PMComanchePekNPEm Resource

From: Monarque, Stephen
Sent: Thursday, December 17, 2009 3:54 PM
To: ComanchePeakCOL Resource
Subject: FW: RAI #121 and #123 Responses Submitted to NRC nonpublic pending SUNSI review
Attachments: TXNB-09081 RAI #121 and #123.pdf

From: John.Conly@luminant.com [mailto:John.Conly@luminant.com]
Sent: Wednesday, December 16, 2009 4:29 PM
To: rjb@nei.org; david.beshear@txu.com; Biggins, James; rbird1@luminant.com; mike.blevins@luminant.com; Dennis.Buschbaum@luminant.com; russell_bywater@mnes-us.com; JCaldwell@luminant.com; Ronald.Carver@luminant.com; cp34update@certrec.com; Ciocco, Jeff; Timothy.Clouser@luminant.com; Collins, Elmo; John.Conly@luminant.com; Carolyn.Cosentino@luminant.com; brock.degeyter@energyfutureholdings.com; nancy.douglas@txu.com; Eric.Evans@luminant.com; Rafael.Flores@luminant.com; sfrantz@morganlewis.com; Goldin, Laura; Hamzehee, Hossein; kazuya_hayashi@mnes-us.com; masaya_hoshi@mnes-us.com; mutsumi_ishida@mnes-us.com; Johnson, Michael; Kallan, Paul; masahiko_kaneda@mnes-us.com; kak@nei.org; Allan.Koenig@luminant.com; Kramer, John; mlucas3@luminant.com; Fred.Madden@luminant.com; Matthews, David; tmatthews@morganlewis.com; Monarque, Stephen; Ashley.Monts@luminant.com; Bill.Moore@luminant.com; masanori_onozuka@mnes-us.com; ck_paulson@mnes-us.com; Plisco, Loren; Robert.Reible@luminant.com; jrund@morganlewis.com; jeff.simmons@energyfutureholdings.com; Singal, Balwant; nan_sirirat@mnes-us.com; Takacs, Michael; joseph_tapia@mnes-us.com; Tindell, Brian; Bruce.Turner@luminant.com; Vrahoretis, Susan; Ward, William; Matthew.Weeks@luminant.com; Willingham, Michael; Donald.Woodlan@luminant.com; diane_yeager@mnes-us.com
Cc: James.Hill2@luminant.com
Subject: RAI #121 and #123 Responses Submitted to NRC

Luminant has submitted the attached responses to RAI No. 3232 (CP RAI #123) and No. 3762 (CP RAI #121) to the NRC. All attachments are included with this message. If there are any questions regarding the responses, please contact me or contact Don Woodlan (254-897-6887, Donald.Woodlan@luminant.com).

Thanks,

John Conly

Luminant
COLA Project Manager
(254) 897-5256

Hearing Identifier: ComanchePeak_COL_NonPublic
Email Number: 1330

Mail Envelope Properties (9C2386A0C0BC584684916F7A0482B6CA061B0F0858)

Subject: FW: RAI #121 and #123 Responses Submitted to NRC nonpublic pending SUNSI review
Sent Date: 12/17/2009 3:54:07 PM
Received Date: 12/17/2009 3:54:10 PM
From: Monarque, Stephen

Created By: Stephen.Monarque@nrc.gov

Recipients:
"ComanchePeakCOL Resource" <ComanchePeakCOL.Resource@nrc.gov>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	Size	Date & Time
MESSAGE	2515	12/17/2009 3:54:10 PM
TXNB-09081 RAI #121 and #123.pdf	1628338	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Luminant

Rafael Flores
Senior Vice President &
Chief Nuclear Officer
rafael.flores@luminant.com

Luminant Power
P O Box 1002
6322 North FM 56
Glen Rose, TX 76043

T 254.897.5590
F 254.897.6652
C 817.559.0403

CP-200901682
Log # TXNB-09081

Ref. # 10 CFR 52

December 16, 2009

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555
ATTN: David B. Matthews, Director
Division of New Reactor Licensing

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 3 AND 4
DOCKET NUMBERS 52-034 AND 52-035
RESPONSES TO REQUESTS FOR ADDITIONAL INFORMATION NO. 3232 AND 3762

Dear Sir:

Luminant Generation Company LLC (Luminant) submits herein responses to Requests for Additional Information No. 3232 and 3762 for the Combined License Application for Comanche Peak Nuclear Power Plant Units 3 and 4. The affected Final Safety Analysis Report pages are included with the responses.

Should you have any questions regarding these responses, please contact Don Woodlan (254-897-6887, Donald.Woodlan@luminant.com) or me.

The commitments made in this letter are specified on page 3.

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

Executed on December 16, 2009.

Sincerely,

Luminant Generation Company LLC

Rafael Flores for

Attachments: 1. Response to Request for Additional Information No. 3232 (CP RAI #123)
2. Response to Request for Additional Information No. 3762 (CP RAI #121)

Electronic distribution w/all attachments

mike.blevins@luminant.com
Rafael.Flores@luminant.com
mlucas3@luminant.com
jeff.simmons@energyfutureholdings.com
Bill.Moore@luminant.com
Brock.Degeyter@energyfutureholdings.com
rbird1@luminant.com
Matthew.Weeks@luminant.com
Allan.Koenig@luminant.com
Timothy.Clouser@luminant.com
Ronald.Carver@luminant.com
David.Volkening@luminant.com
Bruce.Turner@luminant.com
Eric.Evans@luminant.com
Robert.Reible@luminant.com
donald.woodlan@luminant.com
John.Conly@luminant.com
JCaldwell@luminant.com
David.Beshear@txu.com
Ashley.Monts@luminant.com
Fred.Madden@luminant.com
Dennis.Buschbaum@luminant.com
Carolyn.Cosentino@luminant.com

Luminant Records Management

masahiko_kaneda@mnes-us.com
masanori_onozuka@mnes-us.com
ck_paulson@mnes-us.com
joseph_tapia@mnes-us.com
russell_bywater@mnes-us.com
diane_yeager@mnes-us.com
kazuya_hayashi@mnes-us.com
mutsumi_ishida@mnes-us.com
nan_sirirat@mnes-us.com
masaya_hoshi@mnes-us.com
rjb@nei.org
kak@nei.org
michael.takacs@nrc.gov
cp34update@certrec.com
michael.johnson@nrc.gov
David.Matthews@nrc.gov
Balwant.Singal@nrc.gov
Hossein.Hamzehee@nrc.gov
Stephen.Monarque@nrc.gov
jeff.ciocco@nrc.gov
michael.willingham@nrc.gov
john.kramer@nrc.gov
Brian.Tindell@nrc.gov
Elmo.Collins@nrc.gov
Loren.Plisco@nrc.com
Laura.Goldin@nrc.gov
James.Biggins@nrc.gov
Susan.Vrahoretis@nrc.gov
sfrantz@morganlewis.com
jrund@morganlewis.com
tmatthews@morganlewis.com

Regulatory Commitments in this Letter

This communication contains the following new or revised commitments which will be completed or incorporated into the CPNPP licensing basis as noted. The Commitment Number is used by Luminant for internal tracking.

Number	Commitment	Due Date/Event
6891	FSAR Figure 3.8-206 and related Chapter 3 figures will be revised in a future FSAR Update Tracking Report as the detailed [ESW and transfer pump room] ventilation design and equipment layout progresses.	Future Update Tracking Report
6901	The [ESW transfer pump room] flooding event evaluation will be described in a new FSAR Subsection 3.4.1.5.3 and the details of the floor drain and sill design will be shown in FSAR Figure 3.8-209 or related FSAR Section 3.8 figures in a future FSAR Update Tracking Report. FSAR Subsection 9.4.5.3.6 will also be revised to reflect the new flooding-related FSAR information.	Future Update Tracking Report

Attachment 1

Response to Request for Additional Information No. 3232 (CP RAI #123)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-3

Seismic I and Seismic II/I – GDC 2

Each pump house is designed as a Seismic I structure and situated so that all engineered safety feature (ESF) Ventilation System (VS) components will be above the design-basis flooding level (DBFL) [Reference FSAR subsection 3.4.1.2]

For guidance with respect to compliance with 10 CFR part 50, Appendix A, General Design Criteria, (GDC) 2, the NRC staff invokes the following excerpt from Technical Rationale "1" of NUREG-0800, Standard Review Plan (SRP) 9.4.5: "The function of the ESFVS is to provide a suitable and controlled operating environment for engineered safety feature components during normal operation, during adverse environmental occurrences, and during and subsequent to postulated accidents, including loss of offsite power. GDC 2 ensures that engineered safety features will remain functional during and after a design basis earthquake."

The safety related design bases for the ultimate heat sink (UHS) essential service water (ESW) pump house ventilation system are provided by the combined license (COL) applicant in FSAR subsection 9.4.5.3.6. This subsection reads that "*All ventilation system equipment and components are classified as equipment class 3, seismic category I.*" and that "*The UHS ESW pump house ventilation system components are protected from tornado generated missiles by their location inside a seismic category I structure.*"

The NRC staff found that COL Figure 9.4-201 "UHS ESW Pump House Ventilation System Flow Diagram" of the applicant's FSAR does not indicate seismic classification of the components of the UHS ESW Pump House Ventilation System. Items 2.A and B of Section III "Review Procedures of SRP 9.4.5 indicates that the piping and instrumentation diagrams (P&IDs) should designate the seismic classifications of components and demarcate division between classifications.

Please provide P&IDs that designate the seismic classifications of components and demarcate division between classifications

In addition, the NRC staff found that it appears from review of Figure 9.4-201 that heating ventilation and air conditioning (HVAC) duct work exists on both sides of the back draft dampers of the air outlets and on the upstream side of the back draft dampers of the air intakes of each room's ventilation system. The staff found that Table 3.2-201 "Classification of Site-Specific Mechanical and Fluid Systems, Components, and Equipment" does not list "ducts" or ducting as a system component for UHS ESW Pump House Ventilation System. Please explain why Table 3.2-201 does not list ducts or ducting as a system component.

Also, it is not clear to the NRC staff whether any other non-safety related and/or non-seismic systems or components will be located within the Seismic Category I UHS ESW Pump Houses. Please clarify if there is any other non-safety or non-seismic systems or components located within the Seismic Category I UHS ESW Pump Houses?

Section III Item 3.A "Review Procedures" of SRP section 9.4.5 reads: "The failure of nonessential portions of the system or of other nonseismic SSCs located close to essential portions of the system will not preclude operation of the essential portions of the ESFVS."

What plant programs and/or ITAAC will ensure that the existence of such non-safety related and/or non-seismic systems or components will not represent a threat to the operability of safety-related systems and components within the UHS ESW Pump Houses.

ANSWER:

1. The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. All ventilation system equipment and components are classified as equipment class 3, seismic category I. There is no seismic classification break needed. A note has been added to FSAR Figure 9.4-201 stating that all UHS ESW Pump House Ventilation System equipment and components (fans, heaters, dampers) are seismic category I.

2. The UHS ESW Pump House Ventilation System contains no ductwork, as indicated by revised FSAR Figure 9.4-201.

3. The UHS ESW Pump Houses each contain a wet-pipe sprinkler system, hose station and smoke detection system. These fire protection components are classified as non-safety-related. With the exception of standpipes supplying manual hose stations, these fire protection components are seismically supported such that their failure during a design basis seismic event will not damage any of the safety-related equipment in the areas. As discussed in DCD Subsection 9.5.1.2.4, the standpipe systems supplying hose stations are designed to remain functional under safe shutdown earthquake loadings for manual fire suppression in areas containing equipment required for safe-shutdown.

4. The following design features and programs ensure that non-safety-related and/or non-seismic systems and components will not represent a threat to the operability of safety-related systems and components within the UHS ESW pump houses. The wet-pipe sprinkler system and standpipe are seismically supported such that the failure of the system piping during a design basis seismic event will not damage any of the safety-related equipment in the room. The fire suppression system is designed to NFPA codes and standards, using approved material. The fire suppression system is installed under a QA program that ensures system integrity.

5. The ITAAC to verify the as-built plant is designed and constructed to avoid adverse seismic interactions is appropriately addressed as part of ITAAC item 2 for as-built verification of the SSCs as described in FSAR Part 10 Appendix A.2 Table A.2-1.

Revised FSAR Figure 9.4-201 is attached to show that the exhaust fans are wall mounted and the backdraft dampers are located in the wall openings. No duct work is installed in the system. A note has been added stating that ventilation system equipment and components (fans, heaters, dampers) are seismic category I.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 9.4-5, 9.4-6, and 9.4-17.

Impact on S-COLA

None.

Impact on DCD

None.

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to preventUnit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

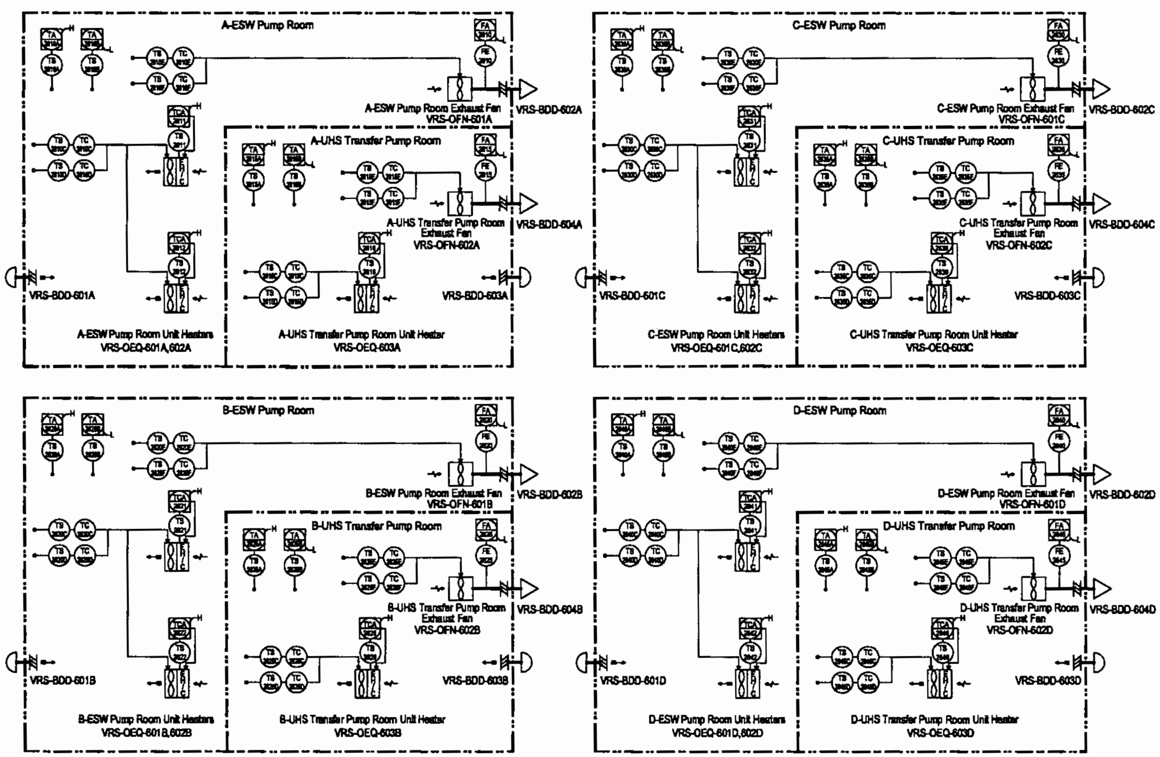
temperature conditions in these areas. These alarms are an indication of a loss of ventilation or a loss of heating. RCOL2_09.04.05-8

The UHS ESW pump houses each contain a wet-pipe sprinkler system, hose station and smoke detection system. These fire protection components are classified as non -safety-related. With the exception of standpipes supplying manual hose stations, these fire protection components are seismically supported such that their failure during a design basis seismic event will not damage any of the safety-related equipment in the areas. The standpipe systems supplying hose stations are designed to remain functional under safe shutdown earthquake loadings for manual fire suppression in areas containing equipment required for safe-shutdown. RCOL2_09.04.05-3

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.3.5

9.4.5.3.6 UHS ESW Pump House Ventilation System

- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan located in each UHS ESW pump house are powered by the different Class 1E buses.
- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan are separated by a three-hour fire rated barrier. Therefore, each fan powered by different Class 1E power supplies is protected and remains functional in the event of a fire in either room.
- The safety function of the UHS ESW pump house ventilation system is assured by the physical separation provided by the four separate and independent UHS ESW pump houses. All ventilation system ~~equipment and~~ components are classified as equipment class 3, seismic category I. RCOL2_09.04.05-10
- The ESW pump room exhaust fans and the UHS transfer pump room exhaust fans are capable of performing its safety function under all associated design basis accidents coincident with LOOP.
- Failure of a single active component in one of the UHS ESW pump house ventilation system exhaust fans does not result in a loss of the system's safety function.
- The UHS ESW pump house ventilation system components are protected from tornado generated missiles by their location inside a seismic category I structure.
- Backdraft dampers are capable of withstanding the affects of tornado wind and atmospheric differential pressure loading.
- The ESW pump house air intakes and air outlets are protected from tornado missiles as described in Subsection 3.8.4.1.3.2. RCOL2_09.04.05-4



NOTE

1. All fans, dampers and heaters in this sheet are designated in accordance with Seismic Category I.
2. Backdraft dampers are mounted in the wall opening.
3. No system ductwork is installed.
4. Exhaust fans are wall-mounted.

RCOL2_09.04.05-3

CP COL 9.2(6)

Figure 9.4-201 UHS ESW Pump House Ventilation System Flow Diagram

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-4

Externally Generated Missiles – GDC 4

Section I of SRP section 9.4.5 specifies a "Review Interface" with SRP 3.5.2 "Structures, Systems, And Components to Be Protected From Externally-Generated Missiles".

Section II "SRP Acceptance Criteria" of SRP section 9.4.5 reads: "For GDC 4, acceptance is based on meeting the acceptance criteria in the following SRP sections, as they apply to the ESFVS: SRP Sections 3.5.1.1, 3.5.1.4, 3.5.2, and SRP Section 3.6.1."

Therefore, with respect to GDC 4 and SRP section 3.5.2 the NRC staff notes that conventional air intake and air outlet symbols (per US-APWR DCD Figure 1.7-4 "Legend for Piping and Instrumentation Diagrams of HVAC System") are displayed on COL Figure 9.4-201. The NRC staff also notes that tornado dampers are provided a unique symbol in the legend of DCD Figure 1.7-4. This unique symbol is not employed on COL Figure 9.4-201.

It is not clear to the NRC staff from its review of the applicant's FSAR Chapters 3 and 9 how these air intakes and air outlets are protected from tornado generated missiles. The staff could find no discussion of this design basis commitment in its review of FSAR Chapter 3 "Design of Structures, Systems, Components, And Equipment". The NRC staff requests that the applicant clarify the FSAR appropriately with information designating tornado dampers.

ANSWER:

Backdraft dampers are mounted in the wall opening on the outside air intakes and the exhaust outlets as shown in FSAR Figure 9.4-201. These backdraft dampers perform a function similar to tornado dampers. The safety-related design basis contained in the seventh bullet of FSAR Subsection 9.4.5.3.6 states that the backdraft dampers are capable of withstanding the affects of tornado wind and atmospheric differential pressure loading. Therefore, separate tornado dampers are not required.

The design basis commitment for the air intakes and outlets for the ESW and transfer pump rooms is that these openings are protected against tornado generated missiles with reinforced concrete missile shields which overhang the ventilation openings. The discussion in FSAR Subsection 3.8.4.1.3.2 has been revised to reflect this design basis commitment. The locations of the missile shields for the UHS ESW pump house are shown in the plan view of the UHSRS in FSAR Figure 3.8-206 at the northwest and southeast corners of each UHS ESW pump house. The missile shields for the transfer pump room air intake and exhaust openings are not shown in FSAR Figure 3.8-206. The locations of the ESW and transfer pump room ventilation opening missile shields are subject to change as detailed ventilation design and equipment layout progresses. FSAR Figure 3.8-206 and related Chapter 3 figures will be revised in a future FSAR Update Tracking Report as the detailed ventilation design and equipment layout progresses.

With respect to structural design of the ESW and transfer pump rooms, venting of the rooms is anticipated during a tornado event due to the ventilation openings present. However, for purposes of structural design, the external walls of the ESW pump rooms and transfer pump rooms are conservatively designed as unvented and the full tornado atmospheric pressure differential is included in the structural design. The internal walls and slabs of these rooms are also conservatively designed for the full tornado atmospheric pressure differential. This was clarified in the response to RAI No. 2819 (CP RAI #66) Question 03.03.02-6 attached to Luminant letter TXNB-09061 dated November 5, 2009 (ML093130123).

FSAR Subsection 9.4.5.3.6 has been revised to refer to Subsection 3.8.4.1.3.2, and Subsections 3.8.4.1.3.2 and 9.4.5.3.6 have been revised to reflect this response.

<u>Impact on R-COLA</u>

See attached marked-up FSAR Revision 1 pages 3.8-6 and 9.4-6.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

The operating floor of the pump house is a reinforced concrete slab spanning east-west and supported by UHS basin exterior and interior walls. The operating floor supports the ESWS pump, UHS transfer pump, and motors. The roof of the pump house is a reinforced concrete slab spanning north-south and supported by reinforced concrete beams. To allow access to the ESWS pump/motor, a removable reinforced concrete cover is provided in an opening in the roof of the pump house.

