RAI Number: 06.02.01-1

VCS DEP 2.0-2 increases the maximum noncoincident wet bulb temperature from 86.1°F to 87.3°F. The departure justification states that this increase does not change the maximum containment pressure value reported in the DCD. Please describe the analyses supporting this statement, including initial conditions, break locations, resulting peak pressure and pressure at 24 hours.

VCSNS RESPONSE:

Please refer to Westinghouse document VCS-GW-GLE-XXX which was prepared to support VCS DEP 2.0-2 and is included as Attachment 1 to this submittal. This document provides amplifying information necessary to support increasing the maximum safety wet-bulb temperature from 86.1°F as currently stated in the AP1000 DCD to 87.3°F as required to support the site specific conditions existing at VCSNS Units 2 and 3.

This response is PLANT SPECIFIC.

ASSOCIATED VCSNS COLA REVISIONS:

VCSNS COLA Part 2 will be revised in a future update as indicated below and annotated with a left margin annotation (LMA) of VCS DEP 2.0-2:

Add the following information after the 4th paragraph of DCD Subsection 6.2.1.1.3 as follows:

The maximum safety non-coincident wet bulb temperature for VCSNS Units 2 and 3 is increased from 86.1 ^{o}F to 87.3 ^{o}F, however there are no impacts on the performance of the safety systems.

Add the following information at the end of DCD Subsection 6.2.2.3 as follows:

There are no changes to the AP1000 design required to address any safety issues associated with the VCSNS Units 2 and 3 increased maximum safety wet bulb temperature of 87.3 ^{o}F. The peak containment pressure at the maximum safety wet bulb temperature of 87.3 ^{o}F for the VCSNS Units 2 and 3 site is bounded by the results of the current AP1000 analysis.

The pressure decay curve for the containment utilizing the standard maximum safety wet bulb value of 87.3 °F is the same as the containment response for wet bulb temperatures equal to the standard maximum safety wet bulb value.

Add the following information at the end of the first bullet in DCD Subsection 9.2.2.1.2.1 as follows:

The most limiting component cooled by the CCS, the RCP motor cooling system, has been designed to operate for at least 6 hours continually with cooling water supplied at temperatures up to 100 °F.

The performance of the standard AP1000 CCS and SWS for single cooling water train, full power operation at a maximum safety wet bulb temperature of 87.4 °F has demonstrated the highest CCS temperature achieved at these conditions is 97.4 °F, for a period of less than 2 hours. As ambient wet bulb temperature decreases, the CCS temperature follows and will return to below 95 °F with ambient wet bulb temperature slightly lower than 84 °F, assuming nominal performance of both the CCS and SWS. Since the definition of the maximum normal wet bulb temperature value is the seasonal 1% exceedence value observed at the site, the annual total operating time for which CCS temperatures could exceed 95 °F is less than 30 hours per year, for periods of a few hours at most. The maximum CCS temperature of 97.6 °F is bounded by the maximum allowable cooling water temperature for Reactor Coolant Pumps (the most limiting component) and the increase in maximum safety wet bulb temperature is therefore acceptable on this basis.

Add the following information at the end of the third bullet in DCD Subsection 9.1.3.1.3.1 as follows:

SFS performance following restart after a normal refueling is affected by a change in maximum safety wet bulb temperature. Calculations confirm that spent fuel pool temperature remains below 115 °F with a CCS supply temperature of 97 °F at the specified pool spent fuel loading condition and decay time on the fuel fraction just replaced during the previous 17 day refueling outage.

While the maximum CCS temperature expected for VCSNS Units 2 and 3 is 97.3 °F, an increase of 0.3 °F in CCS supply temperature will produce a similar increase (ie, 0.3 °F) in the spent fuel pool maximum temperature (approximately 115.3 °F); therefore, the requirement to maintain spent fuel temperature below 120 °F is met with margin.