Tornado missile shields are provided to protect the air intake and air outlets of the ESWS pump house HVAC system from tornado missiles. The structural design considers tornado differential pressure loads as discussed in Subsection 3.3.2.2.2. RCOL2_09.04.05-4

UHS cooling tower enclosures - Each UHS basin has one cooling tower with two cells. Each cell is enclosed by reinforced concrete structures that house the equipment required to cool the water for ESWS. The reinforced concrete wall running north-south separates the two cell enclosures. The enclosures are an integral part of the UHS basin supported by the basin interior and exterior walls on the basemat foundation. A reinforced concrete wall, running east-west, separates the cell enclosure portion of the basin from the rest of the UHS basin. An east-west wall is provided with openings at the basemat to maintain the continuity of the UHS basin. Air intakes are located at the north and south faces of the cooling tower enclosure. The missile shields at the air intakes are ~~and~~ configured to protect the safety-related substructures and components housed within the UHS structure from tornado missiles. FSAR Table 3.2-201 lists the site-specific equipment and components located in the UHSRS that are protected from tornado missiles. The north side air intake is an integral part of the cooling tower enclosure, whereas the south side air intake is an integral part of the ESWPT, and is supported by reinforced concrete piers which are supported by the ESWPT walls and basemat. RCOL2_03.08.04-3

Each cooling tower cell enclosure is equipped with a fan and associated equipment to cool the water. Equipment includes header pipe, spray nozzles, and drift eliminators with associated reinforced concrete beams supported by the exterior walls of the enclosure. The fan and motor are supported by reinforced concrete deck above the drift eliminators. A circular opening is provided in the deck for the fan, and the deck is supported by enclosure walls and a deep upside circular concrete beam around the fan opening. The fan is supported by a north-south concrete beam at the center of enclosure. For air circulation and to protect the fan and motor from tornado missiles, a circular opening is provided at the roof of the enclosure (centered on the fan) with a reinforced concrete slab and heavy steel grating between the roof and the deck. The fans, motors and associated equipment are designed with consideration given to the effects of design basis tornado differential pressure. RCOL2_09.02.05-3

All exposed parts of cooling tower enclosure, the UHS ESWS pump house and the UHS basin that could be impacted by a tornado missile are designed to prevent full penetration or structural failure by the spectrum of tornado missiles identified in Subsection 3.5.1.4.

temperature conditions in these areas. These alarms are an indication of a loss of ventilation or a loss of heating. RCOL2_09.04.05-8

The UHS ESW pump houses each contain a wet-pipe sprinkler system, hose station and smoke detection system. These fire protection components are classified as non -safety-related. With the exception of standpipes supplying manual hose stations, these fire protection components are seismically supported such that their failure during a design basis seismic event will not damage any of the safety-related equipment in the areas. The standpipe systems supplying hose stations are designed to remain functional under safe shutdown earthquake loadings for manual fire suppression in areas containing equipment required for safe-shutdown. RCOL2_09.04.05-3

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.3.5

9.4.5.3.6 UHS ESW Pump House Ventilation System

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- The safety function of the UHS ESW pump house ventilation system is assured by the physical separation provided by the four separate and independent UHS ESW pump houses. All ventilation system ~~equipment and~~ components are classified as equipment class 3, seismic category I. RCOL2_09.04.05-10
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- The ESW pump house air intakes and air outlets are protected from tornado missiles as described in Subsection 3.8.4.1.3.2. RCOL2_09.04.05-4

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-5

Internal Flooding – GDC 4

Section II of SRP section 9.4.5 provides the "Technical Rationale" behind the acceptance criteria for GDC 4. An excerpt from this passage reads: "Compliance with GDC 4 requires that structures, systems, and components important to safety be designed to accommodate the effects of, and be compatible with, environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be protected against dynamic effects (e.g., those of missiles, pipe whipping, and discharging fluids) that may result from equipment failure and from events and conditions outside the nuclear power unit."

Two of the "Review Interfaces" from SRP section 9.4.5 that these "dynamic effects" refer to are captured in SRP section 3.4.1 "Internal Flood Protection For Onsite Equipment Failures" and SRP section 3.6.1 "Plant Design For Protection Against Postulated Piping Failures In Fluid Systems Outside Containment".

The NRC staff notes that US-APWR DCD subsection 3.4.1.1 contains the following excerpt:

> "Safety-related SSCs are protected from flooding by external and internal sources. The US-APWR design includes the following:
>
> - The separation of redundant trains of safety-related SSCs as addressed in Chapters 1
> - Protective barriers and enclosures, where necessary, as addressed in this section
> - The placement of essential SSCs above internal flood levels
> - In general, SSCs are mounted above the flood level. However, if safety-related SSCs are located below flood level, their safety function is assured, as described in Section 3.11."

The safety-related design basis contained in the second bullet of COL FSAR subsection 9.4.5.3.6 reads: "The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan are separated by a three-hour fire rated barrier. Therefore, each fan powered by different Class 1E power supplies is protected and remains functional in the event of a fire in either room."

The NRC staff requests additional information about the barrier between the ESW pump room and the UHS transfer pump room. COL FSAR Appendix 9A "Fire Hazard Analysis" indicates that the there may be 3-hour fire rated passages between the two rooms. With respect to the issue of internal flooding, the staff could find no information contained in the COL applicant's FSAR subsection 3.4. Please clarify, is there a flood barrier between the UHS ESW pump and the UHS Transfer Pump? Please update the FSAR as appropriate.

ANSWER:

The transfer pump motor drive is located within a room separated from the ESW pump motor drive by a 12-inch-thick concrete wall which has a 3-hour fire rated access door. In the remote probability of a failure of the ESW pump discharge piping and flooding of the ESW pump room, the concrete wall and the access door would prevent flooding of the transfer pump room. The flooding of the ESW pump room is controlled by drains in the concrete floor of the pump room allowing the flood water to drain back into the water basin beneath. The access door is set at a sill height of 6" and is required to be structurally designed for the static head of flood waters that may accumulate above the sill height before being drained away by the floor drains. Therefore, any seepage from the ESW pump room to the transfer pump room, which may occur due to a flooding event in the ESW pump room, will be minimal and will not jeopardize the safety functions of equipment located in the transfer pump room.

Similarly, in the event of a break in the transfer pump discharge pipe causing flooding in the transfer pump room, seepage into the ESW pump room would be minimal, being retained by the 12-inch concrete walls and the access door sill. The flooded transfer pump room would be drained back to the basin beneath by several small floor drains through the concrete floor.

The detailed evaluation of the flooding event described above and the detailed design of the floor drains and door sill are not complete at this time. The flooding event evaluation will be described in a new FSAR Subsection 3.4.1.5.3 and the details of the floor drain and sill design will be shown in FSAR Figure 3.8-209 or related FSAR Section 3.8 figures in a future FSAR Update Tracking Report. FSAR Subsection 9.4.5.3.6 will also be revised to reflect the new flooding-related FSAR information.

<u>Impact on R-COLA</u>

None.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-6

Internally Generated Missiles – GDC 4

The NRC staff notes that the safety related design basis contained in the sixth bullet of COL FSAR subsection 9.4.5.3.6 reads: "The UHS ESW pump house ventilation system components are protected from tornado generated missiles by their location inside a seismic category I structure."

SRP 9.4.5 Section I links a "Review Interface" to the review requirements of SRP 3.5.1.1 "Internally Generated Missiles (Outside Containment)".

US-APWR DCD subsection 3.3.2.3 "Effect of Failure of Structures or Components Not Designed for Tornado Loads" reads: "It is the responsibility of the COL Applicant to assure that site-specific structures and components not designed for tornado loads will not impact either the function or integrity of adjacent safety-related SSCs, or generate missiles having more severe effects than those discussed in Subsection 3.5.1.4. Where required by the results of investigations, structural reinforcement and/or missile barriers are implemented so as not to jeopardize safety-related SSCs."

The NRC staff found that the COL applicant failed to address in either COL FSAR subsection 9.4.5 "Engineered Safety Function Ventilation System" or COL FSAR subsection 3.5 "Missile Protection", the potential threat of any and all internally generated missiles to safety-related SSCs contained in the ESW pump room and the UHS transfer pump room. More specifically, the COL applicant has not addressed the threats from internally generated missiles created by:

- the fan blades of the unit heaters,
- the fan blades of the exhaust fans, or
- any and all sources of internally generated missiles

within the UHS ESW Pump Houses. The NRC staff requests the applicant address internally generated missiles and update the FSAR, as appropriate.

ANSWER:

DCD Revision 2, Subsection 3.5.1, provides a discussion of potential missiles from internal sources outside containment and is incorporated by reference in the FSAR. Included in this discussion are probabilities of missile generation due to failure of rotating equipment (pump, fan, etc.), and piping and valves containing high energy fluids.

Design considerations that apply to the UHS ESW pump houses include:

- Rotating elements are contained within the pump/motor casing and the induction motors are designed to withstand an over-speed.
- The fan blades of the unit heaters are contained inside the unit heater housing, which is designed to prevent the fan blades from penetrating it.
- The fan blades of the exhaust fans are mounted on the wall and there is a steel shroud placed around it. These fans are not in line with the motors so that a thrown blade would not strike the motor.
- There are no rotating equipment sources of internally generated missiles in the pump house other than the motors themselves.
- Rotation of the cooling tower exhaust fans is such that if a fan blade leaves the hub it will tend to travel down since it is forcing air up. Beneath the fans, there is a substantial steel and concrete structure to restrain the blade. The fan blades are shrouded on the sides by a concrete wall that prevents the blades from leaving the shrouded area in a horizontal direction. The concrete slab above the fans, placed there for external missile protection, will also prevent a broken blade from leaving the fan room in the upward direction. The fan room itself is enclosed by concrete walls and partial roof that will prevent any broken fan blade pieces from leaving the room.
- The only other high energy, rotating equipment that could be a source of an internal missile are the pumps and pump motors. These are all enclosed within concrete walls capable of preventing a generated missile from leaving the pump compartment. The transfer pump motor is situated within a concrete wall enclosure that isolates it from the ESW pump motor so that failure of one does not affect operation of the other. Failure of a pump impeller by fracture of the impeller blade will not affect the other pump in the same basin as the broken blade will be confined within the pump casing and finally fall to the basin bottom when the energy is expended.

Missiles originating from piping under high pressure or in the pressurized portion of the valves in high-energy piping during normal operation are not considered credible due to ASME Code, Section III and Section XI design and inspection criteria. There is no site-specific high energy piping as discussed in FSAR Subsection 3.6.1.3. For moderate energy fluid systems, the systems have insufficient stored energy to generate a missile as indicated in DCD Subsection 3.5.1.1. In addition, any SSCs with the potential to cause damage to safety-related SSCs following an earthquake are analyzed and designed using the same methods and stress limits specified for seismic category I SSCs. In summary, internally generated missiles are addressed by DCD Subsection 3.5.1 information that is incorporated by reference in the FSAR. Internally generated missile hazards within the UHS ESWS pump houses are not considered credible. A new FSAR Subsection 3.5.1.1.2 has been added to discuss the design provisions that are applicable to potential internal missile hazards from high-speed rotating equipment located in the UHS ESW pump house as discussed above.

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 3.5-1.

Impact on S-COLA

None.

Impact on DCD

None.

3.5 MISSILE PROTECTION

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

3.5.1.1.2 High-Speed Rotating Equipment

RCOL2_09.04.05-6

After the fifth paragraph of DCD Subsection 3.5.1.1.2, add the following:

Potential sources of internal missiles from high-speed rotating equipment are assessed for the UHS ESW pump house. Internally generated missiles from ventilaton fans, pumps and cooling tower fans are not considered credible. Design considerations that apply include:

- Rotating elements are contained within the casing, and the induction motors are designed to withstand an over-speed.
- The fan blades of the unit heaters are contained inside the unit heater housing. The unit heater housing are designed to prevent the fan blades from penetrating it.
- The exhaust fans are mounted on the wall with steel shrouds placed around each fan. These fans are not in line with the motors so that a fan blade would not strike the motor.
- Rotation of the UHS cooling tower exhaust fans is such that if a fan blade leaves the hub it will tend to travel down since it is forcing air up. Beneath the fans, there is a substantial steel and concrete structure to restrain the blade. The fan blades are shrouded on the sides by a concrete wall that prevents the blades from leaving the shrouded area in a horizontal direction. The concrete slabs above the fans, placed there for external missile protection, also prevent any broken blades from leaving the fan room in the upward direction. The fan room itself is enclosed by concrete walls and partial roof that prevents any broken fan blade pieces from leaving the room.
- The ESW pumps and pump motors are all enclosed within concrete walls capable of preventing a generated missile from leaving the pump compartment. The transfer pump motor is enclosed within a concrete wall enclosure that isolates it from the ESW pump motor so that failure of one does not affect operation of the other. Failure of a pump impeller by fracture of the impeller blade does not affect the other pump in the same basin as the broken blade is confined within the pump casing and falls to the basin bottom when the energy is expended.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-7

Maintaining Design Basis Temperatures – GDC 4

Section II "Acceptance Criteria" of SRP 9.4.5 for GDC 4 contains the following excerpt: "...The evaluation with respect to GDC 4 also includes evaluation of the adequacy of environmental support provided to structures, systems, and components important to safety located within areas served by the ESFVS."

The "Design Bases" from COL FSAR subsection 9.4.5.1.1.6 "UHS ESW Pump House Ventilation System" reads:

> "The UHS ESW pump house ventilation system provides and maintains the proper environmental conditions within the required temperature range (40 °F – 120 °F) to support the operation of the instrumentation and control equipment and components in the individual UHS ESW pump houses during a design basis accident and LOOP with outside ambient design temperature condition of 0% temperature exceedance values."

During its review of the guidance of NUREG-800 SRP 9.4.5, the NRC staff found that the COL applicant did not include references in FSAR Section 9.4.8 that would provide the bases for the calculations used in sizing the capacities of the heaters and of the exhaust fans the for the UHS ESW Pump House Ventilation System. (Reference: COL FSAR Table 9.4-202 "UHS EXW Pump House System Equipment Design Data").

The applicant is requested to either establish clear performance criteria for the ESW Pump House Ventilation System and a means (ITAAC and/or startup testing) of verifying that heaters have been sided adequately or provide the following information to justify the value selected.

- What is the basis for the sizing of the ventilation system?

In order to facilitate confirmatory calculations please provide the inputs to the design calculations used in the derivation of the sizing of the ventilation system.

- Each of the room heaters has an attendant fan displayed in COL FSAR Figure 9.4.201 "UHS ESW Pump House Ventilation System Flow Diagram". However, FSAR Table 9.4-202 does not list a design specification air flow rate for these unit heater fans. Please explain why there is no air flow rate for these unit heater fans.

- What is the impact on the UHS ESW Pump House room temperature when the effect of a 140°F UHS Basin temperature (COL FSAR Table 7.5-201) is combined with the effects of the most severe summertime ambient conditions for the plant site and the heat load from the ESW pump motor? What is the expected room temperature in this scenario? Will the ESF equipment within the room remain operable?

Regulatory Guide 1.206 section C.I.9.4.5.1 "Design Bases" reads:

> "The design bases for the air handling and treatment system for areas that house ESF equipment should include the criteria and/or features to ensure the system's performance (i.e., flow rates, temperature limits, humidity limits, filtration) and reliability (i.e., single failure, redundancy, seismic design, environmental qualification) for all modes of operation, including normal, abnormal, and SBO conditions. The design bases should also include requirements for manual or automatic actuation, system isolation, monitoring for radiation, and other controls essential to the performance of the system functions. In addition, the applicant should provide details concerning the means used to protect system vents and louvers from externally and internally generated missiles."

The NRC staff found the "System Description" of COL FSAR subsection 9.4.5.2.6 lacking significant detail when compared to the prescriptive guidance of Regulatory Guide 1.206 section C.I.9.4.5.1 "Design Bases".

SRP 9.4.5 section IV. "Evaluation Findings" permits the staff to perform confirmatory calculations on a select basis to provide reasonable assurance of the plant's overall integrity with respect to safety-related component design. More specifically, section IV reads: "The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions."

In addition, the NRC staff notes that the "Technical Rationale" section of SRP 9.4.5 provides the reasoning behind the acceptance criteria contained in the SRP. In particular, the staff invokes the following clause from Technical Rationale 2: "...The function of the ESFVS is to provide a suitable and controlled operating environment for engineered safety feature components during normal operation, during adverse environmental occurrences, and during and subsequent to postulated accidents, including loss of offsite power. This requirement is imposed to ensure that engineered safety features function through the course of operating and accident events. In addition, the ESFVS design must withstand dynamic effects associated with postulated accidents.

> Meeting these requirements provides assurance that engineered safety features will not fail to operate as designed, thus providing protection against loss of core cooling and/or containment integrity."

Based on the review requirements and technical rationale of SRP 9.4.5, the staff:

1) requests the COL Applicant provide the level of detail in the FSAR consistent with the guidance of Regulatory Guide 1.206; and

2) requests that the COL Applicant provide, for the purposes of conducting confirmatory calculations, the inputs to design calculations used in the derivation of the heater and exhaust flow capacity values for these components of the UHS ESW Pump House Ventilation System.

ANSWER:

1. The design basis for the sizing of the UHS ESW pump house ventilation is as follows: The UHS ESW pump house ventilation system provides and maintains the proper environmental conditions within the required temperature range of 40 °F – 120 °F to support the operation of the instrumentation and control equipment and components in the individual UHS ESW pump houses during a design basis accident and LOOP. The ventilation system is designed based on the outside ambient design temperature conditions (-5 °F – 112 °F) using 0% temperature exceedance values.

The calculation bases for the UHS ESW pump house ventilation system are described as follows:

a) The exhaust ventilation requirement for the ESW pump room and the UHS transfer pump room is determined based on the heat load from the motor and the heat gain from the solar heat and is calculated using the following formula.

$$Q = (q_1 + q_2) / (1.1 \times \Delta T_1)$$

where,

Q : Ventilation air flow (CFM)

q_1 : Heat load from the motor (BTU/h)

q_2 : Heat gain from the solar heat (BTU/h)

1.1 : Heat transfer coefficient which includes consideration of air density (ρ= 0.075lb/ft^3) and specific heat (c_p = 0.24BTU/lb-^{o}F)

ΔT_1 : Temperature differential between the maximum outdoor temperature and the maximum room temperature (deg F)

The ventilation requirements are determined by the design conditions presented in Table 1 (attached). Table 1 shows the input and output of the design calculations used in the derivation of the sizing of the ventilation system to facilitate confirmatory calculations by the NRC.

b) The heating requirements are determined based on maintaining the ESW pump room and the UHS transfer pump room at or above the minimum allowable room temperature during the lowest outdoor temperature in winter. The heating requirement is calculated using the following formula.

$$q = (k / l) \times A \times \Delta T_2$$

where,

q : Amount of heat loss (BTU/h)

k : Conductivity for concrete (13.5Btu-in / h-ft^2-deg F)

l : Concrete wall thickness (in)

A : Cross-sectional area normal to heat flow (ft^2)

ΔT_2: Temperature differential between the minimum outdoor temperature and the minimum room temperature (deg F)

The heating requirements are determined by the design conditions presented in Table 1 (attached). Table 1 shows the input and output of the design calculations used in the derivation of the sizing of the heating coils and is provided to facilitate confirmatory calculations by the NRC.

2. The reason FSAR Table 9.4-202 does not list a design specification air flow rate for these unit heater fans is as follows:

The unit heaters are supplied by a vendor in compliance with a procurement specification. This specification requires a maximum allowable Watt density for a specific coil design. The airflow is provided by the vendor who is responsible for the design of the heaters. The vendor insures that a minimum air velocity is provided so that the specified allowable Watt density of the unit heater coils is not exceeded. This information has been added to the FSAR in Subsection 9.4.5.2.6.

3. Table 7.5-201 provides the indication range for the instruments (32-140 °F) that serve the Cooling Water System. The UHS basin temperature monitor has the maximum range temperature of 140 °F. The maximum water temperature in the basin is 95 °F as stated in Table 9.2.5-201. The UHS ESW pump house ventilation is designed as described above to maintain the room temperature within a range of 40 °F – 120 °F.

4. Regarding the level of detail in the FSAR, please see the response to Question No. 09.04.05-8 to this RAI which has provided an updated system description to FSAR Subsection 9.4.5.2.6 "UHS ESW Pump House Ventilation System".

<u>Impact on R-COLA</u>

See attached marked-up FSAR Revision 1 pages 9.4-2 and 9.4-5.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

<u>Attachment</u>

Table 1 - Design Conditions

Table 1 - Design Conditions

		ESW Pump Room	Transfer Pump Room
Input value	q_1 (BTU/h)	254,500	18,086
	q_2 (BTU/h)	43,200	2,790
	ΔT_1 (deg F)	8.0	8.0
	l (in)	24	24
	A (ft^2)	6,372	460
	ΔT_2 (deg F)	45	45
Output value	Q (CFM)	33,830	2,372
	Used Value Q (CFM)	34,000	2,400
	q (BTU/h)	161,291	11,644
	q (kW)	47.27	3.41
	Used Value q (kW)	48	3.5

9.4.3.2.3 Main Steam/Feedwater Piping Area HVAC System

CP COL 9.4(4) Replace the second sentence of the first paragraph in DCD Subsection 9.4.3.2.3 with the following.

The capacity of cooling and heating coils that are affected by site specific conditions is shown in Table 9.4-201.

9.4.3.2.4 Technical Support Center HVAC System

CP COL 9.4(4) Replace the second sentence of the first paragraph in DCD Subsection 9.4.3.2.4 with the following.

The capacity of cooling and heating coils that are affected by site specific conditions is shown in Table 9.4-201.

9.4.5 Engineered Safety Feature Ventilation System

CP COL 9.4(6) Delete the third paragraph and insert the following text to the end of the list of ESF ventilation systems in first paragraph of DCD Subsection 9.4.5.

- UHS ESW Pump House Ventilation System

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.1.1.5.

9.4.5.1.1.6 UHS ESW Pump House Ventilation System

The UHS ESW pump house ventilation system provides and maintains the proper environmental conditions within the required temperature range ~~(~~of 40°F – 120°F~~)~~ to support the operation of the instrumentation and control equipment and components in the individual UHS ESW pump houses during a design basis accident and LOOP. The ventilation system is designed based on the ~~with~~ outside ambient design temperature conditions (-5°F – 112°F) ~~of~~using 0% temperature exceedance values. RCOL2_09.04.05-7 RCOL2_09.04.05-7

The ESWP is installed at a location in the pump house where cooling air is adequately being circulated for cooling the ESWP motor. RCOL2_09.02.01-4

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to prevent~~Unit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the~~ freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-8

Maintaining Design Basis Temperatures – GDC 4

From the information provided by the COL applicant in FSAR subsections 9.4.5. 9.4.5.1.1.6, 9.4.5.2.6, 9.4.5.3.6, 9.4.5.4.6, 9.4.5.5.6, 9.4.7, FSAR Table 9.4-202 and FSAR Figure 9.4-201, the operating status of the UHS ESW Pump House Ventilation System during normal plant operations was not clear to the staff. It appears that this Class 1E system would secured, but ready and armed to support emergency response operations.

It seems probable that a non-Class 1E non-safety related heating system would be required during the winter months to maintain the UHS ESW Pump House above the lowest limiting design basis temperature for all safety-related equipment within the pump house. In contrast, after the NRC staff read the information provided by the COL applicant in the above FSAR sections and the Part 10 "ITAAC and Proposed License Conditions" Appendix A.2 for the "UHS ESW Pump Hose Ventilation System," does not indicate that the required need will be met. The NRC staff found the "System Description" of COL FSAR subsection 9.4.5.2.6 lacking significant detail when compared to the prescriptive guidance of Regulatory Guide 1.206 section C.I.9.4.5.2 "Systems Description"

For normal plant operations, the staff requests additional information about the COL applicant's intent with respect to maintaining the operability of this safety related equipment and to maintain the integrity of the pump houses' instrument lines, wet pipe sprinkler station and the standpipe hose station during the most severe design basis winter conditions.

The NRC staff requests that the COL applicant augment the FSAR to conform to the guidance of Regulatory Guide 1.206 section C.I.9.4.5.2 "Systems Description".

ANSWER:

FSAR Subsection 9.4.5.2.6 has been revised in the attached markup to conform to the guidance of RG 1.206 Section C.I.9.4.5.2.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 9.4-4, 9.4-5, and 9.4-6.

Impact on S-COLA

None.

Impact on DCD

None.

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.2.5.

9.4.5.2.6 UHS ESW Pump House Ventilation System

Each of four independent UHS structures consists of a UHS ESW pump house and a water basin with a cooling tower. The only UHS structures requiring ventilation are the UHS ESW pump houses, each of which contains two separate rooms: the UHS ESW pump room and the UHS Transfer pump room. Each room's ventilation system is a once through type using outdoor air for cooling. The UHS ESW pump houses are not identified as containing any quantities of airborne radioactive contamination and therefore, are not provided with any filtering or radiation monitoring capability and exhaust directly to atmosphere. RCOL2_09.04.05-8

The UHS ESW pump house ventilation systems ~~is~~are shown in Figure 9.4-201. The UHS ESW pump house arrangement is shown in Figure1.2-206. ~~and t~~The equipment design data is presented in Table 9.4-202.

~~There are four separate and independent UHS ESW pump houses and each has its own ventilation system. Each UHS ESW pump house ventilation system has an exhaust fan that provides 100 percent of the ventilation requirements for the associated ESW pump room. The UHS transfer pump room within the UHS ESW pump house has an exhaust fan that provides 100 percent of the ventilation requirements for the UHS transfer pump room. The ESW pump room and the UHS transfer pump room each have separate independent supply and exhaust openings to the outside.~~ RCOL2_09.04.05-8

The safety function of the UHS ESW pump house and its supporting ventilation system is assured by the four-train design configuration. Failure of a single active component in one of the UHS ESW pump house ventilation systems does not result in a loss of the ESW system and the associated ventilation system's safety function because of the four-train design configuration. The four UHS ESW pump houses are physically separate and independent structures and are each supplied by independent Class 1E power supplies with Emergency Gas Turbine Generators backup.

The exhaust fan for the ESW pump room is powered by the same Class 1E power source serving the ESW pump motor and the exhaust fan for the transfer pump room is powered by the same Class 1E power source serving the transfer pump motor. All ventilation systems and components associated with the UHS ESW system are capable of performing their safety function under all associated design basis accidents coincident with a LOOP and are classified as safety-related, equipment Class 3, Seismic Category I.

The major components of each UHS ESW pump house ventilation system include the ESW pump room exhaust fan, the transfer pump room exhaust fan, gravity type backdraft dampers on the exterior walls of each supply and exhaust opening, two ESW pump room unit heaters and one transfer pump room unit heater.

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to prevent~~Unit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the~~ freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

temperature conditions in these areas. These alarms are an indication of a loss of ventilation or a loss of heating. RCOL2_09.04.05-8

The UHS ESW pump houses each contain a wet-pipe sprinkler system, hose station and smoke detection system. These fire protection components are classified as non -safety-related. With the exception of standpipes supplying manual hose stations, these fire protection components are seismically supported such that their failure during a design basis seismic event will not damage any of the safety-related equipment in the areas. The standpipe systems supplying hose stations are designed to remain functional under safe shutdown earthquake loadings for manual fire suppression in areas containing equipment required for safe-shutdown. RCOL2_09.04.05-3

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.3.5

9.4.5.3.6 UHS ESW Pump House Ventilation System

- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan located in each UHS ESW pump house are powered by the different Class 1E buses.
- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan are separated by a three-hour fire rated barrier. Therefore, each fan powered by different Class 1E power supplies is protected and remains functional in the event of a fire in either room.
- The safety function of the UHS ESW pump house ventilation system is assured by the physical separation provided by the four separate and independent UHS ESW pump houses. All ventilation system ~~equipment and~~ components are classified as equipment class 3, seismic category I. RCOL2_09.04.05-10
- The ESW pump room exhaust fans and the UHS transfer pump room exhaust fans are capable of performing its safety function under all associated design basis accidents coincident with LOOP.
- Failure of a single active component in one of the UHS ESW pump house ventilation system exhaust fans does not result in a loss of the system's safety function.
- The UHS ESW pump house ventilation system components are protected from tornado generated missiles by their location inside a seismic category I structure.
- Backdraft dampers are capable of withstanding the affects of tornado wind and atmospheric differential pressure loading.
- The ESW pump house air intakes and air outlets are protected from tornado missiles as described in Subsection 3.8.4.1.3.2. RCOL2_09.04.05-4

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-9

Proper Functioning of the Essential Electric Power System – GDC 17

The second paragraph from Section II "Acceptance Criteria" of SRP section 9.4.5 "Technical Rationale" item 4 reads:

> "With regard to the ESFVS, the plant design should ensure that electrical contacts and relays in diesel generator rooms are protected from dust, dirt, and grit. For example, contacts and relays must be enclosed in dust-tight cabinets with fully gasketed openings and ventilation louvers must be equipped with filters. In addition, air used for ventilation should be filtered and should be taken from a height of at least 7 meters (20 feet) above ground level."

The NRC staff notes that NUREG-CR/0660 "Enhancement of Onsite Emergency Diesel Generator Reliability" addresses this issue.
The staff could find no information in the COL FSAR about the spatial positioning of the fresh air intake dampers. More specifically, to limit the flow of airborne particulate (dust) into the two rooms of the UHS ESW Pump House, the bottom of the fresh air intakes are to be positioned 20 feet above grade elevation. Alternately, or in addition to, the electrical and instrumentation cabinets are to be provided with suitable seals or gaskets to prevent dust from entering the cabinets.

The NRC staff requests additional information about how the design of the UHS ESW Pump House satisfies these required design attributes of GDC 17.

ANSWER:

The bottom of the fresh air intakes are positioned as high as physically possible above the ground level. The height of the UHS ESW pump house is 16 feet above grade and the air is not filtered. In addition, electrical and instrument enclosures are NEMA type 12 (dust tight and drip tight – for indoor use) and any louvered vents on the enclosure are provided with filters to minimize the intake of dust, dirt, and grit. Therefore, the UHS ESW pump house is designed to satisfy the requirements of GDC 17.

FSAR Subsection 9.4.5.2.6 has been revised to reflect this response.

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 9.4-5.

Impact on S-COLA

None.

Impact on DCD

None.

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to preventUnit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-10

Proper Functioning of the Essential Electric Power System – GDC 17

Section III "Review Procedures" indicates that the reviewer using the results of the failure modes and effects analyses (FMEA) will determine that the safety-related portion of the system is capable of sustaining a failure of any active component.

In particular, Item 3.D of SRP section 9.4.5 reads: "Essential components and subsystems can function as required in the event of a loss of offsite power. The system design will be acceptable if the ESFVS meets minimum system requirements as stated in the SAR, assuming failure of a single, active component within the system itself or in the auxiliary electric power source which supplies the system. The SAR is reviewed to verify that for each ESFVS component or subsystem affected by the loss of offsite power, the resulting system performance will not affect the capability of any engineered safety feature equipment. Statements in the SAR and results of failure modes and effects analyses are considered in verifying that the system meets these requirements. This will be an acceptable verification of system functional reliability."

The NRC staff notes that the fifth bullet of COL FSAR "Safety Evaluation" subsection 9.4.5.3.6 reads "*Failure of a single active component in one of the UHS ESW pump house ventilation system exhaust fans does not result in a loss of the system's safety function.*" However, the staff, in its review of the COL applicant's FSAR, could not find the results of a FMEA specific to the UHS ESW Pump House Ventilation System nor did the COL Applicant include a reference to a FMEA. Regulatory Guide 1.206 section C.I.9.4.5.3 "Safety Evaluation" also speaks to this issue.

The NRC staff attempted to draw this safety conclusion based on other sources of information contained in the COL applicant's FSAR. However, as documented below, this only led to more findings of inconsistencies with respect to the instrumentation of the UHS ESW Pump House Ventilation System.

An excerpt from the third bullet of COL FSAR subsection 9.4.5.3.6 reads "*...All ventilation system equipment and components are classified as equipment class 3, seismic category I.*" From this excerpt, the staff concludes that all the instrumentation (e.g. TS, TC, FE) and alarms displayed on Figure 9.4-201 "UHS ESW Pump House Ventilation System Flow Diagram" is equipment class 3 and seismic category I. The staff found the following inconsistencies for this homogeneous grouping of instrumentation:

- COL FSAR subsection 9.4.5.5.6 does not list TS and TCA instruments/alarms for the unit heaters contained in the ESW Pump Room or the UHS Transfer Pump Room

- Not all the instrumentation displayed on Figure 9.4-201 appears in Table 3D-201 "Site-Specific Environmental Qualification Equipment List". FSAR subsection 3.11.1.1 reads "This table (i.e. Table 3D-201) lists information on site specific safety-related or important to safety equipment." In addition, Table 3D-201 does not list the tornado resistant back draft dampers for the ESW Pump Rooms and UHS Transfer Pump Rooms (e.g. VRS-BDD-603A, VRS-BDD-601A)

- COL FSAR Chapter 7 "Instrumentation and Controls" does not include any reference to the homogeneous grouping of instruments displayed on Figure 9.4-201. Most of these instruments, if not all, are safety-related.

Based on the above findings and the absence of a FMEA for the UHS ESW Pump House Ventilation System, the staff requests that the COL applicant:

1) Provide a summary of the FMEA for this ventilation system

2) Provide additional information about the instrumentation inconsistencies documented above

3) Augment the COL FSAR as appropriate to provide clarification with respect to these issues.

ANSWER:

1. FSAR Table 9.4-203 has been added to provide the FMEA for the UHS ESW Pump House Ventilation System.

2a. The safety-related temperature switches associated with the UHS ESW Pump House Ventilation System are identified in items 33 through 64 of FSAR Table 3D-201. The safety function of these switches is to initiate the ESW and UHS transfer pump room exhaust fans and heaters. As stated in the response to RAI No. 3532 (CP RAI No. 83) Question 14.03.07-27 attached to Luminant letter TXNB-09065 dated November 13, 2009 (ML093210468), the remaining alarms, displays, and controls shown on FSAR Figure 9.4-201 are not relied upon for safety-related operation of the UHS ESW Pump House Ventilation System. The description in FSAR Subsection 9.4.5.5.6 has been revised to be consistent with FSAR Table 3D-201.

2b. The backdraft dampers are seismic Category I and do not perform an active safety function as shown in revised ITAAC Table A.2-2 provided in the response to RAI No. 3532 (CP RAI No.83) Question 14.03.07-21 attached to Luminant letter TXNB-09062 (ML093130124) and provided below. The backdraft dampers are a gravity balance type which open in the direction of air flow, and close due to the counterbalance when no air flow is present. Therefore, the backdraft dampers are not included as active safety mechanical components and are not required to be listed in FSAR Table 3D-201.

3. Standard Review Plan (SRP) Section 7.1, Revision 5 provides guidance pertaining to the scope of FSAR Chapter 7, regarding nine categories of instrumentation and control in Subsection 7.1.I.1.

The instrumentation described in DCD Subsection 9.4.5.5 and shown in FSAR Figure 9.4-201 is consistent with category 7.1.I.1(I), which states:

> Auxiliary supporting features and other auxiliary features are systems or components of systems that provide services required for the safety systems to accomplish their safety functions. Heating, ventilation, and air conditioning systems and electrical power systems are examples of auxiliary supporting features. Auxiliary supporting features are discussed primarily in Chapters 8 and 9 of the SAR. Examples of other auxiliary features include built-in test equipment and isolation devices. The I&C aspects of auxiliary supporting features and other auxiliary features are addressed in the review of those SAR sections which discuss the systems which provide these features. To the extent that the operation of auxiliary supporting features or other auxiliary features are initiated by the protection system, this aspect is included in the review of Sections 7.2 or 7.3 of the SAR.

The instrumentation described in DCD Subsection 9.4.5.5 and shown in FSAR Figure 9.4-201 supports safety-related HVAC system operation and is therefore described in Chapter 9. FSAR Table 7.4-201 includes the ESW pump room and UHS transfer pump room exhaust fans and heaters among the site-specific components required for safe shutdown.

<u>Impact on R-COLA</u>

See attached marked-up FSAR Revision 1 pages 9.4-5, 9.4-6, 9.4-7, 9.4-12, 9.4-13, 9.4-14, 9.4-15 and 9.4-16.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

<u>Attachment</u>

ITAAC Table A.2-2 page 23 as revised by the response to Question 14.03.07-21

Table A.2-2
UHS ESW Pump House Ventilation System Equipment Characteristics

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Active Safety Function	PSMS control	Loss of Motive Power Position
ESW Pump Room Exhaust Fan	VRS-OFN-601A,B,C,D	-	Yes	-	Yes/No	Start	High Temperature	-
UHS Transfer Pump Room Exhaust Fan	VRS-OFN-602A,B,C,D	-	Yes	-	Yes/No	Start	High Temperature	-
ESW Pump Room Unit Heater	VRS-OEQ-601A,B,C,D, VRS-OEQ-602A,B,C,D	-	Yes	-	Yes/No	Start	Low Temperature	-
UHS Transfer Pump Room Unit Heater	VRS-OEQ-603A,B,C,D	-	Yes	-	Yes/No	Start	Low Temperature	-
ESW Pump Room Temperature	VRS-TS-2610C,D,E,F VRS-TS-2620C,D,E,F VRS-TS-2630C,D,E,F VRS-TS-2640C,D,E,F	-	Yes	-	Yes/No	-	-	-
UHS Transfer Pump Room Temperature	VRS-TS-2615C,D,E,F VRS-TS-2625C,D,E,F VRS-TS-2635C,D,E,F VRS-TS-2645C,D,E,F	-	Yes	-	Yes/No	-	-	-
UHS ESW Pump House supply and exhaust backdraft dampers	VRS-BDD-601 A,B,C,D VRS-BDD-602 A,B,C,D VRS-BDD-603 A,B,C,D VRS-BDD-604 A,B,C,D	-	Yes	-	No/No	-	-	-

RCOL2_14.03.07-6

RCOL2_14.03.07-7

RCOL2_14.03.07-21

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to preventUnit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

temperature conditions in these areas. These alarms are an indication of a loss of ventilation or a loss of heating. RCOL2_09.04.05-8

The UHS ESW pump houses each contain a wet-pipe sprinkler system, hose station and smoke detection system. These fire protection components are classified as non -safety-related. With the exception of standpipes supplying manual hose stations, these fire protection components are seismically supported such that their failure during a design basis seismic event will not damage any of the safety-related equipment in the areas. The standpipe systems supplying hose stations are designed to remain functional under safe shutdown earthquake loadings for manual fire suppression in areas containing equipment required for safe-shutdown. RCOL2_09.04.05-3

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.3.5

9.4.5.3.6 UHS ESW Pump House Ventilation System

- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan located in each UHS ESW pump house are powered by the different Class 1E buses.
- The ESW pump room exhaust fan and the UHS transfer pump room exhaust fan are separated by a three-hour fire rated barrier. Therefore, each fan powered by different Class 1E power supplies is protected and remains functional in the event of a fire in either room.
- The safety function of the UHS ESW pump house ventilation system is assured by the physical separation provided by the four separate and independent UHS ESW pump houses. All ventilation system ~~equipment and~~ components are classified as equipment class 3, seismic category I. RCOL2_09.04.05-10
- The ESW pump room exhaust fans and the UHS transfer pump room exhaust fans are capable of performing its safety function under all associated design basis accidents coincident with LOOP.
- Failure of a single active component in one of the UHS ESW pump house ventilation system exhaust fans does not result in a loss of the system's safety function.
- The UHS ESW pump house ventilation system components are protected from tornado generated missiles by their location inside a seismic category I structure.
- Backdraft dampers are capable of withstanding the affects of tornado wind and atmospheric differential pressure loading.
- The ESW pump house air intakes and air outlets are protected from tornado missiles as described in Subsection 3.8.4.1.3.2. RCOL2_09.04.05-4

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.4.5.

9.4.5.4.6 UHS ESW Pump House Ventilation System

The general requirements in Subsection 9.4.5.4 apply.

CP COL 9.4(6) Add the following new subsection after DCD Subsection 9.4.5.5.5.

9.4.5.5.6 UHS ESW Pump House Ventilation System

The following instrumentation serving the UHS ESW pump houses includes:

- Alarm on low airflow for ESW pump room or UHS transfer pump room.
- Indication of the status of the exhaust fans.
- Alarm on high room temperature in ESW pump room or UHS transfer pump room.
- Alarm on low room temperature in ESW pump room or UHS transfer pump room.
- Temperature switches for control of ESW pump room and UHS transfer pump room exhaust fans and heaters. RCOL2_09.04.05-10

9.4.6.2.4.1 Containment Low Volume Purge System

CP COL 9.4(4) Replace the second sentence of the first paragraph in DCD Subsection 9.4.6.2.4.1 with the following.

The capacity of cooling and heating coils that are affected by site specific conditions is shown in Table 9.4-201.

9.4.6.2.4.2 Containment High Volume Purge System

CP COL 9.4(4) Replace the second sentence of the first paragraph in DCD Subsection 9.4.6.2.4.2 with the following.

The capacity of cooling and heating coils that are affected by site specific conditions is shown in Table 9.4-201.