Add the following information at the end of the second bullet in DCD Subsection 5.4.7.1.2.3 as follows:

The steaming prevention function is evaluated assuming the ambient wet bulb temperature is at the maximum safety value for the site. During plant operation, maximum IRWST temperature is reduced below 120 ^{o}F whenever necessary by circulating IRWST water through one of the RNS heat exchangers, and removing the heat through the CCS and SWS. Since the RNS heat exchangers are not being used to remove decay heat with the plant at power, at least one is available for IRWST heat removal. Only one train of CCS (pump and heat exchanger) and one train of SWS (pump, strainer, and cooling tower cell) during power operation. There is sufficient margin in CCS pump flow capacity and motor size, and in CCS heat exchanger UA, to valve in one of the RNS heat exchangers and remove IRWST heat by directing CCS flow through the heat exchanger and transferring the excess heat to the SWS cooling tower. CCS temperature rises slightly above the normal maximum value for power operation (97.4 ^{o}F) during this evolution.

Prevention of IRWST steaming following high pressure heat removal operations with the Passive Residual Heat Removal (PRHR) heat exchanger is accomplished in the same manner, by lining up one of the two RNS heat exchangers to the CCS and the IRWST. CCS is delivered to the RNS heat exchanger at a temperature consistent with the maximum safety ambient wet bulb temperature and the CCS and SWS heat duty and flow rates. Cooling is assumed to begin two hours after reactor trip, with decay heat appropriate for that time after the event. Calculations performed to determine the maximum IRWST temperature achieved following a high pressure heat removal event using the PRHR heat exchanger assumed CCS temperature is determined by use of a maximum safety ambient wet bulb temperature value of 87.4 ^{o}F. This maximum predicted IRWST liquid temperature is 201 ^{o}F. Therefore, it can be concluded that IRWST cooling performance (prevention of steaming) is acceptable.

Add the following information at the end of the first paragraph under “Normal Operation” in DCD Subsection 9.2.7.2.4 as follows:

The increased heat load based on the higher wet bulb temperature of 87.3 ^{o}F can be accommodated within the available capacity margin without impacting the system or supporting systems design or plant operation. With the higher wet bulb temperature, the low capacity chiller load increases to 182 tons (maximum with margin), however the low capacity chillers are sized for 230 tons load.

ASSOCIATED ATTACHMENTS:

See VCS-GW-GLE-xxxx

Brief Description of the Impact (what is being changed and why):

Impacts of an increase in the Maximum safety Wet Bulb non-coincident temperature for the V C Summer site from 86.1 ^oF to 87.3 ^oF.

FSAR Sections Impacted:
Impacts Tier 1 Chapter 5, Table 5.0-1 / Chapter 2 Table 2-1 (Sheet 1 of 3) (Tier 2) and 2.3.5 of the Standard Review Plan (SRP). Other sections are 5.4.7.1.2.3, 6.2.2.3, 9.2.2.1.2.1 and Table 6.2.1.1-2

This evaluation is prepared to document the impacts of an increase in the value of Maximum safety non-coincident Wet Bulb temperature at the V C Summer site. This document provides the justifications for the acceptability of a departure from the standard AP1000 DCD and certification basis that will be included in the Summer Combined License Application (COLA).

I. TECHNICAL DESCRIPTION

AP1000 DCD Revision 17 Table 5.0-1 Tier 1 and Table 2-1 (sheet 1of 3) Tier 2 provides a listing of standard values for site environmental parameters. The V C Summer Plant maximum safety non-coincident wet bulb temperature exceeds the standard value given in the DCD.

The Maximum safety non-coincident wet bulb temperature for the V C Summer site was recently re-evaluated and increased from the standard value of 86.1 ^oF to 87.3 ^oF to reflect expected site maximum temperature conditions. This change requires that an evaluation be performed for the various plant performance requirements and commitments affected by maximum safety non-coincident wet bulb temperature to confirm that the performance of the plant's safety systems remains within the bounds described in the AP1000 DCD.

The following sections in the AP1000 DCD describe areas that could be affected by an increase in maximum safety wet bulb temperature. Each of these areas has been reviewed and the evaluations demonstrate that there is sufficient margin to accommodate the increase in maximum safety non-coincident wet Bulb temperature without requiring changes to the certified AP1000 design.