RCOL2_09.04.05-10

Table 9.4-203 (Sheet 1 of 5)
UHS ESW Pump House Ventilation System Failure Modes and Effects Analysis

Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
ESW Pump Room Exhaust Fans (VRS-OFN-601A, B, C, D)	Draws outside air through ESW Pump Room to provide cooling	All	Fails to start on t'sat commant	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	One Train out due to maintenance does not affect safety function, because a minimum of two ESW pumps and two transfer pumps are required.
			Fails to stop on t'sat command	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Trips for any reason	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
ESW Pump Room Air Intake Gravity Type Backdraft Dampers (VRS-BDD-601A, B, C, D)	Opens to provide air flow path	All	Fails to open	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to close	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	

RCOL2_09.04.05-10

Table 9.4-203 (Sheet 2 of 5)
UHS ESW Pump House Ventilation System Failure Modes and Effects Analysis

Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
ESW Pump Room Air Discharge Gravity Type Backdraft Dampers (VRS-BDD-602A, B, C, D)	Opens to provide air flow path	All	Fails to open	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to close	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
ESW Pump Room Unit Heaters (VRS-QEQ-601A, B, C, D)	Provides heating to ESW Pump Room	All	Fails to energize on t'sat command	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to deenergize on t'sat command	Room high temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Trips for any reason	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Unit heater fan fails	High heating element temperature alarm in MCR	None, Remaining three ESW pump houses are available	

RCOL2_09.04.05-10

Table 9.4-203 (Sheet 3 of 5)
UHS ESW Pump House Ventilation System Failure Modes and Effects Analysis

Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
ESW Pump Room Unit Heaters (VRS-QEQ-602A, B, C, D)	Provides heating to ESW Pump Room	All	Fails to energize on t'sat command	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to deenergize on t'sat command	Room high temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Trips for any reason	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Unit heater fan fails	High heating element temperature alarm in MCR		

RCOL2_09.04.05-10

Table 9.4-203 (Sheet 4 of 5)
UHS ESW Pump House Ventilation System Failure Modes and Effects Analysis

Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
UHS Transfer Pump Room Exhaust Fans (VRS-OFN-602A, B, C, D)	Draws outside air through Transfer Pump Room to provide cooling	All	Fails to start on t'sat commant	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to stop on t'sat command	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	
			Trips for any reason	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
UHS Transfer Pump Room Air Intake Gravity Type Backdraft Dampers (VRS-BDD-603A, B, C, D)	Opens to provide air flow path	All	Fails to open	Low air flow alarm in MCR	None, Remaining three ESW pump houses are available	
			Fails to close	Room low temperature alarm in MCR	None, Remaining three ESW pump houses are available	

RCOL2_09.04.05-10

Table 9.4-203 (Sheet 5 of 5) UHS ESW Pump House Ventilation System Failure Modes and Effects Analysis

Description of Component	Safety Function	Plant Operating Mode	Failure Mode(s)	Method of Failure Detection	Failure Effect on System Safety Function Capability	General Remarks
UHS Transfer Pump Air Discharge Gravity Type Backdraft Dampers (VRS-BDD-604A, B, C, D)	Opens to provide air flow path	All	Fails to open	Low air flow alarm in MCR	None. Remaining three ESW pump houses are available	
			Fails to close	Room low temperature alarm in MCR	None. Remaining three ESW pump houses are available	
			Trips for any reason	Low air flow alarm in MCR	None. Remaining three ESW pump houses are available	
UHS Transfer Pump Unit Heaters (VRS-QEQ-603A, B, C, D)	Provides heating to Transfer Pump Room	All	Fails to energize on t'sat command	Room low temperature alarm in MCR	None. Remaining three ESW pump houses are available	
			Fails to deenergize on t'sat command	Room high temperature alarm in MCR	None. Remaining three ESW pump houses are available	
			Trips for any reason	Room low temperature alarm in MCR	None. Remaining three ESW pump houses are available	
			Unit heater fan fails	High heating element temperature alarm in MCR	None. Remaining three ESW pump houses are available	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-11

Coping with a Station Blackout Event – 10 CFR 50.63

The NRC staff acknowledges that the COL applicant incorporated by reference with no departures or supplements DCD subsection 8.4 "Station Blackout".

The information contained within DCD Table 8.3.1-6 "Electrical Load Distribution – AAC GTG Loading (SBO Condition)" indicates that one Essential Service Water Pump (i.e. ESW pump) will be required to be in operation for the duration of the 8-hour coping event. Phase "3" (i.e. "After AAC GTG has restored power to the Class 1E power system within 60 minutes of the start of the event) of DCD subsection 8.4.2.1.2 "Station Blackout Coping Analysis" indicates that the supporting systems will include I&C, cooling system & HVAC. The NRC staff observes that three Motor Control Centers (MCCs) listed Table 8.3.1-6 would have to be of sufficient size to absorb the power requirements of the UHS ESW Pump House Ventilation System (i.e. heaters, exhaust fans, instrumentation and controls)

Based on the above:

1) The NRC staff requests additional information about this scenario. In particular, whether the COL applicant has determined that the electrical sizing of the 3 MCCs relative to all miscellaneous Comanche Peak 3 (or 4) SBO loads is bounded by the electrical capacity of the three MCCs listed in Table 8.3.1-6. These miscellaneous loads would come from not only the UHS ESW Pump House Ventilation System but from other HVAC systems and cooling systems.

2) The staff notes that per COL FSAR subsection 9.4.5.1.1.6, the required temperature range of the ESW pump house is 40°F -- 120°F. DCD subsection 8.4.2.1.2 indicates that all Class 1E electrical cabinets and I&C cabinets are rated to keep their integrity up to 50°C (or 122°F). Will any of the Class 1E electrical and I&C cabinets be located within the ESW pump house?

   The current COL FSAR has no non-class 1E ventilation system dedicated to normal power operations to prevent the ESW Pump House room temperatures from exceeding 100°F during the extreme summertime high temperatures of central Texas. Please explain how you demonstrate the Class 1E cabinet temperatures will not exceed 122°F during the first hour of the SBO event when the AAC GTG has yet to be aligned to the Class 1E bus for HVAC cooling.

3) For the upper operating range average room temperature of 120°F for the ESW Pump House rooms what is the temperature in the Class 1E cabinets? Given that internal cabinet temperatures typically run 5-10°F above average room temperatures, the staff requests additional information about the applicant's analysis that justified an average room temperature of 120°F as the design basis limit. Please explain how you demonstrate the cabinets remain below the design temperature.

ANSWER:

1) Table 8.3.1-6 was revised in DCD Revision 2 to include two Motor Control Centers (MCCs) that supply the UHS ESW Pump House HVAC System components with the following rated loads:

ESWP pump room unit heater	24kW
UHS transfer pump room unit heater	3.5kW
ESWP pump room unit exhaust fan	5HP
UHS transfer pump room exhaust fan	1/4HP

Other required loads in the SBO condition are listed in Table 1 (attached).

The total capacity of these loads, including the UHS ESW Pump House HVAC System components, is approximately 210kW. Since DCD Table 8.3.1-6 shows 400 kW as the MCC capacity, the MCCs can easily supply the required loads and additional miscellaneous loads.

2) The Class 1E electrical and I&C cabinets described in DCD Subsection 8.4.2.1.2 are located within the Class 1E electrical room and I&C room as described in the response to DCD RAI 11 Question No.08.04-7 (Letter UAP-HF-08128 dated July 18, 2008, ML082040270), and are not located within the UHS ESW pump house. As stated in DCD Subsection 8.4.2.1.2 (page 8.4-8):

> Until AAC GTG restores power to the Class 1E power system within one hour after SBO occurs, Class 1E electrical room HVAC system cannot be operated. However, all Class 1E electrical cabinets and I&C cabinets are rated to keep their integrity up to 50°C temperature. The temperature of Class 1E electrical room and I&C room will not reach 50°C within one hour even without HVAC.

3) The non-Class 1E electrical and I&C cabinets are located within UHS ESW pump house and are typically designed to maintain their integrity at the maximum allowable room temperatures, including cabinet internal heating effects. Also, the failure of the non-Class 1E electrical and I&C cabinets will not impact any of the UHS/ESW safety-related functions.

<u>Impact on R-COLA</u>

None.

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

Attachment

Table 1 - Required Loads in SBO Condition.

Table 1 - Required Loads in SBO Condition

A-Motor Control Center		
Name	Capacity [kW]	
A-Emergency Feed Water Pump (T/D) Area Air Handling Unit	8.5	
A-Essential Chiller Unit Control Panel	2	kVA
A-Essential Chilled Water Pump	53	
A-UPS Unit	-*	kVA
A-Main Control Room Air Handling Unit	13	
A-Safeguard Component Area Air Handling Unit	9	
A-Class 1E Battery Room Exhaust Fan	1.5	
A-Battery Charger	70	kVA
A-Emergency Lighting Transformer	10	kVA
A1-Motor Control Center		
Name	Capacity [kW]	
A-Main Control Room Emergency Filtration Unit Fan	5.5	

*:UPS Unit is supplied via Battery Charger.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3232 (CP RAI #123)

SRP SECTION: 09.04.05 - Engineered Safety Feature Ventilation System

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

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.04.05-12

Inspection and Testing Requirements (including Preoperational Testing and ITACC)

(Based on the requirements of GDC 4 and 10CFR 52.80(a) the review guidance of SRP section 9.4.5 and SRP section 14.3.7)

SRP section 9.4.5, Section I "Areas of Review", item 2, requires review of safety-related portions of the ESFVS with respect to: "C. The ability of the safety features equipment in the areas being serviced by the ventilation system to function under the worst anticipated degraded ESFVS system performance; D. The capability of the system to circulate sufficient air to prevent accumulation of flammable or explosive gas or fuel-vapor mixtures from components such as storage batteries and stored fuel;"

To this end, the NRC staff requests additional information about:

1) the location of the fresh air intakes of the four UHS ESW Pump Houses with respect to the closest external sources of flammable or explosive gas, fuel-vapor mixtures or exhaust fumes;
2) whether the four UHS ESW Pump Houses will internally harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis or on a periodic basis during plant maintenance activities or basin water chemistry maintenance activities (e.g. hydrogen sulfide gas);
3) the plant programs the applicant will use to detect degraded equipment performance of the UHS ESW Pump House Ventilation System.

The NRC staff also notes that SRP 14.3.7 section II "SRP Acceptance Criteria" "1." reads " ...*Tier I should be reviewed for consistency with the initial test program described in DCD Tier 2 Chapter 14.2..*".

The staff found that the COL applicant invokes in FSAR subsection 9.4.5.4.6 the general requirements of US-APWR DCD subsection 9.4.5.4 with respect to "Inspection and Testing Requirements". One of the safety related design bases of FSAR subsection 9.4.5.3.6 reads ... "*Backdraft dampers are capable of withstanding the effects of tornado wind and atmospheric differential pressure loading*". The staff could find no mention of demonstrating this capability in either:

- Part 10 "Inspections, Tests, Analyses And Acceptance Criteria (ITAAC) And Proposed License Conditions" of the COL Application;
- Preoperational Test 14.2.12.1.114 "UHS ESW Pump House Ventilation System Preoperational Test";
- COL FSAR Chapter 3 "Design Of Structures, Systems, Components, And Equipment"; or
- FSAR subsection 9.4.5.4.6.

The staff requests the COL applicant amend FSAR subsection 9.4.5.4.6 to include required factory testing of these dampers that demonstrates this capability and amend the ITAAC to include verification of the integrity of the installed safety related backdraft dampers.

In addition, the staff finds that Preoperational Test 14.2.12.1.114 "UHS ESW Pump House Ventilation System Preoperational Test" lacks sufficient detail to clearly demonstrate the capability of the UHS ESW Pump House Ventilation to meet its safety related design basis of:

> "The UHS ESW pump house ventilation system provides and maintains the proper environmental conditions within the required temperature range (40 °F – 120 °F) to support the operation of the instrumentation and control equipment and components in the individual UHS ESW pump houses during a design basis accident and LOOP with outside ambient design temperature condition of 0% temperature exceedance values."

More specifically, the staff notes that the "Test Method" lacks verification that the heaters are capable of meeting their name plate heating capacities (i.e. 24 Kw & 3.5 Kw). The preoperational test lacks verification of proper operation of heater controls and alarms. In addition, the preoperational test's acceptance criteria fail to include criteria that require heater fan flow rates and exhaust fan flow rates meet or exceed design specification values. The NRC staff requests the COL applicant amend Preoperational Test 14.2.12.1.114 to remove these deficiencies.

ANSWER:

The US-APWR power block general arrangement drawings show the physical relationship of the UHS ESW pump houses to those plant features which could affect the system. The UHS ESW pump houses are not located near any gas storage facility. There are no storage batteries or stored fuel in UHS ESW Pump Houses. Based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings.

The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis.

The potential presence of explosive hazards internal to the pump houses is addressed by the CPNPP Fire Protection Program, which includes general housekeeping practices, control of transient combustibles, and procedures for the control of flammable and combustible gases. The Fire Protection Program provisions for control of combustibles and ignition sources, as described in FSAR Subsections 9.5.1.6.4.2.4 and 9.5.1.6.4.2.5, apply to the ESW pump houses.

The development of procedures for plant operations, testing, and maintenance will be completed as discussed in FSAR Subsections 13.5.1 and 13.5.2. System testing and required maintenance of the UHS ESW pump house ventilation system is performed at specified intervals to ensure continued operability of the system and to detect degraded equipment performance.

In response to RAI No. 3532 (CP RAI #83), Question 14.03.07-21 attached to Luminant letter TXNB-09065 dated November 13, 2009 (ML093210468), COLA Part 10, Table A.2-2 has been revised to add the UHS ESW pump house supply and exhaust backdraft dampers. The backdraft dampers are Seismic Category I and do not perform an active safety function as indicated in ITAAC Table A.2-2 page 23 (attached). The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. The backdraft dampers will be procured to withstand the effects of site specific tornado wind and atmospheric differential pressure loading, as the detailed design of the system progresses.

As indicated in the response to RAI No. 3366 (CP RAI #82) Question 14.03.07-15, also attached to Luminant letter TXNB-09065, ITAAC Table A.2-1, Item 4 (page 21, attached), the Design Commitment (DC) and Acceptance Criteria (AC) have been clarified to show that the UHS ESW pump house ventilation system maintains the area design temperature limits in the respective rooms. The temperature limits of the ESW pump house ventilation system are defined in FSAR Subsection 9.4.5.1.1.6 (40°F to 120°F) for design basis accident conditions. The DC and AC will verify the capability of the system unit heaters to perform their intended safety related function. Luminant considers the revised ITAAC to be consistent with the guidance in Standard Review Plan Section 14.3, Appendix A.

The ESW pump house ventilation system is considered to be part of the ESF Ventilation System as described in DCD Subsection 9.4.5. As described in DCD Subsection 14.2.12.2.4.11, Test Method and Acceptance Criteria confirm that temperature conditions are maintained in ESF areas in accordance with DCD Subsection 9.4.5. Heater fan and exhaust fan flow rates are verified during construction testing as described in FSAR Subsection 14.2.12.1.114 Item B-1 and B-2, and proper operation of heater controls and alarms is verified as described in Item C-2.

FSAR Subsection 9.4.5.2.6 has been revised to reflect this response.

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 9.4-5.

Impact on S-COLA

None.

Impact on DCD

None.

Attachments

COLA Part 10 ITAAC Table A.2-1 page 21

COLA Part 10 ITAAC Table A.2-2 page 23

Appendix A.2

Table A.2-1 (Sheet 2 of 2)
UHS ESW Pump House Ventilation System
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria	
3.b. Separation is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E cable.	3.b Inspections of the as-built Class 1E divisional cables ~~and raceways~~ will be performed.	3.b ~~The as-built Class 1E electrical cables with only one division are routed in raceways assigned to the same division. There are no other safety division electrical cables in a raceway assigned to a different division.~~Physical separation or electrical isolation is provided between the as-built cables of Class 1E divisions and between Class 1E divisions and non-Class 1E cables.	RCOL2_14 .03.07-4
4. The UHS ESW pump house ventilation system maintains area design temperature limits in the respective room.~~provides and maintains the proper environmental conditions within the respective room.~~	4. Tests and analyses of the as-built UHS ESW pump house ventilation system will be performed for all four divisions.	4. The as-built UHS ESW pump house ventilation system ~~provides and maintains the proper environmental conditions~~ is capable of maintaining area design temperature limits within the respective room. ~~by the exhaust fan and/or unit heater operation.~~	RCOL2_14 .03.07-15
5.a. Controls exist in the MCR to start and stop the UHS ESW pump house ventilation system exhaust fans and unit heaters identified in Table A.2-3.	5.a. Tests will be performed on the as-built exhaust fans and unit heaters identified in Table A.2-3 using controls in the as-built MCR.	5.a Controls exist in the as-built MCR ~~operate~~ to start and stop the as-built UHS ESW pump house ventilation system exhaust fan and unit heaters identified in Table A.2-3.	RCOL2_14 .03.07-16
5.b. The UHS ESW pump house ventilation system exhaust fans and unit heaters units identified in Table A.2-2~~A.2-3~~ as having PSMS control, perform an active safety function ~~start~~ after receiving a signal from PSMS.	5.b. Tests of the as-built UHS ESW pump house ventilation system exhaust fans and unit heaters identified in Table A.2-2 will be performed using real or simulated signals.	5.b. The as-built UHS ESW pump house ventilation system exhaust fans and unit heaters identified in Table A.2-2~~A.2-3~~ as having PSMS control, perform an active safety function identified in the table ~~start~~ after receiving a simulated signal.	RCOL2_14 .03.07-6
6. MCR alarms and displays~~Displays~~ of the ~~UHS ESW pump house ventilation system~~ parameters identified in Table A.2-3 can be retrieved in the MCR.	6. Inspections will be performed for retrievability of the as-built UHS ESW pump house ventilation system parameters in the as-built MCR.	6. MCR alarms and displays~~The displays~~ identified in Table A.2-3 can be retrieved in the as-built MCR.	RCOL2_14 .03.07-7

Table A.2-2
UHS ESW Pump House Ventilation System Equipment Characteristics

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Active Safety Function	PSMS control	Loss of Motive Power Position
ESW Pump Room Exhaust Fan	VRS-OFN-601A,B,C,D	-	Yes	-	Yes/No	Start	High Temperature	-
UHS Transfer Pump Room Exhaust Fan	VRS-OFN-602A,B,C,D	-	Yes	-	Yes/No	Start	High Temperature	-
ESW Pump Room Unit Heater	VRS-OEQ-601A,B,C,D, VRS-OEQ-602A,B,C,D	-	Yes	-	Yes/No	Start	Low Temperature	-
UHS Transfer Pump Room Unit Heater	VRS-OEQ-603A,B,C,D	-	Yes	-	Yes/No	Start	Low Temperature	-
ESW Pump Room Temperature	VRS-TS-2610C,D,E,F VRS-TS-2620C,D,E,F VRS-TS-2630C,D,E,F VRS-TS-2640C,D,E,F	-	Yes	-	Yes/No	-	-	-
UHS Transfer Pump Room Temperature	VRS-TS-2615C,D,E,F VRS-TS-2625C,D,E,F VRS-TS-2635C,D,E,F VRS-TS-2645C,D,E,F	-	Yes	-	Yes/No	-	-	-
UHS ESW Pump House supply and exhaust backdraft dampers	VRS-BDD-601 A,B,C,D VRS-BDD-602 A,B,C,D VRS-BDD-603 A,B,C,D VRS-BDD-604 A,B,C,D	-	Yes	-	No/No	-	-	-

RCOL2_14.03.07-6
RCOL2_14.03.07-7
RCOL2_14.03.07-21

The UHS ESW Pump House Ventilation System contains no ductwork. The damper is mounted in the seismic category I wall opening and the fan is mounted on the seismic category I wall of each independent UHS ESW pump house. RCOL2_09.04.05-3

The UHS ESW pump house fresh air intakes are positioned as high as physically possible above ground level to minimize dust entrainment. The height of the UHS ESW pump house is 16 feet above grade and the intake air is not filtered. The electrical and instrument enclosures within the UHS ESW pump house are NEMA type 12 (dust tight and drip tight – for indoor use) and if there are louvered vents on the enclosures they are provided with filters to minimize the intake of dust, dirt, and grit. The UHS ESW pump house is designed to satisfy the requirements in compliance with GDC 17. Also, based on the location of the UHS ESW pump houses' fresh air intakes, there is no source of hazardous contaminant that could enter through the outside air openings. The UHS ESW pump houses do not harbor any potential sources of explosive gas or fuel-vapor mixtures on a continuous basis. RCOL2_09.04.05-9 RCOL2_09.04.05-12

The ESW pump room exhaust fan and the transfer pump room exhaust fan provide 100% of the ventilation required for their associated rooms during normal and emergency plant operations. The ventilation system is thermostatically controlled by area temperature controllers to cycle the exhaust fans off and on to maintain design temperatures during the summer and winter. These exhaust fans, mounted in exterior walls, each have independent gravity type backdraft dampers which discharge to the outdoors. Makeup supply air is drawn into each pump room through wall openings with gravity type backdraft dampers mounted in the walls. In the event of the presence of smoke, the exhaust fans may be actuated to purge the smoke. RCOL2_09.04.05-8

The unit heaters in each pump room maintain minimum room temperatures, during normal and emergency plant operations, to prevent~~Unit heaters are provided in the UHS transfer pump room and the ESW pump room to maintain a minimum room temperature to prevent the~~ freezing of instrument lines, the wet pipe sprinkler system, and the standpipe hose station. The unit heaters are controlled by locally mounted thermostats. When the temperature drops below the set point, the heating element and fan will be energized. When the temperature rises above the set point, the heating element will de-energize. The ESW pump room and the transfer pump room unit heater elements and fans are designed such that they do not exceed a specified allowable Watt density for the unit heater coils. The fan will continue to run, circulating air through the unit until the fan is de-energized by a time delay relay. RCOL2_09.04.05-7 RCOL2_09.04.05-8

The backdraft dampers are Seismic Category I and do not perform an active safety function. The backdraft dampers are a gravity type and open in the direction of air flow, and close due to the counterbalance when no air flow is present. RCOL2_09.04.05-10

Temperature sensors are provided in the ESW and transfer pump rooms, which alarm in the main control room to notify operators of either high or low RCOL2_09.04.05-8

Attachment 2

Response to Request for Additional Information No. 3762 (CP RAI #121)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-1

The ultimate heat sink (UHS) must be designed to quality standards commensurate with the safety functions to be performed in accordance with the requirements of 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 1. Section 3.2 of the Comanche Peak combined license (COL) Final Safety Analysis Report (FSAR) incorporates by reference Section 3.2.2 of the US-APWR DCD, which requires quality standards to be specified for structures, systems, and components (SSCs) based on safety importance and other considerations. The NRC staff found that the UHS description and designations are incomplete with respect to the following items:

- The description provided in FSAR Section 9.2.5 does not clearly indicate which components and control, alarm, and indication functions are safety-related versus those that are not safety-related, so appropriate designations can be confirmed. Also, the cooling tower structure and components (including materials that are used) are not described and appropriate designations and standards are not specified, such as for the cooling tower structure itself, drift eliminators, film fills, risers, water distribution system/piping and valves (including nozzles), and fan vibration monitors.

- FSAR Table 3D-201 indicates that the operational duration for the UHS basin water level and temperature instruments is only two weeks. This is not consistent with the long-term performance criteria that are specified in Regulatory Guide 1.27, 'Ultimate Heat Sink,' Revision 2 (January 1976) and this relatively short operational duration needs to be explained and justified.

Therefore, the applicant is requested to provide additional information to address these items and revise the FSAR, as necessary to adequately reflect this information.

ANSWER:

- DCD Subsection 3.2.1.3 and Table 3.2-4 address classification of buildings and structures, and identify UHS related structures (UHSRS) to be designed to seismic Category I. Note 4 on DCD Table 3.2-4 indicates that the UHSRS includes the cooling tower enclosure and pump house. DCD Subsection 3.2.1.3 and Table 3.2-4 are incorporated in the CPNPP Units 3 and 4 FSAR by reference. Thus all cooling tower structures are designed to seismic Category I per standard US-

APWR plant design. Therefore these are not identified as site-specific structures for the purposes of design classification. DCD Subsection 9.2.5.1, last bullet states, "The safety-related structures and components of the UHS are designed to equipment Class 3 and seismic Category I requirements to remain functional during and following a SSE." FSAR Table 3.2-201 identifies all ESW return piping located at the UHSRS as piping designed to equipment Class 3 (safety class 3) and quality group C requirements. This includes cooling tower risers, water distribution piping and valves including spray nozzles. FSAR Figure 9.2.5-201 identifies all this to be equipment class 3. FSAR Subsection 9.2.5 is revised to clarify this. Fan vibration switches are procured as part of the cooling tower package and are designed to equipment Class 3 (safety class 3) requirements like other cooling tower components.

The process variables and/or equipment status that are monitored (indication/control/alarm) from the MCR via either safety related Protection and Safety Monitoring System (PSMS) or Plant Control and Monitoring System(PCMS) are represented by a square box (with an inner circle and a horizontal line) symbol on the P&IDs (FSAR Figures 9.2.1-1R and 9.2.5-201). H/L lettering attached to the above square box symbol represent the associated high or low alarm status displayed in PSMS/PCMS. The local instruments which have no monitoring capability in the MCR are represented by a simple circle/bubble symbol on the P&IDs (FSAR Figures 9.2.1-1R and 9.2.5-201). The instruments that are safety-related or important to safety are listed in FSAR Table 3D-201.

- Because the UHS basin water level and temperature instruments in question are located outside the containment, they are accessible and can be repaired, replaced or recalibrated within two weeks duration. This is consistent with DCD Table 3D-1 "Equipment Post-Accident Operability Times," which establishes a post-accident operability time of two weeks for "Equipment located outside containment, is accessible, and can be repaired, replaced, or recalibrated." Instrument short term repair/replacement/recalibration capability is not considered to be an inconsistency with the long-term performance criteria delineated in Regulatory Guide 1.27, "Ultimate Heat Sink," Revision 2 (January 1976).

Impact on R-COLA

See attached mark-up of FSAR Revision 1 pages 9.2-8 and 9.2-9.

Impact on S-COLA

None.

Impact on DCD

None.

- The structures and components of the UHS are designed and constructed as safety-related structures to the requirements of seismic Category I as defined in RG 1.29 and equipment Class 3. RCOL2_09.02.05-4 RCOL2_09.02.05-1

9.2.5.2 System Description

CP COL 9.2(3) CP COL 9.2(4) CP COL 9.2(5) CP COL 9.2(18) CP COL 9.2(19)

Replace the last six paragraphs in DCD Subsection 9.2.5.2 with the following.

Mechanical draft cooling towers with basins, based on site condition and meteorological data, are used for CPNPP Units 3 and 4.

CP COL 9.2(20) CP COL 9.2(21)

A detailed description and drawing of the UHS are provided in Subsection 9.2.5.2.1, Figure 9.2.5-201, and Table 9.2.5-201.

The source of makeup water to the UHS inventory and blowdown discharge location are discussed below. Subsection 10.4.5.2.2.11 describes treatment of blowdown in order to meet wastewater discharge limits. RCOL2_09.02.05-16

9.2.5.2.1 General Description

Each unit is provided with its own independent UHS, with no sharing between the two units. The UHS for each unit consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train, and four 33 one-third percent capacity basins to satisfy the thirty day cooling water supply criteria of RG 1.27.

Each cooling tower consists of two cells with fans and motors, drift eliminators, film fills, risers, and water distribution system all enclosed and supported by a seismic category I reinforced concrete structure. Cooling tower components are designed per equipment Class 3 and quality group C requirements. Each basin includes an ESWP intake structure that contains one 50 percent capacity ESWP and one 100 percent capacity UHS transfer pump, and associated piping and components. Tornado missile protection for the cooling tower components, ESWPs and piping is provided by the UHS safety-related seismic category I structures and ESW pipe tunnel as discussed in Subsection 3.8.4. The UHS structural design, including pertinent dimensions, is also discussed in Subsection 3.8.4. RCOL2_09.02.05-1

Each cooling tower consists of two cells, each with a motor driven fan driven with a right-angle gear reducer. The fan motors are powered from the Class 1E normal ac power system. On loss of offsite power (LOOP), the motors are automatically powered from their respective division emergency power source.

The cooling towers are designed for the following conditions: water flow of 12,000 gpm, hot (inlet) water temperature of 128° F, cold (outlet) water temperature of RCOL2_09.02.05-5

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.0 2.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.0 2.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.0 2.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.0 2.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.0 2.05-10 RCOL2_09.0 2.05-11

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-2

The ultimate heat sink (UHS) must be designed to quality standards commensurate with the safety functions to be performed in accordance with GDC 1 requirements. As specified by Section 3.2.1.1.2 of the DCD and FSAR Section 3.2, non-safety-related parts of the UHS should be designated as Seismic Category II if a failure under seismic loading conditions could prevent or reduce the functional capability of a safety-related SSC. The NRC staff found that insufficient information was provided in FSAR Section 9.2.5 to determine if the seismic designation for non-safety-related parts of the UHS is appropriate. Therefore, the applicant is requested to provide additional information to address this item and revise the FSAR, as necessary to adequately reflect this information.

ANSWER:

The non-safety-related parts of the UHS are non-seismic (NS). As stated in FSAR Subsection 3.8.4, no site-specific seismic category II structures are applicable at CPNPP Units 3 and 4. Structural failure of the UHS non-safety-related SSCs will not adversely impact the seismic Category I SSCs. FSAR Table 3.2-201 is revised to add a new row that reflects classification of the non-seismic components of the UHS.

FSAR Subsection 9.2.5.3 is revised to reflect this response.

<u>Impact on R-COLA</u>

See attached mark-up of FSAR Revision 1 page 9.2-14 and Table 3.2-201, Sheet 2 of 3.

<u>Impact on S-COLA</u>

None

<u>Impact on DCD</u>

None.

The results of the UHS capability and safety evaluation are discussed in detail in Subsection 9.2.5.2.3 and in this Subsection. The UHS is capable of rejecting the heat under limiting conditions as discussed in Subsection 9.2.5.2.3.

The failure modes and effects analysis for the UHS are included in Table 9.2.5-202 and demonstrate that the UHS satisfies the single failure criteria.

The safety-related SSCs of the UHS and the ESWS are classified as seismic Category I. The site-specific safety-related components are identified in FSAR Table 3.2-201. The non-seismic (NS) SSCs are segregated from the seismic Category I SSCs. Structural failure of the UHS non-safety related SSCs will not adversely impact the seismic category I SSCs. These non-safety SSCs are classified as non-seismic. RCOL2_09.02.05-2

The basin is designed to withstand the effect of natural phenomena, such as earthquake, tornado, hurricanes, and floods taken individually, without loss of capability to perform its safety function.

The combined volume of water in the three basins is sufficient to provide at least 30 days required cooling capacity.

The total required 30 days cooling water capacity is approximately ~~8.54~~8.40 million gallons, or approximately ~~2.85~~2.80 million gallons per cooling tower (CT) basin. This is the minimum volume required in each basin to satisfy the thirty day cooling water supply criteria of RG 1.27. Each basin dimension, not including any column or wall sections, is 120 feet x 120 feet. Normal water level is maintained at 31 feet above the basin floor. A water level decrease to 30 feet above the basin floor is alarmed. Allowing 1 foot for sedimentation accumulation at the floor, with a water depth of 29 feet, ~~from the minimum maintained water level, the~~a usable water volume ~~available for each basin is~~of approximately 3.12 million gallons is available for each basin before the operator is alerted of abnormal conditions. ~~The water depth excludes one foot of unusable space from the basin floor, where sedimentation may accumulate.~~ The CT basin volume of 2.80 million gallons does not include the water volume located in the ESWP intake basin below the CT basin. The ESWP pump intake basin water level maintains adequate pump NPSH under design basis conditions. RCOL2_09.02.05-5 RCOL2_09.02.01-1 RCOL2_09.02.05-5 RCOL2_09.02.01-1 RCOL2_09.02.01-1

During normal power operation, the UHS basin water temperature is expected to be below 93° F under the worst-case ambient condition (i.e. wet bulb temperature of 83° F based on the 0% annual exceedance value). At the initiation of the LOOP event, each basin contains approximately 3.12 million gallons of water (minimum required is 2.80 million gallons per Technical Specification 3.7.9). The heat load peaks (196 million Btu/hr/train) four hours into the accident and then decreases continuously. The heat load is approximately 81 million Btu/hr/train at 24 hours into the accident. Cooling tower water discharge at 95° F and at a flow rate of 12,000 gpm mixing with the large quantity of basin water increases the basin water temperature (initially below 93° F). The basin water temperature increases until an equilibrium is reached. However, since the cooling tower is designed for RCOL2_09.02.05-5

CP COL 3.2(4)
CP COL 3.2(5)

Table 3.2-201 (Sheet 2 of 3)

Classification of Site-Specific Mechanical and Fluid Systems, Components, and Equipment

System and Components	Equipment Class	Location	Quality Group	10 CFR 50 Appendix B (Reference 3.2-8)	Code and Standards(3)	Seismic Category	Notes
2. UHS							
UHS transfer pumps	3	UHSRS	C	YES	3	I	
UHS cooling tower fans	3	UHSRS	C	YES	5	I	
UHS basins	3	UHSRS	C	YES	3	I	
Transfer line piping and valves from UHS sink transfer pumps to basins	3	UHSRS essential service water pipe tunnel (ESWPT)	C	YES	3	I	
ESW return line piping	3	UHSRS	C	YES	3	I	
UHS basin makeup piping and valves	9	UHSRS	NA	NA	5	Non-seismic (NS)		RCOL2_09.0 2.05-2
3. UHS ESW pump house ventilation system							
ESW pump room exhaust fans	3	UHSRS	C	YES	5	I	
UHS transfer pump room exhaust fans	3	UHSRS	C	YES	5	I	
UHS ESW pump house supply and exhaust backdraft dampers	3	UHSRS	C	YES	5	I	
ESW pump room unit heaters	3	UHSRS	C	YES	5	I	
UHS transfer pump room unit heaters	3	UHSRS	C	YES	5	I	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-3

The ultimate heat sink (UHS) must be capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, and external missiles without loss of capability to perform its safety functions with and without off-site power available in accordance with the requirements of GDC 2. Because the cooling towers are located in relatively close proximity to each other, the following concerns were identified:

- Missiles from a single tornado can impact the exposed parts of multiple cooling tower basins and cause damage to the cementitious membrane.
- The low pressure created by a tornado vortex could impact all of the cooling tower fans as well as the water inventory that is contained in the exposed areas of the cooling tower basins.

Therefore, the applicant is requested to provide additional information to address these items and revise the FSAR, as necessary to adequately reflect this information.

ANSWER:

Missiles

All exposed parts of the UHS cooling tower structure, including the basins, that could be impacted by a tornado missile are constructed of reinforced concrete designed to prevent full penetration, or structural failure, by any of the spectrum of tornado missiles identified in DCD Subsection 3.5.1.4. The probability of a tornado missile striking the outside face of the basin walls is greater than the probability of a tornado missile striking the interior walls of the basin; however, a missile strike on either face is considered. The cementitious membrane adhered to the interior faces of the reinforced concrete walls of the cooling tower basins is placed there to preclude long-term seepage of water from the basin through any cracks in the concrete that may develop with time. Penetration through or cracking of, the cementitious lining would not jeopardize the integrity of the water inventory within the basins because the four-foot thick reinforced concrete wall would remain and retain the water. Because the walls would not be penetrated by the pipe tornado missile and the design precludes spalling or scabbing, the water inventory in the UHS would not be jeopardized. Any through cracking of the walls due to the structural response from the automobile missile strike would be minimal and of a minor width such that the amount of water that could seep from the basin would be substantially less than the capacity of the makeup and transfer system to replace.

Low Pressure

Significant loss of water inventory due to the low pressure effects of the design basis tornado acting on the exposed areas of the basin is not a credible event. The basins are partially covered by the cooling tower enclosures and pump houses, and each basin is divided at its surface by a separation wall as shown in FSAR Figure 3.8-206. The ratio of inventory volume versus the exposed surface area for the UHS basins is relatively large, which inhibits the ability of a tornado to withdraw water from the basins. Further, the basin water surface during normal operating conditions is four feet below the top of the basin walls, which affords some protection of the water surface from the tornado winds. Also, the fetch across the basin water surface is too small to allow generation of significant surface waves due to tornado winds. As a result, wave heights due to tornado effects would not be expected to reach the height of the basin walls when the water level is at normal operational height. Therefore, sufficient inventory is expected to remain in the basin in the event of a design basis tornado.

If the basin water level was postulated to fall approximately 6 inches below the normal water level, the makeup water control valve would automatically open to start replenishing the basin. An alarm would actuate in the MCR if the inventory falls one foot below the normal water level. In this case remedial actions would be taken per operating procedures to maintain the safe shutdown capability, even if more than one basin were impacted by the same tornado. Therefore, the low pressure effects of a tornado vortex would not impact the safety functions of the cooling tower basins.

The cooling tower components, including the fans and associated motors, are required to be designed giving consideration to the design basis tornado differential pressure effects. The differential pressure effects include any resulting changes in the air flow velocity. Therefore, the low pressure created by a tornado vortex will not impact the ability of the cooling tower components, including the fans and associated motors, to perform the required safety functions.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 3.8-5 and 3.8-6.

Impact on S-COLA

None.

Impact on DCD

None.

mat slab as well due to overturning moments and a greater overall weight of this segment versus the other segments. RCOL2_03.08.04-1

It is intended that at the interface of two different segments, the interior wall, mat, and slab surfaces line up evenly with the adjacent segments and any difference in slab thicknesses affects only the outer dimensions of the ESWPT segments.

3.8.4.1.3.2 UHSRS

The UHSRS consists of a cooling tower enclosure; UHS ESW pump house, and UHS basin. All of them are reinforced concrete structures, described below.

UHS Basin - There are four basins for each unit and each reinforced concrete basin has one cooling tower with two cells. Each basin rests on a separate foundation, is square in shape, constructed of reinforced concrete, and separated from the adjacent basin by a minimum 4 inch expansion joint. A site-specific specification for the expansion/separation joint that provides material or system performance requirements will be prepared. Performance requirements for an elastomeric material include requirements bounding the allowable stress-strain properties, durability requirements, and specification for a material testing program. Each basin serves as a reservoir for the ESWS. There is a cementitious membrane adhered to the interior faces of the reinforced concrete walls of the basins which minimizes long-term seepage of water from the basin. An UHS ESW pump house is located at the south-west corner of each basin. Adjacent to the pump house on the east side of the basin are cooling tower enclosures supported by UHS basin walls. The ESWPT runs east-west along the south exterior wall of the UHS basin, and is separated by a minimum 4 inch expansion joint. RCOL2_03.08.04-2 RCOL2_09.02.05-3

Each basin is divided into two parts, as shown on Figure 3.8-206. The larger section of the basin shares the pump house and one cooling tower cell enclosure. The other cooling tower cell enclosure is in the smaller segment of the basin. A reinforced concrete wall, running east-west, separates the cooling tower enclosure basin area from rest of the basin. This wall is provided with slots to maintain the continuity of the reservoir.

See Figure 3.8-206 for general arrangement, layout, and dimensions of the UHSRS.

UHS ESW pump house - The pump house is an integral part of the UHS basin supported by UHS basin exterior and interior walls. Each pump house contains one ESW pump and one UHS transfer pump with associated auxiliaries. The pump bay (lowest portion of the pump house required for the pump suction) is deeper than the rest of the UHS basin. A reinforced concrete wall, running east-west, divides the pump house basin from rest of the UHS basin. This wall is provided with slots for flow of water. Two baffle walls (running east-west) are provided inside the pump house basin, before the pump bay. These baffle walls are provided with slots to maintain the flow of water and are staggered to prevent trajectory of postulated direct or deflected design basis tornado missiles.

The operating floor of the pump house is a reinforced concrete slab spanning east-west and supported by UHS basin exterior and interior walls. The operating floor supports the ESWS pump, UHS transfer pump, and motors. The roof of the pump house is a reinforced concrete slab spanning north-south and supported by reinforced concrete beams. To allow access to the ESWS pump/motor, a removable reinforced concrete cover is provided in an opening in the roof of the pump house.

Tornado missile shields are provided to protect the air intake and air outlets of the ESWS pump house HVAC system from tornado missiles. The structural design considers tornado differential pressure loads as discussed in Subsection 3.3.2.2.2. RCOL2_09.04.05-4

UHS cooling tower enclosures - Each UHS basin has one cooling tower with two cells. Each cell is enclosed by reinforced concrete structures that house the equipment required to cool the water for ESWS. The reinforced concrete wall running north-south separates the two cell enclosures. The enclosures are an integral part of the UHS basin supported by the basin interior and exterior walls on the basemat foundation. A reinforced concrete wall, running east-west, separates the cell enclosure portion of the basin from the rest of the UHS basin. An east-west wall is provided with openings at the basemat to maintain the continuity of the UHS basin. Air intakes are located at the north and south faces of the cooling tower enclosure. The missile shields at the air intakes are ~~and~~ configured to protect the safety-related substructures and components housed within the UHS structure from tornado missiles. FSAR Table 3.2-201 lists the site-specific equipment and components located in the UHSRS that are protected from tornado missiles. The north side air intake is an integral part of the cooling tower enclosure, whereas the south side air intake is an integral part of the ESWPT, and is supported by reinforced concrete piers which are supported by the ESWPT walls and basemat. RCOL2_03.08.04-3

Each cooling tower cell enclosure is equipped with a fan and associated equipment to cool the water. Equipment includes header pipe, spray nozzles, and drift eliminators with associated reinforced concrete beams supported by the exterior walls of the enclosure. The fan and motor are supported by reinforced concrete deck above the drift eliminators. A circular opening is provided in the deck for the fan, and the deck is supported by enclosure walls and a deep upside circular concrete beam around the fan opening. The fan is supported by a north-south concrete beam at the center of enclosure. For air circulation and to protect the fan and motor from tornado missiles, a circular opening is provided at the roof of the enclosure (centered on the fan) with a reinforced concrete slab and heavy steel grating between the roof and the deck. The fans, motors and associated equipment are designed with consideration given to the effects of design basis tornado differential pressure. RCOL2_09.02.05-3

All exposed parts of cooling tower enclosure, the UHS ESWS pump house and the UHS basin that could be impacted by a tornado missile are designed to prevent full penetration or structural failure by the spectrum of tornado missiles identified in Subsection 3.5.1.4.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-4

The UHS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. The UHS description and piping and instrumentation diagram (P&ID) were reviewed to assess the design adequacy of the UHS for performing its heat removal functions. However, the NRC staff found that some of the descriptive information that was provided for the UHS is confusing, incomplete, inaccurate, or inconsistent. In order for the NRC staff to complete this assessment, the applicant is requested to address the following items and revise the FSAR, as appropriate to reflect this information:

- Much of the information related to the UHS that is discussed in other parts of the FSAR has not been included in the description provided in FSAR Section 9.2.5. Consequently, the description of the UHS design basis that is provided in FSAR Section 9.2.5 is incomplete. For example, information related to the UHS that is listed in FSAR Section 1.2.1.7.1, "General Plant Arrangement," such as "The UHS is designed and constructed as a safety-related structure, to the requirements of seismic category I, as defined in RG 1.29," should be included in the description provided in FSAR Section 9.2.5.

- FSAR Section 9.2.5 indicates that the cooling tower basins are of uniform depth, whereas FSAR Section 3.8.4 indicates that the pump wells are deeper than the rest of the basin. This needs to be clarified, as well as which depth is the point of reference for specifying the nominal water level in the basin.

- The system description does not specify if the cooling tower fans are single speed or multiple speed units, and what air flow rate is required.

- The system description and P&ID do not fully describe where all indications are displayed (e.g., local, remote panel, control room), and what instruments provide input to a process computer and/or have alarm and automatic actuation functions.

- The P&ID indicates that overflow protection for the basin is provided by a spillway or drain line, but this is not described in FSAR Section 9.2.5, and design specifications, size requirements, and other design details are not provided.

- FSAR Section 9.2.5 indicates that the power supplies for the transfer pumps are provided by alternate trains from the train associated with its respective cooling tower. For example, the transfer pump for the A Train can be powered by the C or D trains depending on the breaker alignment. However, the FSAR does not indicate if this logic also applies to the transfer pump valves and indications.