- DCD Section 6.2.2, Passive Containment Cooling System performance
- DCD Section 5.4.7.1.2.3, Normal Residual Heat Removal System – In-Containment Refueling Water Storage Tank temperature control
- DCD Section 9.2.2.1.2.1, Component Cooling Water – Normal Operation temperature limit
- DCD Section 9.2.2.1.2.2, Component Cooling Water – Normal Plant Cooldown (time to temperature)
- DCD Section 9.1.3.1.3.1, Spent Fuel Pool Cooling-Partial Core Shuffle (normal refueling pool temperature control)
- DCD Section 9.1.3.1.3.2, Spent Fuel Pool Cooling – Full Core Off-Load pool

temperature control

- DCD Section 9.2.1.2.3.4, Service Water System – Plant Cooldown/Shutdown maximum cooling water temperature at peak heat load
- DCD Section 9.2.2.1.2.3, Component Cooling Water – Refueling
- DCD Section 9.2.7.2.4, Central Chilled Water System – Normal Operation

II. CHANGE JUSTIFICATION

Design Assessment

The impact of the higher maximum safety non-coincident wet bulb temperature was evaluated on a system by system basis. The same type of analyses have been performed twice previously for two required increases in AP1000 standard site temperature conditions, and once to justify a departure for a specific site whose site temperature conditions exceeded standard site temperature conditions documented in the DCD.

Several of the areas of concern listed in Section I above are not affected by a change in maximum safety wet bulb temperature at V C Summer, since the performance of the potentially impacted systems depends only on dry bulb temperature and/or is based on the limiting AP1000 1% exceedance (maximum normal) wet bulb temperature value of 80.1^{o}F. The equivalent V C Summer values for these parameters are bounded by the standard site values for AP1000.

The areas that could be affected by the increased maximum safety wet bulb temperature at the V C Summer site include:

- Passive containment cooling system (PCS) design and performance
- Component cooling system (CCS) and service water system (SWS) design and performance
- Spent fuel cooling system (SFS) design and performance
- Turbine building closed cooling water system (TCS) design and performance
- In-Containment Refueling Water Storage Tank (IRWST) temperature control
- Nuclear Island non-radioactive ventilation system (VBS) design and performance
- RTNSS availability and decay heat removal capability of SWS and CCS during RCS reduced-inventory operation in Modes 5 and 6

One of the safety systems described in the AP1000 DCD is affected only by changes in the site maximum safety dry bulb temperature and is therefore unaffected by the increase in maximum safety wet bulb temperature for the V C Summer site:

- Passive heat sink performance for the Main Control Room (MCR) and 1E electrical equipment rooms

Several other areas discussed in the DCD are unaffected by the increase in the maximum safety non-coincident wet bulb temperature because their performance is based on the limiting value of the site maximum normal non-coincident wet bulb temperature or on the coincident maximum dry bulb and wet bulb temperature. For V C Summer the site-specific values of these temperature parameters are bounded by the standard AP1000 values. The areas dependent only upon these unaffected temperature parameters include:

- Plant cooldown with the normal residual heat removal system (RNS) from 350 °F to 125 °F within 96 hours
- Maximum SWS cold water temperature at peak system heat load conditions associated with the beginning of RNS cooldown
- Normal high capacity chilled water system (VWS) design and performance
- Spent fuel pool cooling for full core off-load and emergency core off-load conditions

Use of Reference Calculations as Basis for Conclusions

The maximum safety non-coincident wet bulb temperature value for the proposed Florida Power and Light (FP&L) Turkey Point AP1000 site (87.4 °F) has been determined to exceed the standard AP1000 site value specified for this parameter (86.1 °F). FP&L previously requested that Westinghouse perform an evaluation to determine the potential design and performance impacts associated with the increased temperature value. This evaluation was used to prepare a Departure for the Turkey Point COLA.

The calculations performed for FP&L to determine the effects of the maximum safety non-coincident wet bulb temperature are cited herein as reference calculations for V C Summer, since the Turkey Point site value of this parameter bounds the V C Summer value (87.3 °F). The V C Summer maximum safety non-coincident wet bulb temperature (87.3 °F) has been determined using available historical records from the site by applying standard statistical methods to compute the 100 year return temperature. The same approach was also used to determine the value of this parameter for the Turkey Point site (87.4 °F). Therefore, comparisons using the two stochastic values are valid. Conclusions regarding the acceptability of the AP1000 design and performance areas affected by changes in maximum safety non-coincident wet bulb temperature for the Turkey Point site therefore apply to the V C Summer site.