- FSAR Figures 1.2-206, Section E1-E1, and 1.2-210, Section D2-D2, show the transfer pump discharge pipe going into different essential service water (ESW) tunnel compartments; whereas, the description in FSAR Section 9.2.5 and Figure 9.2.5-201 indicate that there is only one common transfer pump discharge/transfer pipe such that only one of the compartments would be used.

- FSAR Table 3.7.1-3R, Note 5, indicates that the mat for the cooling tower basin supports one UHS basin with two pools; whereas, the description in FSAR Section 9.2.5 indicates that each basin has only one pool.

- FSAR Section 9.2.5 and other FSAR sections do not specifically state that the cooling towers are Seismic Category 1, and there is no discussion explaining how the seismic qualification of the cooling towers will be established.

ANSWER:

- FSAR Subsection 9.2.5.1 is revised to note that the UHS is designed and constructed as a safety-related structure, to the requirements of seismic Category I, as defined in RG 1.29. FSAR Subsection 9.2.5 is also updated via the responses to other Questions of this RAI to provide additional descriptive information related to the UHS.

- The UHS basin depth is clarified in the response to RAI 3698 (CP RAI #109), Question 09.02.01-1 as attached to Luminant letter TXNB-09071, dated November 20, 2009. As noted in FSAR Subsection 9.2.5, each cooling tower (CT) structure consists of the UHS basin located underneath the tower. The UHS ESW intake basin, located underneath the ESW pump house, is interconnected with the UHS basin and maintains the same water level. The UHS basin floor elevation is 791 ft. The UHS ESW intake basin floor elevation is 779 ft. FSAR Figure 3.8-209 provides a typical section view of the UHS basin including the ESWS pump elevation. During plant operation, normal water level of approximately 31 feet above the UHS basin floor (822 ft elevation) is maintained. This provides a water level of 43 feet in the UHS ESW pump intake basin.

- Each cooling tower consists of two cells with one fan in each cell. The cooling tower design is not finalized. Single speed fans are anticipated. The required air flow rate is to be calculated by the cooling tower vendor. Preliminary calculations estimate required air flow to be 685,900 cubic feet per minute (cfm). As noted in response to Question 09.02.05-5 of this RAI, FSAR Table 9.2.5-201 is revised to include the required air flow rate.

- As stated in the response to the first bullet item of Question 9.02.05-1 of this RAI, FSAR Figures 9.2.1-1R and 9.2.5-201 include information to identify local instrumentation and instrumentation that provides input to the MCR (via PSMS or PCMS). The attached COLA Part 10, Appendix A.1 Tables A.1-2 and A.1-3, as revised per response to RAI 3293 (CP RAI 81), Questions 14.03.07-5 and 14.03.07-7, respectively show: (1) the site-specific UHS and ESWS equipment characteristics (including remotely operated valves and active safety functions of equipment); and (2) alarms, displays and controls in the MCR and remote shutdown console (RSC).

- The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. FSAR Figure 9.2.5-201 has been revised to delete Note 2 regarding the construction of a spillway or drain line to preclude an overflow caused by the transfer pumps or makeup flow.

- The power operated discharge valves and instruments/indicators associated with each of the transfer pumps are powered from the same trains powering the transfer pump(s), except for the power operated valve at each line transferring into the UHS basin. FSAR Subsection 9.2.5.2.2 is updated to clarify this item.

- A common discharge header is provided for all four UHS transfer pumps. A discharge pipe from each transfer pump penetrates its basin wall and is connected to the common header. The discharge header running the entire length of the cooling towers is located in the ESW pipe tunnels adjacent to the UHS basins and penetrates the tunnel wall. FSAR figure 9.2.5-201 is a piping and instrumentation diagram and not all structural details are shown on this drawing. FSAR Subsection 9.2.5 is revised to clarify the description.

- As noted in FSAR Subsection 9.2.5, each UHS basin has only one pool. Note 5 to FSAR Table 3.7.1-3R is corrected.

- Cooling towers are designed as Seismic Category I (see response to Question 09.02.05-1 of this RAI). Seismic qualification of the CT will be established using the methods described in FSAR Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment" and in accordance with the MHI US-APWR EQ Program, "US-APWR Equipment Qualification Program, MUAP-08015(R1)" (ML093160512). This program is referenced in DCD Revision 2, Section 3.11.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 Table 3.7.1-3R; pages 9.2-8, 9.2-9, 9.2-11, 9.2-24, and 9.2-25.

Impact on S-COLA

None.

Impact on DCD

None.

Attachments

COLA Part 10, Appendix A.1, Tables A.1-2 (2 sheets) and A.1-3 from RAI No. 3293 (CP RAI #81) Response (ML093210468).

Table A.1-2

Ultimate Heat Sink System and Essential Service Water System
(Portions Outside the Scope of the Certified Design)
Equipment Characteristics

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Active Safety Function	PSMS Control	Loss of Motive Power Position
Ultimate heat sink transfer pumps	UHS-OPP-001 A, B, C, D	3	Yes	-	Yes/No	Start Stop	Remote Manual	-
Ultimate heat sink cooling tower fans	UHS-OEQ-001 A, B, C, D, 002 A, B, C, D	-	Yes	-	Yes/No	Start Stop	ECCS Actuation; LOOP Sequence; Remote Manual	-
Ultimate heat sink transfer pump discharge valves	UHS-MOV-503 A, B, C, D	3	Yes	Yes	Yes/No	Transfer Closed Transfer Open	Remote Manual	As is
Ultimate heat sink transfer line basin inlet valves	UHS-MOV-506 A, B, C, D	3	Yes	Yes	Yes/No	Transfer Closed Transfer Open	Remote Manual	As is

RCOL2_14.03.07-6

Appendix A.1

Table A.1-2

Ultimate Heat Sink System and Essential Service Water System (Portions Outside the Scope of the Certified Design) Equipment Characteristics

Equipment Name	Tag No.	ASME Code Section III Class	Seismic Category I	Remotely Operated Valve	Class 1E/ Qual. For Harsh Envir.	Active Safety Function	<u>PSMS Control</u>	Loss of Motive Power Position
Ultimate heat sink basin blowdown control valves	ESW-HCV-2000,2001, 2002,2003	3	Yes	Yes	Yes/No	Transfer Closed	<u>ECCS actuation or UHS basin low water level;</u> <u>Remote manual</u>	Closed
Ultimate heat sink basin water level	UHS-LT-2070A,B,2071 A,B,2072A,B,2073A,B	-	Yes	-	Yes/ No	-	<u>-</u>	-
Ultimate heat sink basin temperature	UHS-TE-2070,2071,2072,2073	-	Yes	-	Yes/ No	-	<u>-</u>	-

RCOL2_14.03.07-6

NOTE:
Dash (-) indicates not applicable.

Appendix A.1

Table A.1-3

Ultimate Heat Sink System and Essential Service Water System (Portions Outside the Scope of the Certified Design) Equipment Alarms, Displays, and Control Functions

Equipment/Instrument Name	MCR/RSC Alarm	MCR/RSC Display	MCR/RSC Control Function	~~RSC Display~~
Ultimate heat sink transfer pumps UHS-OPP-001A, B, C, D	No	Yes	Yes	~~Yes~~
Ultimate heat sink cooling tower fans UHS-OEQ-001A, B, C, D, 002A, B, C, D	No	Yes	Yes	~~Yes~~
Ultimate heat sink transfer pump discharge valves UHS-MOV-503A, B, C, D	No	Yes	Yes	~~Yes~~
Ultimate heat sink transfer line basin inlet valves UHS-MOV-506A, B, C, D	No	Yes	Yes	~~Yes~~
Ultimate heat sink basin blowdown control valves ESW-HCV-2000, 2001, 2002, 2003	No	Yes	Yes	~~Yes~~
Ultimate heat sink basin water level UHS-LT-2070A, B, 2071 A, B, 2072A, B, 2073A, B	Yes	Yes	~~Yes~~No	~~Yes~~
Essential Service Water basin water temperature UHS-TE-2070, 2071, 2072, 2073	Yes	Yes	~~Yes~~No	~~Yes~~

RCOL2_14.03.07-7

Table 3.7.1-3R

Major Dimensions of Seismic Category I Structures(1)

	Structure	Basemat Embedment Depth Below Grade (ft)	Basemat Width and Length (ft)	Max. Structure Height
	R/B	26'-8"/38'-10"	210' x 309'(3)	190' - 9"
	PCCV	See note 2.	See note 2.	268' - 3"
	Containment Internal Structure	See note 2.	See note 2.	139' - 6" (top of pressurizer compartment)
	PS/B	37'-3"	71' x 117'	51'-11"
CP COL 3.7(28)	PSFSV	40'-0" (nominal)	88'-6" x 78'-6"	42'-7" (+/-) (4),(6)
CP COL 3.7(28)	UHSRS	47'-0"/35'-0"	131'-6" x 131'-6" (5)	112'-0" (4)
CP COL 3.7(28)	ESWPT	30'-11" (typical) 31'-5" (maximum) (7)	26' (typical) / 35' (maximum) (7) x length connecting R/B to UHSRS	18'-8" (typical) (4) 51'-5" (maximum) (7)

Notes:

1) The dimensions shown are approximate and are based on the general arrangement drawings in Section 1.2.
2) The R/B, PCCV, and containment internal structure rest on a common basemat as shown on the general arrangement drawings in Section 1.2.
3) Width and height are the distances between column lines of exterior walls.
4) The maximum structure height indicated for these structures is from bottom of mat to top of structure. The shear key dimensions of the ESWPT and PSFSVs are not included.

CP COL 3.7(28) 5) Each mat foundation supports one UHS basin with ~~two pools~~one pool. RCOL2_09.02.05-4

6) This includes height of curb at the high point on the roof slab.
7) The maximum dimensions occur at the UHS air intake missile shields mounted on the ESWPT adjacent to the UHSRS.

- The structures and components of the UHS are designed and constructed as safety-related structures to the requirements of seismic Category I as defined in RG 1.29 and equipment Class 3. RCOL2_09.02.05-4 RCOL2_09.02.05-1

9.2.5.2 System Description

CP COL 9.2(3) CP COL 9.2(4) CP COL 9.2(5) CP COL 9.2(18) CP COL 9.2(19)

Replace the last six paragraphs in DCD Subsection 9.2.5.2 with the following.

Mechanical draft cooling towers with basins, based on site condition and meteorological data, are used for CPNPP Units 3 and 4.

CP COL 9.2(20) CP COL 9.2(21)

A detailed description and drawing of the UHS are provided in Subsection 9.2.5.2.1, Figure 9.2.5-201, and Table 9.2.5-201.

The source of makeup water to the UHS inventory and blowdown discharge location are discussed below. Subsection 10.4.5.2.2.11 describes treatment of blowdown in order to meet wastewater discharge limits. RCOL2_09.02.05-16

9.2.5.2.1 General Description

Each unit is provided with its own independent UHS, with no sharing between the two units. The UHS for each unit consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train, and four 33 one-third percent capacity basins to satisfy the thirty day cooling water supply criteria of RG 1.27.

Each cooling tower consists of two cells with fans and motors, drift eliminators, film fills, risers, and water distribution system all enclosed and supported by a seismic category I reinforced concrete structure. Cooling tower components are designed per equipment Class 3 and quality group C requirements. Each basin includes an ESWP intake structure that contains one 50 percent capacity ESWP and one 100 percent capacity UHS transfer pump, and associated piping and components. Tornado missile protection for the cooling tower components, ESWPs and piping is provided by the UHS safety-related seismic category I structures and ESW pipe tunnel as discussed in Subsection 3.8.4. The UHS structural design, including pertinent dimensions, is also discussed in Subsection 3.8.4. RCOL2_09.02.05-1

Each cooling tower consists of two cells, each with a motor driven fan driven with a right-angle gear reducer. The fan motors are powered from the Class 1E normal ac power system. On loss of offsite power (LOOP), the motors are automatically powered from their respective division emergency power source.

The cooling towers are designed for the following conditions: water flow of 12,000 gpm, hot (inlet) water temperature of 128° F, cold (outlet) water temperature of RCOL2_09.02.05-5

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.02.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.02.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.02.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.02.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.02.05-10 RCOL2_09.02.05-11

Four 100% capacity UHS transfer pumps, one located in each UHS ESW pump house, are provided to transfer cooling water from a non-operating UHS basin to the operating UHS basins when required during accident conditions. RCOL2_09.02.05-6

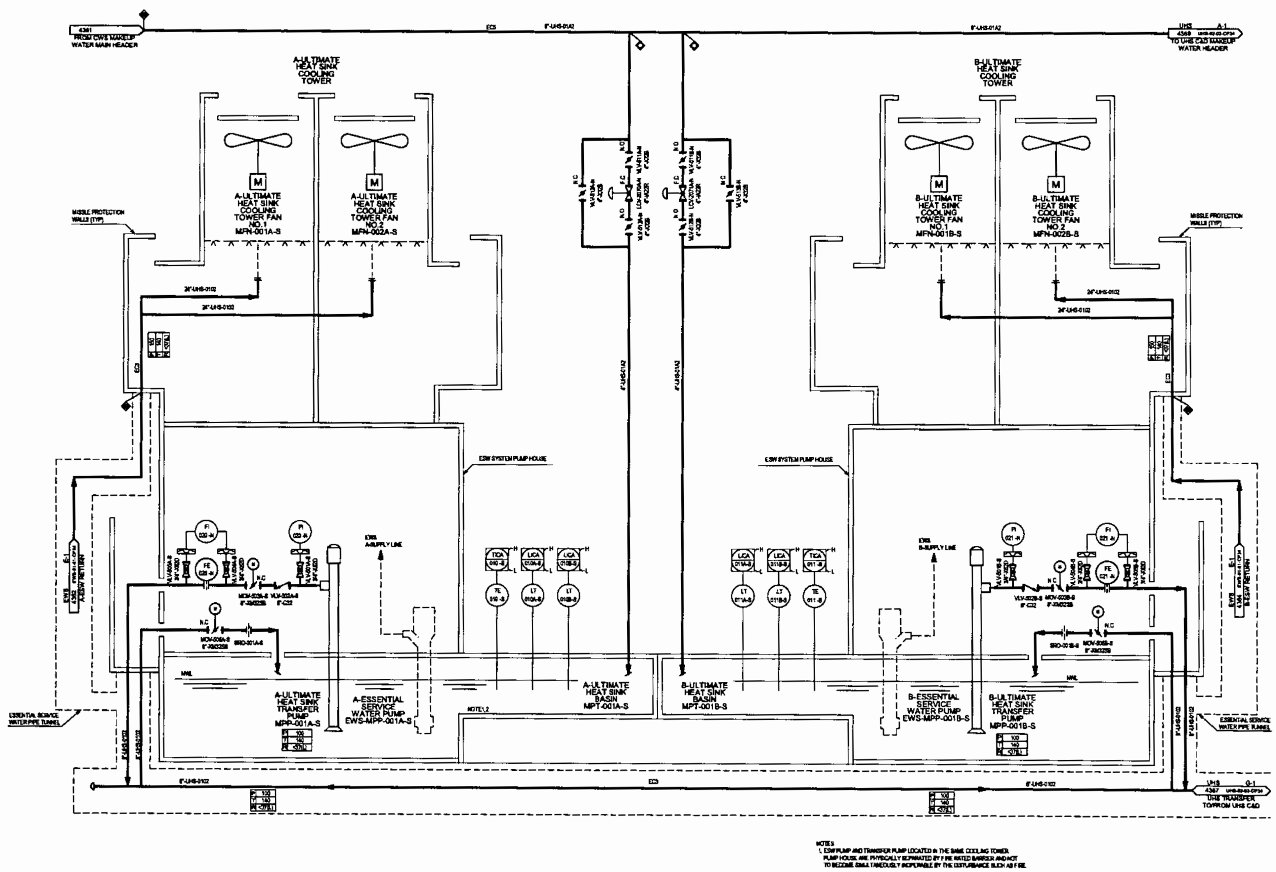
All transfer pumps discharge into a common header which in turn discharges to individual UHS basins. All discharge piping is located in missile protected and tornado protected areas. The common discharge header and other UHS system piping are designed to seismic Category I requirements. The piping is located in seismic Category I structures. There is no non-seismic piping in the vicinity of this header, and there are no seismically induced failures. Pipes are protected from tornado missiles. The UHS transfer pump(s) operate during accident conditions, during IST in accordance with plant Technical Specifications, during maintenance, and for brief periods during cold weather conditions for recirculation. As the header is normally not in service, deterioration due to flow-accelerated corrosion is insignificant. Transfer of water inventory is required assuming one train/basin of ESW/UHS is out of service (e.g., for maintenance), and a second train is lost due to a single failure. When a transfer pump is in operation, fluid velocity in the header is approximately 5.1 ft/sec. Operating conditions are approximately 20 psig and 95° F. Therefore, header failures are not considered credible. RCOL2_09.02.05-4 RCOL2_09.02.05-6

The UHS transfer pump is designed to supply 800 gpm flow at a total dynamic head (TDH) of 40 feet. Transfer pump capacity is more than adequate to replenish the maximum water inventory losses from two operating ESWS trains. Minimum available net positive suction head (NPSHA) is approximately 40 feet. This is based on the lowest expected water level of approximately 12 feet in the UHS ESW intake basin and 95° F water temperature. Transfer pump location and submergence level precludes vortex formation. In addition, the transfer pump and the ESW pump from the same basin do not operate simultaneously. RCOL2_09.02.05-7

The UHS transfer pumps and the ESWPs located in each basin are powered by the different Class 1E buses, e.g., for basin A, the ESWP is powered from bus A, and the UHS transfer pump is powered from bus C or D, depending on manual breaker alignment. The power operated valve at each transfer pump discharge and instrumentation associated with each individual transfer pump are powered from the same buses as the transfer pump. The power operated valves at the transfer lines discharging into the UHS basins are powered from different buses than the transfer pumps in their respective basins. RCOL2_09.02.05-4

The cooling tower fans are automatically activated by the emergency core cooling system (ECCS) actuation signal, the LOOP sequence actuation signal, or the remote manual actuation signal in case of automatic actuation failure. RCOL4_16-6

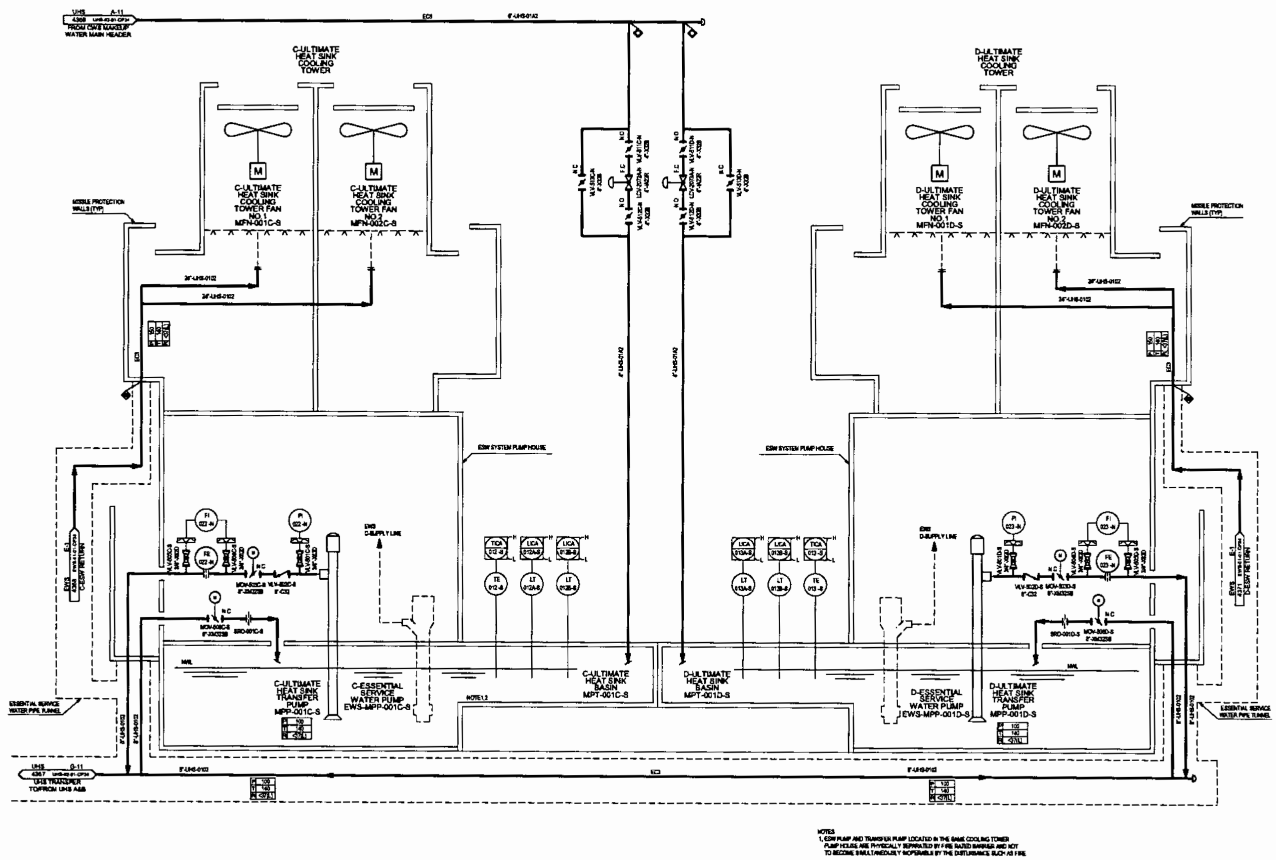
The ECCS actuation signal ensures continuous cooling to the reactor during accidents to allow the reactor to be brought to safe shutdown condtions. The LOOP sequence actuation signal automatically starts the Class 1E gas turbine generators (GTGs) to resume power to the active components in each UHS train during LOOP events. RCOL4_16-6



RCOL2_09.02.05-4

CP COL 9.2(20)

Figure 9.2.5-201 Ultimate Heat Sink System Piping and Instrumentation Diagram (Sheet 1 of 2)



RCOL2_09.02.05-4

CP COL 9.2(20)

Figure 9.2.5-201Ultimate Heat Sink System Piping and Instrumentation Diagram (Sheet 2 of 2)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-5

The UHS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. The capability of the UHS as described in FSAR Section 9.2.5 was reviewed by the NRC staff to assess the adequacy of the UHS for performing its heat removal functions. However, the NRC staff found that the FSAR description did not demonstrate adequate performance of the UHS for the most limiting conditions. As such, the applicant is requested to address the following items in this regard and revise the FSAR, accordingly to reflect this information:

- The analysis assumes that the starting water temperature in the cooling tower basin is 95 °F, which is the maximum temperature that is allowed for ESWS operation. There is no discussion of how the temperature in the basin will trend to confirm that 95 °F is not exceeded, and there is no recognition and confirmation that the heat transfer rate is sufficient to achieve cold shutdown conditions within 36 hours as required by Technical Specification requirements and specified in the review criteria established in NUREG-0800, Standard Review Plan (SRP) Section 5.4.7.