It is important to note that conclusions in the referenced calculation notes regarding the impact of the increase of the Turkey Point site maximum normal non-coincident wet bulb temperature to 81.5 °F do not apply to V C Summer, since the maximum normal Summer site wet bulb value is bounded by the standard AP1000 value of 80.1 °F.

Safety System Design Basis

There are no changes to the AP1000 design required to address any safety issues associated with the increased maximum safety wet bulb temperature at the V C Summer site. Evaluations performed for Turkey Point (Westinghouse calculation note TPG-GW-GSC-001 Revision 0, *WGOTHIC Containment Peak Pressure Analysis for the Evaluation of FP&L Turkey Point COL Maximum Wet Bulb Temperature Departure from DCD*) and for the standard AP1000 plant design (APP-GW-GSC-040 Revision 0) demonstrate that the AP1000 accident analysis cases of record bound the performance expected at the Turkey Point site maximum safety non-coincident wet bulb temperature of 87.4 °F. The peak containment pressure at the slightly lower maximum safety wet bulb temperature of 87.3 °F for the V C Summer site is therefore also bounded by the results of the current AP1000 analysis.

The pressure decay curve for the containment is identical for wet bulb temperatures equal to the standard maximum safety wet bulb value and the Turkey Point value. The containment response for V C Summer at its maximum safety wet bulb temperature will therefore also be identical to the standard containment response.

The passive heat sinks associated with the Main Control Room Habitability System (VES) control the auxiliary building safety related room temperatures post-accident. The temperature profiles of these rooms are impacted by ambient dry bulb temperature only. The V C Summer maximum ambient dry bulb temperature (112 °F) is enveloped by the current AP1000 standard site value of 115 °F and thus the passive heat sink analysis of record for AP1000 remains valid for V C Summer as well.

Component Cooling System and Service Water System Design and Performance

The limiting temperature performance for the CCS and SWS occurs during normal power operation, with the site ambient wet bulb temperature at its maximum safety value. The AP1000 maximum safety wet bulb temperature is defined as the annual “0% exceedence” value measured at or calculated for the site. It is based on the maximum observed wet bulb temperature value of less than 2 hour duration.

The original AP1000 design criterion for CCS and SWS performance was that the maximum CCS supply temperature should not exceed 95 °F for normal plant power operation with a single train of cooling water systems in service and wet bulb temperature at the maximum safety non-coincident value. Increases in the value of the standard site maximum safety wet bulb temperature from 81 °F to 85.5 °F and finally (in DCD Revision 17) to 86.1 °F have been made to include a larger number of candidate sites within the standard site temperature envelope for AP1000. The most limiting component cooled by the CCS, the RCP motor cooling system, has been designed to operate for at least 6 hours continually with cooling water supplied at temperatures up to 100 °F, as a result of the increases in CCS temperature above 95 °F associated with the previous increases in wet bulb temperature.

Calculation note TPG-CCS-M3C-001, Revision 0, *Turkey Point Units 6 and 7 Performance Evaluation using Elevated Maximum Non-Coincident Safety Wet Bulb Temperature* documents the performance of the standard AP1000 CCS and SWS for single cooling water train, full power operation at the higher maximum safety wet bulb temperature of 87.4 °F. The highest CCS temperature achieved at these conditions is 97.4 °F, for a period of less than 2 hours. (The expected maximum CCS temperature will be slightly lower for V C Summer since the controlling wet bulb temperature is lower compared to the Turkey Point site.)

As ambient wet bulb temperature decreases, the CCS temperature follows and will return to below 95 ^{o}F with ambient wet bulb temperature slightly lower than 84 ^{o}F, assuming nominal performance of both the CCS and SWS. Since the definition of the maximum normal wet bulb temperature value is the seasonal 1% exceedence value observed at the site, the annual total operating time for which CCS temperatures could exceed 95 ^{o}F is less than 30 hours per year, for periods of a few hours at most. The maximum CCS temperature of 97.6 ^{o}F is bounded by the maximum allowable cooling water temperature for Reactor Coolant Pumps (the most limiting component) and the increase in maximum safety wet bulb temperature for V C Summer is therefore acceptable on this basis. No changes to the design of the CCS or SWS are required for V C Summer.