- The analysis is based on a wet bulb temperature of 80 °F (includes 2 °F margin), but Table 2.0-1R shows that the most limiting wet bulb temperature for heat removal is 83 °F. The applicant used an average temperature that was based on the worst 30-day historical record, which is inappropriate for establishing the worst-case conditions for heat removal because it is not bounding and will not demonstrate that the maximum allowed ESWS supply temperature will not be exceeded. Additionally, Table 2.0-1R indicates that temperature peaks that are less than two hours in duration are excluded, but no explanation or justification was provided for this exception. If peak temperatures that are less than two hours in duration can cause the UHS temperature limit to be exceeded, they can not be excluded from consideration in Table 2.0-1R.

- Table 9.2.5-201 shows that the design heat load of each cooling tower is 1.96×10^8 Btu/hr, which does not provide any excess margin in performance capability to allow for cooling tower fouling and degradation, the effects of other cooling towers and nearby structures, and analytical uncertainties that exist. The cooling tower design heat load needs to be justified accordingly, showing that the heat removal capability is sufficient to handle the maximum heat load and to establishing cold shutdown conditions within 36 hours (per Technical Specification requirements and the guidance in SRP Section 5.4.7) without exceeding a basin temperature of 95 °F. Additionally, Table 9.2.5-201 should also list the design air flow that is required and corresponding fan speeds, as well as the cooling tower design approach temperature that corresponds to the most limiting conditions that are assumed, taking into consideration the maximum amount of cooling tower fouling and degradation that is allowed over the life of the plant and other factors that apply.

- The water inventory analysis was not adequately explained and justified. For example, the assumptions that give the maximum evaporation and water loss rates are different from those that are limiting for heat removal. Unlike the heat removal analysis, the most limiting temperature assumptions that apply for inventory assessment can be based on the most limiting 30 day historical record. However, the factors that are used for drift and evaporation need to be justified based upon site-specific conditions and cooling tower design specifications, and how they relate to the factors that are assumed. Additionally, other water loss considerations must be addressed as well, such as natural evaporation and wind loss from the exposed parts of the basins, blowdown, seepage, and ESWS leakage.

ANSWER:

Part 1

The cooling towers are designed in accordance with Regulatory Guide (RG) 1.27 based on tower water flow of 12,000 gpm, tower hot (inlet) water temperature of 128°F, tower cold (outlet) water temperature of 95°F, ambient wet bulb temperature of 80°F, and design heat load of 196.00x10^6 Btu/hr.

As noted in DCD Revision 2, Table 9.2.5-2, the ESWS maximum heat load per ESW train (with two trains operating) is 196x10^6 Btu/hr for safe shutdown with loss of offsite power (LOOP) and 158x10^6 Btu/hr for a loss of coolant accident (LOCA). The LOCA peak heat loads are less than the safe shutdown peak heat loads. Therefore, the cooling tower design is based on the safe shutdown with LOOP heat load.

During normal power operation, the UHS basin water temperature is expected to be below 93°F under the worst-case ambient condition (i.e. wet bulb temperature of 83°F based on 0% annual exceedance value). (Note: The Technical Specification maximum UHS basin water temperature is revised to be ≤ 93°F in response to question 09.02.05-14). At the initiation of the LOOP event, the minimum usable water volume available for each basin is nominally 3.12 million gallons (the revised Technical Specification minimum useable volume and the maximum volume required for accident mitigation equal 2.80 million gallons). As shown in DCD Table 9.2.5-2, with two EWS trains operating, the LOOP safe shutdown heat load (196 million Btu/hr/train) peaks at four hours into the accident and then decreases continuously. The maximum design cooling tower water discharge, i.e., at a temperature of 95°F and a flow rate of 12,000 gpm, mixes with the large quantity of basin water which increases the basin water temperature (initially at or below 93°F). The basin water temperature increases until equilibrium is reached. However, since the cooling tower is designed for a maximum 95°F discharge water with peak heat load of 196 million Btu/hr, the basin water temperature will not exceed 95°F any time during the design basis event.

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation" with ESW water temperature of 95°F, the residual heat removal system (RHRS) is capable of reducing the reactor coolant temperature from 350° F to 200°F within 36 hours of shutdown as required by Technical Specifications. As the Technical Specifications surveillance ensures that the UHS water temperature is 93°F or less, the evaluation provided in DCD Subsection 5.4.7 is bounding.

Part 2

As noted in FSAR Subsection 9.2.5.2.3, fourth paragraph, the cooling towers are designed in accordance with RG 1.27, and the meteorological conditions resulting in maximum evaporation and drift loss are based on the worst 30-day average combination of controlling parameters (wet bulb and dry bulb temperatures). The cooling tower design wet bulb temperature of 80°F is based on 30-year (1977-2006) worst 30-day period data between June 1, 1998, and June 30, 1998, with an average wet bulb temperature of 78° F(a 2°F recirculation penalty was added).

The 83°F wet bulb temperature shown in FSAR Table 2.0-1R corresponds to the 0% annual exceedance value (two consecutive hourly peak temperature on July 12, 1995, at 1500 hours and 1600 hours) in accordance with SRP 2.3.1. The 0% exceedance criterion means that the wet bulb temperature does not exceed the 0% exceedance value for more than two consecutive data occurrences, namely two consecutive hours on data recorded hourly.

The 83° F wet bulb temperature is used as the controlling factor for establishing the cooling tower basin initial water temperature as described in the response to Part 1 above.

Basin water temperature of 93°F at the initiation of the accident was calculated using the performance curve generated for a typical cooling tower design, and the wet bulb temperature of 83° F (corresponding to 0% annual exceedance value).

Even with 2 hours operation at peak heat loads and initial basin water temperature of 93°F, preliminary calculation shows a resulting basin temperature of approximately 94° F which does not exceed the UHS temperature limit of 95°F.

FSAR Subsection 9.2.5.2.3 is revised to address this discussion.

Part 3

The cooling tower procurement specification will require the vendor to take into consideration fouling, degradation and the effects of other cooling towers and nearby structures in the design. Cooling tower performance monitoring per GL 89-13 requirements, periodic maintenance based on lessons learned from cooling tower structure events described in Institute of Nuclear Power Operations (INPO) Topical Report TR8-62, "Cooling Tower Structure Events" dated March 2008, are established to keep cooling tower degradation to a minimum.

As noted in the FSAR Subsection 9.2.5, two cases were analyzed for the cooling tower performance for the limiting two out of four operating UHS/ESW trains: 1) safe shutdown with LOOP and 2) LOCA. Peak heat load for these cases are as follows:

Safe shutdown with LOOP: 196×10^6 BTU/hr /train

LOCA: 158×10^6 BTU/hr /train

The cooling tower is sized for the design heat load of 196×10^6 BTU/hr, even though this peak heat load occurs only for a short duration (one hour as per DCD Table 9.2.5-2) during the safe shutdown scenario. Thus the cooling tower design provides ample margin for LOCA heat loads and safe shutdown heat loads.

FSAR Table 9.2.5-201 has been revised to incorporate UHS cooling tower design air flow, fan speed, design approach and design life.

Part 4

In accordance with RG 1.27, the UHS is designed with a sufficient inventory to provide the required cooling for at least 30 days following an accident, with no make-up water. The most severe meteorological conditions resulting in maximum evaporation and drift loss should be the worst 30-day average combination of controlling parameters (wet bulb and dry bulb temperatures).

The cooling tower design wet bulb temperature of 80°F is based on 30-year (1977-2006) worst 30-day period. This corresponds to the data taken between June 1, 1998 and June 30, 1998, with an average wet bulb temperature of 78°F (a 2°F recirculation penalty was added).

As noted in DCD Subsection 9.2.5 two cases were analyzed – 1) LOCA and, 2) Safe Shutdown with LOOP. Heat loads for these cases are provided in DCD Table 9.2.5-2. Using industry standard methodology noted in FSAR Subsection 9.2.5.2.3, evaporation and drift losses for 30 days total are computed. With two trains operating, these are as follows: LOCA – $8.20x10^6$ gallons ($2.73x10^6$ gallons/basin with three basins available), Safe Shutdown with LOOP - $8.40x10^6$ gallons ($2.80x10^6$ gallons/basin with three basins available). As noted in DCD Table 9.2.5-2, heat loads are higher for Safe Shutdown with LOOP than for LOCA over a 30-day period. Accumulative evaporation and drift losses are greater for Safe Shutdown with LOOP and are used in sizing the basin capacity. Calculated losses are based on the site-specific most limiting historical data and bound any incidental temperature.

The UHS basin is sized for the safe shutdown with LOOP case water usage. The maximum usable volume required for the safe shutdown with LOOP case is $2.80x10^6$ gallons, which is equal to the revised Technical Specification minimum required usable volume. The maximum usable volume required for LOCA is $2.73x10^6$ gallons. Also, as noted in the FSAR, each basin will nominally contain a minimum usable volume of $3.12x10^6$ gallons (taking into account sedimentation accumulation) prior to the accident. This provides adequate margin to keep the basin water equal to or below 95°F. Also, water from the non-operating basin can be transferred to operating basin(s) during short duration peak heat load transient to maintain water temperature equal to or below 95°F.

As noted in FSAR Subsection 9.2.5.5, the blowdown valves close automatically upon receiving an emergency core cooling actuation signal. Failure of the valves to close is alarmed and then the valves can be closed manually. Thus, the water inventory is not depleted due to blowdown when in an accident mode. The UHS basins are located below the grade level. A four-foot high curb wall above the grade level is provided over the entire perimeter of the basin. Water losses due to wind effects are insignificant. Four-foot thick reinforced concrete cementitious lined basin walls and floor minimize seepage losses. ESWS and UHS components are walked down in accordance with the ISI program. This keeps system leakages to a minimum.

Normal water level is maintained at 31 feet (elevation 822 feet). Low water level is alarmed at 30 feet above the basin floor. Allowing one foot for sedimentation accumulation at the basin floor, minimum of 29 feet of water will be in each basin prior to the alarm. Thus, each UHS basin contains a usable water volume of 3.12 million gallons before the operator is alerted of abnormal conditions. The maximum required 30-day useable volume without make-up for each basin is 2.80 million gallons.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 9.2-8, 9.2-9, 9.2-12, 9.2-13, 9.2-14, 9.2-15, and 9.2-23.

See attached mark-up of COLA Part 4 Technical Specifications Revision 1 pages 3.7.9-2, B 3.7.9-2, and B 3.7.9-4.

Impact on S-COLA

None.

Impact on DCD

None.

- The structures and components of the UHS are designed and constructed as safety-related structures to the requirements of seismic Category I as defined in RG 1.29 and equipment Class 3. RCOL2_09.02.05-4 RCOL2_09.02.05-1

9.2.5.2 System Description

CP COL 9.2(3) CP COL 9.2(4) CP COL 9.2(5) CP COL 9.2(18) CP COL 9.2(19)

Replace the last six paragraphs in DCD Subsection 9.2.5.2 with the following.

Mechanical draft cooling towers with basins, based on site condition and meteorological data, are used for CPNPP Units 3 and 4.

CP COL 9.2(20) CP COL 9.2(21)

A detailed description and drawing of the UHS are provided in Subsection 9.2.5.2.1, Figure 9.2.5-201, and Table 9.2.5-201.

The source of makeup water to the UHS inventory and blowdown discharge location are discussed below. Subsection 10.4.5.2.2.11 describes treatment of blowdown in order to meet wastewater discharge limits. RCOL2_09.02.05-16

9.2.5.2.1 General Description

Each unit is provided with its own independent UHS, with no sharing between the two units. The UHS for each unit consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train, and four 33 one-third percent capacity basins to satisfy the thirty day cooling water supply criteria of RG 1.27.

Each cooling tower consists of two cells with fans and motors, drift eliminators, film fills, risers, and water distribution system all enclosed and supported by a seismic category I reinforced concrete structure. Cooling tower components are designed per equipment Class 3 and quality group C requirements. Each basin includes an ESWP intake structure that contains one 50 percent capacity ESWP and one 100 percent capacity UHS transfer pump, and associated piping and components. Tornado missile protection for the cooling tower components, ESWPs and piping is provided by the UHS safety-related seismic category I structures and ESW pipe tunnel as discussed in Subsection 3.8.4. The UHS structural design, including pertinent dimensions, is also discussed in Subsection 3.8.4. RCOL2_09.02.05-1

Each cooling tower consists of two cells, each with a motor driven fan driven with a right-angle gear reducer. The fan motors are powered from the Class 1E normal ac power system. On loss of offsite power (LOOP), the motors are automatically powered from their respective division emergency power source.

The cooling towers are designed for the following conditions: water flow of 12,000 gpm, hot (inlet) water temperature of 128° F, cold (outlet) water temperature of RCOL2_09.02.05-5

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.02.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.02.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.02.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.02.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.02.05-10 RCOL2_09.02.05-11

The basins are concrete seismic category I structures and are located mostly below grade. Hence, a complete failure resulting in loss of water inventory is considered highly improbable.

Operation details of the ESWS, including chemical treatment, pump NPSH, and freeze protection operation, are provided in Subsection 9.2.1.

A portion of the basin water is discharged through the blowdown via the ESWS when the makeup water is available. The blowdown rate is determined using a conductivity cell located at ESW pump discharge and is based on the total dissolved solids in the water and the makeup water source. During design-basis accident (DBA) conditions or loss of makeup water, the blowdown is terminated.

9.2.5.2.3 System Performance

DCD Table 9.2.5-1 lists the UHS peak heat loads during accident conditions (i.e., LOCA) with two trains operation and four trains operation. Table 9.2.5-2 provides the heat loads for LOCA and safe shutdown conditions with loss of off-site power for two-train and four-train operations of the ESWS. The heat load per train during two-train operation is higher than the heat load per train during four-train operation. Therefore, the UHS is designed assuming two-train operation of the ESWS, which bounds four-train operation of the ESWS.

The UHS is designed with sufficient inventory to provide cooling for at least 30 days following an accident with no makeup water. The UHS must be capable of dissipating the design bases heat loads under the worst environmental conditions that minimize heat dissipation without exceeding the maximum ESW supply temperature of 95°F.

The wet bulb design temperature was selected to be 80°F based on 30 years (1977-2006) of climatological data obtained from National Climatic Data Center /National Oceanic & Atmospheric Administrator for Dallas/ Fort Worth International Airport Station in accordance with RG 1.27. The worst 30 day period based on the above climatological data was between June 1, 1998 and June 30, 1998, with an average wet bulb temperature of 78.0°F. A 2°F recirculation penalty~~margin~~ was added to the maximum average wet bulb temperature. ~~for conservatism.~~ RCOL2_09.02.05-5

The 83° F wet bulb temperature as shown in the FSAR Table 2.0-1R corresponds to the 0% annual exceedance value (two consecutive hourly peak temperatures on July 12, 1995, at 1500 hours and 1600 hours) in accordance with SRP 2.3.1. The 0% exceedance criterion means that the wet bulb temperature does not exceed the 0% exceedance value for more than two consecutive data occurrences, namely two consecutive hours on data recorded hourly. The 83° F wet bulb temperature is used to establish the cooling tower basin water temperature surveillance requirements.

The UHS is analyzed using the heat loads provided in Table 9.2.5-2 for LOCA and safe shutdown conditions with LOOP and a maximum ESW supply temperature of

95°F. Per Subsection 9.2.1.2, each ESWP is designed to provide 13,000gpm flow. Since cooling water flow is inversely proportional to the cooling tower temperature range, for conservatism, a lower ESW flow of 12,000 gpm to each cooling tower is used in the analysis.

The required total water usage (due to cooling tower drift and evaporation) over the postulated 30 day period is determined using industry standard methodology as follows: RCOL2_09.02.05-5

Total Evaporation (E) and Drift (D) rates were calculated using the ESW flow rate (GPM) of 12,000 gpm times the temperature rise (CR) and a conservative cooling tower factor of 0.0009, E (total) = GPM x CR x 0.0009.

a. The cooling tower factor of 0.0009 is considered conservative since it is based on standard cooling tower evaporation factor of 0.0008, and typical cooling tower drift rate of 0.0002 This is expressed as

   Total Evaporation (E) = GPM x CR x 0.0008 + GPM x 0.0002

b. The ESW temperature rise (CR) was based on heat rate equation of H as

   Heat Rate (H) = m x specific heat x CR,

   where, m = mass flow rate

c. Accumulative evaporation (gallons/cooling tower) is calculated by multiplying the evaporation rate (gpm) and its corresponding time interval.

d. The total water loss due to evaporation and drift for the 30 days period is calculated and is defined as the plant unit minimum required water capacity for the basin design in accordance with RG 1.27.

Based on the above analyses, the governing case for the maximum required 30 days cooling water capacity is two-train operation during ~~LOCA~~Safe Shutdown with LOOP condition, with a total required cooling water of approximately ~~8.54~~8.40 million gallons. The total required 30 days cooling water capacity with two-train operation during LOCA condition is approximately 8.20 million gallons. RCOL2_09.02.05-5

~~For the cooling tower design heat load the governing case is t~~The safe shutdown conditions with LOOP for two-train operation, ~~with~~requires a peak heat load of 196 million Btu/hr to be dissipated. The LOCA case with two train operation peak heat load is 158 million Btu/hr. Therefore safe shutdown with two train operation peak heat loads are used for cooling tower design.

9.2.5.3 Safety Evaluation

CP COL 9.2(22) Replace the content of DCD Subsection 9.2.5.3 with the following.

The results of the UHS capability and safety evaluation are discussed in detail in Subsection 9.2.5.2.3 and in this Subsection. The UHS is capable of rejecting the heat under limiting conditions as discussed in Subsection 9.2.5.2.3.

The failure modes and effects analysis for the UHS are included in Table 9.2.5-202 and demonstrate that the UHS satisfies the single failure criteria.

The safety-related SSCs of the UHS and the ESWS are classified as seismic Category I. The site-specific safety-related components are identified in FSAR Table 3.2-201. The non-seismic (NS) SSCs are segregated from the seismic Category I SSCs. Structural failure of the UHS non-safety related SSCs will not adversely impact the seismic category I SSCs. These non-safety SSCs are classified as non-seismic. RCOL2_09.02.05-2

The basin is designed to withstand the effect of natural phenomena, such as earthquake, tornado, hurricanes, and floods taken individually, without loss of capability to perform its safety function.

The combined volume of water in the three basins is sufficient to provide at least 30 days required cooling capacity.

The total required 30 days cooling water capacity is approximately ~~8.54~~8.40 million gallons, or approximately ~~2.85~~2.80 million gallons per cooling tower (CT) basin. This is the minimum volume required in each basin to satisfy the thirty day cooling water supply criteria of RG 1.27. Each basin dimension, not including any column or wall sections, is 120 feet x 120 feet. Normal water level is maintained at 31 feet above the basin floor. A water level decrease to 30 feet above the basin floor is alarmed. Allowing 1 foot for sedimentation accumulation at the floor, with a water depth of 29 feet, ~~from the minimum maintained water level, the~~a usable water volume ~~available for each basin is~~of approximately 3.12 million gallons is available for each basin before the operator is alerted of abnormal conditions. ~~The water depth excludes one foot of unusable space from the basin floor, where sedimentation may accumulate.~~ The CT basin volume of 2.80 million gallons does not include the water volume located in the ESWP intake basin below the CT basin. The ESWP pump intake basin water level maintains adequate pump NPSH under design basis conditions. RCOL2_09.02.05-5 RCOL2_09.02.01-1 RCOL2_09.02.05-5 RCOL2_09.02.01-1 RCOL2_09.02.01-1

During normal power operation, the UHS basin water temperature is expected to be below 93° F under the worst-case ambient condition (i.e. wet bulb temperature of 83° F based on the 0% annual exceedance value). At the initiation of the LOOP event, each basin contains approximately 3.12 million gallons of water (minimum required is 2.80 million gallons per Technical Specification 3.7.9) . The heat load peaks (196 million Btu/hr/train) four hours into the accident and then decreases continuously. The heat load is approximately 81 million Btu/hr/train at 24 hours into the accident. Cooling tower water discharge at 95° F and at a flow rate of 12,000 gpm mixing with the large quantity of basin water increases the basin water temperature (initially below 93° F). The basin water temperature increases until an equilibrium is reached. However, since the cooling tower is designed for RCOL2_09.02.05-5

95° F discharge water at a peak heat load of 196 million Btu/hr, the basin water temperature will not exceed 95° F. LOCA peak heat loads are less than the safe shutdown peak heat loads. Thus, the safe shutdown analysis bounds the LOCA case. RCOL2_09.02.05-5

During accident conditions, including LOCA and LOOP, makeup to the basin is presumed lost. During such conditions, the UHS transfer pump operates to permit the use of three of the four basin water volumes. The power supply for each transfer pump is from a different division than the ESWP and cooling tower in that basin. Therefore, loss of one electrical train does not compromise the ability to satisfy the short-term accident requirements.