Spent Fuel Cooling System Design and Performance

Only one of the several DCD spent fuel pool cooling performance cases uses the maximum safety non-coincident wet bulb temperature as the basis for determining heat removal performance. This case is the limiting spent fuel pool temperature immediately following plant restart after a normal (fuel shuffle) refueling. All other SFS cooling cases use the maximum normal non-coincident wet bulb temperature as the basis for calculation. Therefore, these latter cases are unaffected by the increase in site maximum safety wet bulb temperature and the performance conclusions described in the DCD and SFS System Design Description remain applicable for V C Summer.

Calculation note APP-SFS-M3C-042, Revision 0, *SFS HX Sizing Calculation Using Florida Power and Light (Turkey Point) Increased Wet Bulb Temperatures* documents the performance of the Turkey Point SFS in removal of spent fuel decay heat for both types of cases. The case representing SFS performance following restart after a normal refueling is the only one affected by a change in maximum safety wet bulb temperature. The results of the calculation confirm that spent fuel pool temperature remains below 115 ^{o}F with a CCS supply temperature of 97 ^{o}F at the specified pool spent fuel loading condition and decay time on the fuel fraction just replaced during the previous 17 day refueling outage.

The maximum CCS temperature expected for V C Summer is 97.3 ^{o}F. An increase of 0.3 ^{o}F in CCS supply temperature (assuming ambient wet bulb temperature achieved equals the V C Summer site maximum safety value of 97.3 ^{o}F instead of the 97 ^{o}F value used in the calculation) will produce a similar increase in the spent fuel pool maximum temperature; therefore, the requirement to maintain spent fuel temperature below 120 ^{o}F is met with margin. Both SFS heat exchangers are required to operate to maintain SFS pool temperature below 120 ^{o}F for the first few weeks after refueling.

The remaining spent fuel pool temperature performance cases use the maximum normal wet bulb temperature as the basis for calculation. These cases are described and evaluated in APP-SFS-M3C-042, but the CCS temperatures assumed exceed the temperatures expected for AP1000 plants with maximum normal wet bulb temperatures bounded by the DCD value of 80.1 ^{o}F. Therefore, the maximum pool temperatures predicted in APP-SFS-M3C-042 bound the temperatures expected for V C Summer under similar conditions.

It can be concluded that no design changes to the V C Summer SFS are required to accommodate the increase in maximum safety non-coincident wet bulb temperature.

Steam and Power Conversion Systems and Turbine Building Closed Cooling Water System (TCS) Design and Performance

Westinghouse has undertaken, with the NuStart utilities, an effort to optimize the turbine generator condenser and evaluate the performance of the condenser and turbine generator (TG) with various Circulating Water System (CWS) flow rates and temperatures. Therefore the optimized standard condenser that has been developed for the AP1000 will adequately accommodate the site conditions for both Turkey Point and V C Summer. Therefore no changes to the standard AP1000 steam and power conversion systems are anticipated for the increased meteorological conditions

The V C Summer Circulating Water System (CWS) is a site specific design, and is not part of the standard AP1000 design. However the CWS does interface with the condenser as well as TCS heat exchangers and condenser vacuum pump seal water heat exchangers and these are part of the AP1000 standard design. The CWS is designed to supply cooling water to the main condenser and the TCS at a nominal temperature of 91 ^{o}F at full power conditions, using mechanical draft cooling towers.

The exact design and performance characteristics of the V C Summer CWS cooling towers are uncertain. However, the cooling tower cold water temperature variation with wet bulb temperature should be similar to that described for the proposed Turkey Point CWS cooling towers in calculation note TPG-TCS-M3C-001, Revision A, *TCS Supply Temperature at 87.4 ^{o}F Ambient Wet Bulb*. The maximum CWS supply temperature is determined by the maximum ambient wet bulb temperature, and for V C Summer would be nearly equivalent to the value estimated in the referenced calculation note. Assuming both cold water temperature values are equal, the conclusions of the Turkey Point TCS performance calculation indicate that the maximum TCS temperature supplied to the plant turbine and generator auxiliaries will be significantly lower than the design temperature limit of 105 ^{o}F for the system.

No changes to the design of the V C Summer TCS, CWS, or steam and power conversion systems are required to accommodate the increase in maximum safety ambient wet bulb temperature for the site.

In-Containment Refueling Water Storage Tank (IRWST) Temperature Control

The RNS heat exchangers are used to control the temperature of the water in the IRWST during normal operation, and to remove heat during Passive Residual Heat Removal System operation to prevent the IRWST from steaming to containment. The steaming prevention function is evaluated assuming the ambient wet bulb temperature is at the maximum safety value for the site. Therefore, an increase in the value of this parameter has the potential to affect the performance of the IRWST steaming prevention function provided by the RNS, CCS, and SWS.

During plant operation, maximum IRWST temperature is reduced below 120 ^{o}F whenever necessary by circulating IRWST water through one of the RNS heat exchangers, and removing the heat through the CCS and SWS. Since the RNS heat exchangers are not being used to remove decay heat with the plant at power, at least one is available for IRWST heat removal. Only one train of CCS (pump and heat exchanger) and one train of SWS (pump, strainer, and cooling tower cell) during power operation. There is sufficient margin in CCS pump flow capacity and motor size, and in CCS heat exchanger UA, to valve in one of the RNS heat exchangers and remove IRWST heat by directing CCS flow through the heat exchanger and transferring the excess heat to the SWS cooling tower. CCS temperature rises slightly above the normal maximum value for power operation (97.4 ^{o}F) during this evolution.

Prevention of IRWST steaming following high pressure heat removal operations with the Passive Residual Heat Removal (PRHR) heat exchanger is accomplished in the same manner, by lining up one of the two RNS heat exchangers to the CCS and the IRWST. CCS is delivered to the RNS heat exchanger at a temperature consistent with the maximum safety ambient wet bulb temperature and the CCS and SWS heat duty and flow rates. Cooling is assumed to begin two hours after reactor trip, with decay heat appropriate for that time after the event. Calculation note APP-PXS-M3C-060, Revision 0, *IRWST Heatup with FPL Wet Bulb Temperature* was performed to determine the maximum IRWST temperature achieved following a high pressure heat removal event using the PRHR heat exchanger. This calculation note assumes CCS temperature is determined by use of the maximum safety ambient wet bulb temperature value applicable to the Turkey Point site (87.4 ^{o}F). Since the V C Summer site ambient wet bulb temperature value is bounded by the Turkey Point site value, the predicted performance of the RNS, CCS, and SWS bounds the anticpated performance for V C Summer.

The maximum predicted IRWST liquid temperature is 201 ^{o}F for Turkey Point. Therefore, it can be concluded that IRWST cooling performance (prevention of steaming) is also acceptable for V C Summer, since its maximum safety wet bulb temperature is lower than the value used in APP-PXS-M3C-060.

<u>Nuclear Island Non-Radioactive Ventilation System Design and Performance</u>

The Nuclear Island Non-radioactive Ventilation System (VBS) is the only HVAC system that is designed to accommodate the maximum safety temperature limits. The remainder of the HVAC systems are designed to accommodate the maximum normal temperature limits (1% exceedance values), including the High Capacity Chilled Water subsystem.

The VBS maintains the safety related heat sink temperatures and is currently designed with a ~35% margin and two 100% capacity subsystems. The increased heat load based on the higher wet bulb temperature of 87.3 ^{o}F can be accommodated within the available capacity margin without impacting the system or supporting systems design or plant operation. Calculation note APP-GW-M1C-002 Revision A, *AP1000 High Humidity HVAC Systems Design Evaluation* assesses the impact of changes in both maximum safety and maximum normal ambient wet bulb temperature on the design and performance of both the High Capacity and Low Capacity Chilled Water Systems. The calculation note assumes that the maximum ambient wet bulb temperature is increased to 87.4 ^{o}F and the maximum normal ambient wet bulb temperature is increased to 81.5 ^{o}F. Since the V C Summer maximum safety wet bulb temperature change results in a limiting temperature value of 87.3 ^{o}F, the results documented in APP-GW-M1C-002 bound the effects of this change on the V C Summer plants. The Summer site maximum normal temperature has not been increased from the AP1000 standard value of 80.1 ^{o}F. Therefore, any conclusions regarding changes needed as a result of increasing the maximum normal ambient wet bulb value do not apply to V C Summer.

The referenced calculation note shows that no changes are needed to the AP1000 Low Capacity Chilled Water system - the system that serves VBS HVAC loads (the MCR and 1E electrical rooms) and the CVS Injection Pump and RNS Pump room coolers. The low capacity chiller load increases to 182 tons (maximum with margin) but the low capacity chillers are sized for 230 tons load. Since they are also air-cooled, their performance is not sensitive to changes in wet bulb temperature. Therefore, the existing, standard air-cooled chiller design serving the VBS is acceptable for V C Summer.

RTNSS Availability and Heat Removal Capability of SWS and CCS

The RTNSS function of the CCS and SWS is to remove decay heat during Mode 5 and Mode 6 reduced RCS inventory operations. Heat removal performance is reduced by increases in ambient wet bulb temperature that cause increases in SWS cold water temperature and CCS supply temperature. However, the total heat duty of the CCS and SWS is significantly lower during this mode of operation, as compared to the normal power or cooldown modes, because there is essentially no sensible heat to remove from the RCS and the core decay heat level is low. Primary plant component heat loads (e.g, from RCPs and VFDs) are also very small. Any slight increase in ambient wet bulb temperature will not compromise the heat removal capability of the systems. The impact of an increase in the V C Summer maximum safety wet bulb temperature from 86.1 ^{o}F to 87.4 ^{o}F on the RTNSS performance of the CCS and SWS is therefore acceptable.

Plant Cooldown With the Normal Residual Heat Removal System (RNS)

Cooldown from 350 ^{o}F to 125 ^{o}F must be accomplished with 96 hours after reactor shutdown, using both trains of RNS, CCS, and SWS. This evolution produces the peak heat duty on the cooling water systems. The basis temperature for plant cooldown is the maximum normal non-coincident wet bulb temperature. Since the maximum normal ambient wet bulb temperature for the V C Summer site has not changed from the standard AP1000 value (80.1 ^{o}F), there is no impact on cooldown performance caused by the change.

Calculation note APP-RNS-M3C-003, Revision 3, *AP1000 RNS Plant Cooldown Performance*

Calculation demonstrates that the standard AP1000 plant (including the V C Summer units) can achieve the 96 hour cooldown requirement with the ambient wet bulb temperature assumed to be 80.1 ^{o}F.

SWS Cold Water Temperature at Peak Heat Load Conditions

The DCD specifies that the maximum value of SWS cold water temperature (supply temperature to CCS heat exchangers) will be 88.5 ^{o}F at the beginning of cooldown, 4 hours after reactor shutdown. This temperature is based on the use of the maximum normal wet bulb temperature as a reference for SWS cooling tower performance. Since the increase in V C Summer site maximum safety wet bulb temperature from 86.1 ^{o}F to 87.3 ^{o}F does not affect the value of the site maximum normal temperture, there is no change to the predicted value of SWS cold water temperature at the beginning of cooldown for the plant.

Calculation note APP-SWS-M3C-009, Revision 1, *Service Water Temperature Variation During RNS Cooldown*, provides a detailed analysis of the time dependence of SWS cold water temperature for several different ambient wet bulb temperatures at the expected peak heat duty. The calculated cold water temperature at 4 hours after reactor shutdown, for ambient wet bulb temperature of 80.1 oF, is 87.22 oF. This value satisfies the DCD commitment and applies to V C Summer as well as to all other AP1000 sites with maximum normal wet bulb temperatures bounded by the standard site temperature.

Conclusions

There are no design changes required in order to accommodate the increased maximum safety wet bulb temperature at the V C Summer site.

There are no impacts on the performance of V C Summer plant safety systems as a result of the increased maximum safety wet bulb temperature.