A description and provision to prevent freezing of the ESWS and the UHS is provided in Subsection 9.2.1.

9.2.5.4 Inspection and Testing Requirements

CP COL 9.2(23) Replace the content of DCD Subsection 9.2.5.4 with the following.

Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, and is included in Section 6.6.

Inservice testing of pumps and valves is performed to ensure operational readiness and is included in Subsection 3.9.6.

Periodic inspections and testing of the mechanical cooling tower components, including fan, motors, and reducing gears, are performed in accordance with cooling tower manufacturer's recommendations, industry operating experience, and as a part of the monitoring required in Generic Letter 89-13 to maintain acceptable system performance. RCOL2_09.02.05-12

Periodic cooling tower fan testing in accordance with Technical Specifications provides a means of detecting and correcting motor failure or excessive vibration. RCOL2_09.02.05-14

A test program is developed to verify and monitor heat exchanger performance. Baseline performance and acceptance criteria for heat transfer capability for all heat exchangers are established. CCW heat exchangers, essential chiller cooling units and cooling towers are included in the program. Tests are performed during normal plant operation per an established schedule. Heat transfer capability at operating conditions is calculated and then prorated to accident mitigation heat transfer capability. Performance of each heat exchanger is trended to determine degradation. RCOL2_09.02.05-13

An inspection program and test procedures are developed to monitor fouling and degradation of the ESW and UHS and to maintain acceptable system performance. The inspection program includes the following:

- Inspect piping for corrosion, erosion and bio-fouling on a regular basis. RCOL2_09.02.05-12

CP COL 9.2(20)

Table 9.2.5-201

Ultimate Heat Sink System Design Data

UHS Cooling Tower and Basin	
Physical Data	
Type and Quantity	Wet, mechanical draft Four (4) – 50 percent cooling tower with basin Two (2) cells per cooling tower
Basin Size	Footprint Approx 123 feet x 123 feet (inside dimensions) Depth Approx 31 feet (at normal water level)
Usable Basin Water Volume	3.12 x 10^6 gallon per basin (at minimum maintained water level)
Fan and Motor Quantity	One (1) each per cell
Fan driver	200 rated hp
Design air flow	685,900 cfm per fan
Fan speed	154 rpm
Cooling Tower Design life	60 years
Process Parameters	
Design Cooling Water Flow Rate	13,000 (gpm per cooling tower)
Design Heat Load	1.96 x10^8 (Btu/hr per cooling tower)
Cooling Water Temperature	Hot (Inlet) 128 °F Cold (Outlet) 95 F
Design wet bulb Temperature	80 °F
Design approach	15 °F

RCOL2_09.02.05-5

UHS Transfer Pump	
Quantity	4
Type	Vertical, centrifugal
Design flow rate	800 gpm
Total Head	40 feet
Design pressure	100 psig
Design temperature	140 ° F
Materials	Stainless Steel
Equipment Class	3

Note:* Design parameters for the cooling tower are based on a typical cooling tower design.

RCOL2_09.02.05-5

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME	
~~D~~E. Required Action and associated Completion Time of Condition A, B, or C not met. OR UHS inoperable for reasons other than Condition A, B, or C.	~~D~~E.1	Be in MODE 3.	6 hours	RCOL4_16-4
	AND			
	~~D~~E.2	Be in MODE 5.	36 hours	RCOL4_16-4

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY	
SR 3.7.9.1	Verify each required UHS basin water level is ≥ ~~2,850,000~~2,800,000 gallons.	In accordance with the Surveillance Frequency Control Program	RCOL2_09.02.05-5
SR 3.7.9.2	Verify water temperature of UHS is ≤ ~~95~~93°F.	In accordance with the Surveillance Frequency Control Program	RCOL2_09.02.05-14
SR 3.7.9.3	Operate each cooling tower fan for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.4	Verify each cooling tower fan starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.5	Verify each UHS transfer pump starts on manual actuation~~operation~~.	In accordance with the ~~Inservice Testing Program~~ Surveillance Frequency Control Program	RCOL4_16-1 RCOL4_16-7

APPLICABLE SAFETY ANALYSES

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation.

The operating limits for the cooling tower and the basin water inventory for safe shutdown with LOOP ~~are based on conservative heat transfer analyses for the worst case LOCA~~. Reference 1 provides the details of the assumptions used in the analysis, which include worst expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst case single active failure (e.g., single failure of a manmade structure). The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 2), which requires a 30 day supply of cooling water in the UHS. RCOL2_09.02.05-14

The UHS satisfies Criterion 3 of 10 CFR 50.36(d)(2)(ii).

LCO

The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ESWS to operate for at least 30 days following the design basis LOCA without makeup water and provide adequate net positive suction head (NPSH) to the ESWS pumps, and without exceeding the maximum design temperature of the equipment served by the ESWS. To meet this condition, three UHS cooling towers with the UHS temperature not exceeding ~~95~~93°F during MODES 1, 2, 3 and 4 and the level in each of three basins being maintained above ~~2,850,000~~2,800,000 gallons are required. Additionally, three of the UHS transfer pumps shall be OPERABLE, with each pump capable of transferring flow from a UHS basin meeting water inventory and temperature limits, and powered from an independent Class 1E electrical division. RCOL2_09.02.05-14 RCOL2_09.02.05-5

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

In MODE 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

A.1 and A.2

If one of the required cooling towers and associated fans is inoperable (i.e., one or more fans per cooling tower inoperable), action must be taken to restore the inoperable cooling tower and associated fan(s) to OPERABLE status within 72 hours ~~days~~. In this Condition, the remaining OPERABLE cooling towers with associated fans are adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE UHS cooling towers could result in a loss of UHS function. RCOL4_16-8

BASES

ACTIONS (continued)

~~C~~D.1, ~~C~~D.2.1, and ~~C~~D.2.2 RCOL4_16-4

If one or more required UHS transfer pump(s) are inoperable, action must be taken to restore the pump(s) to OPERABLE status or implement an alternate method of transferring the affected basin within 7 days. If an alternate method is utilized, action still must be taken to restore the transfer pump(s) to OPERABLE status within 31 days.

The Completion Times are reasonable based on the low probability of an accident occurring during the time allowed to restore the pump(s) or implement an alternate method, the availability of alternate methods, and the amount of time available to transfer the water from one basin to the other under the worst case accident assumptions. Furthermore, the inoperability of all required transfer pumps leaves only two cooling tower basins with a combined design heat removal capacity of approximately 20 days. This cooling period bounds and justifies the 7-day completion time to restore the transfer pumps to operable status. RCOL4_16-3

~~D~~E.1 and ~~D~~E.2 RCOL4_16-4

If the Required Actions and Completion Times of Condition A, B, or C are not met, or the UHS is inoperable for reasons other than Condition A, B, or C, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR verifies that adequate long term (30 day) cooling can be maintained. The specified level also ensures that sufficient NPSH is available to operate the ESWS pumps. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. This SR verifies that each required UHS basin water level is ≥ ~~2,850,000~~2,800,000 gallons. Plant procedures provide the corresponding water level to be verified to assure a usable volume of 2,850,00 gallons, accounting for unusable volume and measurement uncertainty. RCOL2_09.02.05-5 RCOL4_16-2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-6

The UHS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. The capability of the UHS as described in FSAR Section 9.2.5 was reviewed by the NRC staff to assess the adequacy of the UHS for performing its heat removal functions. In order to assure a 30-day inventory of water for the UHS, transfer pumps are provided for each cooling tower basin so water can be transferred from the basin of an inoperable cooling tower to those that are operable. However, the transfer pumps share a common header for transferring the water between basins, and potential failures of the header were not addressed. Also, the transfer pumps are designed to provide 800 gallons per minute, but this was not compared with the maximum makeup rate that is needed to demonstrate that the available flow rate is adequate. The applicant is requested to address these considerations and revise the FSAR as appropriate to reflect this information.

ANSWER:

The UHS transfer pump located in each UHS ESW pump house discharges into a common header, which discharges into the individual UHS basins. All piping is designed to ASME Code Section III and Seismic Category I requirements. The ESW transfer system is included in the ISI/IST program in accordance with ASME Section XI requirements. Piping, including joints, will be inspected periodically in accordance with the ISI program. Any identified piping leakage or deterioration (e.g., identified during IST of the transfer pumps) will be repaired as required by the CPNPP corrective action program. The common discharge header and other UHS system piping are designed to seismic Category I requirements. The piping is located in seismic Category I structures. There is no non-seismic piping in the vicinity of this header, and there are no seismically induced failures. Pipes are protected from tornado missiles. As the header is normally not in service, deterioration due to flow-accelerated corrosion is insignificant. Transfer of water inventory is required assuming one train/basin of ESW is out of service and a second train is lost due to a single failure. When a transfer pump is in operation, velocity in the header is approximately 5.1 ft/sec. Operating conditions are approximately 20 psig and 95^0F. Therefore, header failures are not considered credible.

During normal operation, UHS basin water inventory is depleted primarily due to evaporation and drift losses from the cooling tower, ESW system blowdown, and minor leakage. Makeup water is provided to replenish these losses.

During a postulated loss of coolant accident (LOCA), the emergency core cooling system actuation signal closes the blowdown control valves, automatically stopping water inventory loss. The transfer of water from an assumed out-of-service basin to one of the two assumed operating basins is initiated on low level to replenish losses due to evaporation and drift. Maximum loss rate due to evaporation and drift per cooling tower is approximately 355 gpm. The total loss for two operating trains is approximately 710 gpm, which is significantly below the 800 gpm capacity of the UHS transfer pump, resulting in more than a 10% margin in flow rate. Each UHS basin water level will be at normal level at the initiation of the accident and the transfer pump from the inoperable basin will not be required to transfer the water to operable basins initially. The transfer pump is expected to be put in service after a few days into the accident when evaporation and drift losses will be significantly lower. However, for conservatism, the transfer pump is sized for maximum evaporation and drift losses plus margin.

FSAR Subsection 9.2.5.2.2 has been revised to reflect this response.

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 9.2-11.

Impact on S-COLA

None.

Impact on DCD

None.

Four 100% capacity UHS transfer pumps, one located in each UHS ESW pump house, are provided to transfer cooling water from a non-operating UHS basin to the operating UHS basins when required during accident conditions. RCOL2_09.02.05-6

All transfer pumps discharge into a common header which in turn discharges to individual UHS basins. All discharge piping is located in missile protected and tornado protected areas. The common discharge header and other UHS system piping are designed to seismic Category I requirements. The piping is located in seismic Category I structures. There is no non-seismic piping in the vicinity of this header, and there are no seismically induced failures. Pipes are protected from tornado missiles. The UHS transfer pump(s) operate during accident conditions, during IST in accordance with plant Technical Specifications, during maintenance, and for brief periods during cold weather conditions for recirculation. As the header is normally not in service, deterioration due to flow-accelerated corrosion is insignificant. Transfer of water inventory is required assuming one train/basin of ESW/UHS is out of service (e.g., for maintenance), and a second train is lost due to a single failure. When a transfer pump is in operation, fluid velocity in the header is approximately 5.1 ft/sec. Operating conditions are approximately 20 psig and 95° F. Therefore, header failures are not considered credible. RCOL2_09.02.05-4 RCOL2_09.02.05-6

The UHS transfer pump is designed to supply 800 gpm flow at a total dynamic head (TDH) of 40 feet. Transfer pump capacity is more than adequate to replenish the maximum water inventory losses from two operating ESWS trains. Minimum available net positive suction head (NPSHA) is approximately 40 feet. This is based on the lowest expected water level of approximately 12 feet in the UHS ESW intake basin and 95° F water temperature. Transfer pump location and submergence level precludes vortex formation. In addition, the transfer pump and the ESW pump from the same basin do not operate simultaneously. RCOL2_09.02.05-7

The UHS transfer pumps and the ESWPs located in each basin are powered by the different Class 1E buses, e.g., for basin A, the ESWP is powered from bus A, and the UHS transfer pump is powered from bus C or D, depending on manual breaker alignment. The power operated valve at each transfer pump discharge and instrumentation associated with each individual transfer pump are powered from the same buses as the transfer pump. The power operated valves at the transfer lines discharging into the UHS basins are powered from different buses than the transfer pumps in their respective basins. RCOL2_09.02.05-4

The cooling tower fans are automatically activated by the emergency core cooling system (ECCS) actuation signal, the LOOP sequence actuation signal, or the remote manual actuation signal in case of automatic actuation failure. RCOL4_16-6

The ECCS actuation signal ensures continuous cooling to the reactor during accidents to allow the reactor to be brought to safe shutdown condtions. The LOOP sequence actuation signal automatically starts the Class 1E gas turbine generators (GTGs) to resume power to the active components in each UHS train during LOOP events. RCOL4_16-6

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-7

The UHS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. The capability of the UHS as described in FSAR Section 9.2.5 was reviewed by the NRC staff to assess the adequacy of the UHS for performing its heat removal functions. In order to assure a 30-day inventory of water for the UHS, the water level in the cooling tower basins must be sufficient to satisfy the minimum net positive suction head (NPSH) requirements of the transfer pumps. However, the NPSH requirement for the transfer pumps is not specified and FSAR Section 9.2.5 did not describe how the UHS design will assure that the NPSH requirement for the transfer pumps is satisfied (including consideration of vortex formation) and how much excess margin is provided by the UHS design for the most limiting assumptions. Consequently, the applicant is requested to provide additional information in FSAR Section 9.2.5 to specify what the minimum NPSH requirement is for the transfer pumps and explain how this minimum NPSH requirement is satisfied by the system design when taking vortex formation into consideration, and how much excess margin is available for the most limiting case.

ANSWER:

As noted in the FSAR Subsection 9.2.5.2.2, the UHS transfer pump transfers cooling water inventory from a non-operating cooling tower basin to the operating cooling tower basins during accident conditions to assure a 30-day water inventory for the UHS. One transfer pump is located in each of the four UHS ESW pump houses. Normal water level in the UHS basins at the initiation of the accident (822 ft.) is approximately 41 feet above the transfer pump impeller eye (781 ft).

Transfer of water inventory is required assuming one train/basin of ESWS/UHS is out of service and a second train is lost due to a single active failure. The combined inventory of three basins is available to support 30 days of operation following a design basis accident, and provide adequate NPSH. Each transfer pump is started remote manually by an operator and stopped manually after normal UHS basin water level is reached. Water level in the UHS ESW pump house sump will be approximately 12 feet when the available inventory of this UHS basin is transferred. The pump location and the submergence preclude vortex formation. The transfer pump is located away from the sump walls and the ESW pump. When the transfer pump operation is initiated, the pump is submerged approximately 41 feet and 12 feet when the pump stops. There is no other disturbance in the sump. This precludes vortex formation.

Also, since water is only transferred from the non-operating UHS basin, the ESW pump in that basin will not be operating and thus the transfer pump and the ESW pump do not operate simultaneously.

The UHS transfer pump available NPSH at the lowest water level in the UHS ESW pump house sump is approximately 40 ft. The procurement of the transfer pumps will require that the pump required NPSH be less than 40 ft with adequate margin. The calculation and a figure representing the available NPSH was provided in the response to RAI No. 3698 (CP RAI #109) Question 09.02.01-01 attached with Luminant letter TXNB-09071 dated November 20, 2009 (ML093280698).

FSAR Subsection 9.2.5.2.2 has been revised to reflect this response.

Impact on R-COLA

See attached marked-up FSAR Revision 1 page 9.2-11.

Impact on S-COLA

None.

Impact on DCD

None.

Four 100% capacity UHS transfer pumps, one located in each UHS ESW pump house, are provided to transfer cooling water from a non-operating UHS basin to the operating UHS basins when required during accident conditions. RCOL2_09.02.05-6

All transfer pumps discharge into a common header which in turn discharges to individual UHS basins. All discharge piping is located in missile protected and tornado protected areas. The common discharge header and other UHS system piping are designed to seismic Category I requirements. The piping is located in seismic Category I structures. There is no non-seismic piping in the vicinity of this header, and there are no seismically induced failures. Pipes are protected from tornado missiles. The UHS transfer pump(s) operate during accident conditions, during IST in accordance with plant Technical Specifications, during maintenance, and for brief periods during cold weather conditions for recirculation. As the header is normally not in service, deterioration due to flow-accelerated corrosion is insignificant. Transfer of water inventory is required assuming one train/basin of ESW/UHS is out of service (e.g., for maintenance), and a second train is lost due to a single failure. When a transfer pump is in operation, fluid velocity in the header is approximately 5.1 ft/sec. Operating conditions are approximately 20 psig and 95° F. Therefore, header failures are not considered credible. RCOL2_09.02.05-4 RCOL2_09.02.05-6

The UHS transfer pump is designed to supply 800 gpm flow at a total dynamic head (TDH) of 40 feet. Transfer pump capacity is more than adequate to replenish the maximum water inventory losses from two operating ESWS trains. Minimum available net positive suction head (NPSHA) is approximately 40 feet. This is based on the lowest expected water level of approximately 12 feet in the UHS ESW intake basin and 95° F water temperature. Transfer pump location and submergence level precludes vortex formation. In addition, the transfer pump and the ESW pump from the same basin do not operate simultaneously. RCOL2_09.02.05-7

The UHS transfer pumps and the ESWPs located in each basin are powered by the different Class 1E buses, e.g., for basin A, the ESWP is powered from bus A, and the UHS transfer pump is powered from bus C or D, depending on manual breaker alignment. The power operated valve at each transfer pump discharge and instrumentation associated with each individual transfer pump are powered from the same buses as the transfer pump. The power operated valves at the transfer lines discharging into the UHS basins are powered from different buses than the transfer pumps in their respective basins. RCOL2_09.02.05-4

The cooling tower fans are automatically activated by the emergency core cooling system (ECCS) actuation signal, the LOOP sequence actuation signal, or the remote manual actuation signal in case of automatic actuation failure. RCOL4_16-6

The ECCS actuation signal ensures continuous cooling to the reactor during accidents to allow the reactor to be brought to safe shutdown condtions. The LOOP sequence actuation signal automatically starts the Class 1E gas turbine generators (GTGs) to resume power to the active components in each UHS train during LOOP events. RCOL4_16-6

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-8

The UHS must be capable of removing heat from structures, systems and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. The capability of the UHS as described in FSAR Section 9.2.5 was reviewed by the NRC staff to assess the adequacy of the UHS for performing its heat removal functions. The NRC staff found that FSAR Section 9.2.5 does not address low temperature operation of the UHS, including (for example) the effects of freezing temperatures and ice formation on the cooling tower spray nozzles, fill material (especially for cooling towers that are in standby), basins (including membrane), and ESWS operation. Cooling tower designs typically include a bypass flow path for maintaining the basin water temperature above freezing and to support low temperature operation of the ESWS. However, the NRC staff noted that this capability is not provided for the Comanche Peak cooling towers. Consequently, the applicant is requested to revise FSAR Section 9.2.5 to describe low temperature operation and the effects of ice formation on the UHS.

ANSWER:

FSAR Subsections 9.2.5.2.2 and 9.2.5.3 refer to FSAR Subsection 9.2.1 for freeze protection for the UHS and ESWS. FSAR Subsection 9.2.1.3 states:

> The lowest ambient temperature anticipated at the site will not result in the freezing of the ESW in the basin or the piping for the following reasons:
>
> - The basins are located below grade and thus ground temperature maintains water from freezing.
> - In the operating trains, water is continuously circulated which helps to prevent freezing. Ultimate heat sink (UHS) transfer pumps can be used to circulate water from the idle basins.
> - ESWP house ventilation system maintains predetermined minimum temperature in the pump house areas. This is further described in Subsection 9.4.
> - Any exposed essential piping that may be filled with water while the pump is not operating is heat traced.

Since FSAR Subsection 9.2.1.3 provides sufficient description of low temperature operation and the effects of ice formation on the UHS, FSAR Subsection 9.2.5 does not require a revision.

Impact on R-COLA

None.

Impact on S-COLA

None.

Impact on DCD

None.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-9

The UHS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. Since the cooling tower spray nozzles are located at an elevation that is well above the cooling tower basin water level, there is a potential for the risers in standby loops to drain and create a large void in the supply piping to the cooling tower spray headers. If this occurs, an automatic actuation of the standby UHS trains could result in a waterhammer. Any loop seals in the spray headers and the supply piping that are caused by component design or piping configuration would tend to result in a much more severe waterhammer event. The UHS description does not adequately consider and address waterhammer vulnerabilities (such as this) in FSAR Section 9.2.5 and (to the extent that waterhammer is a valid consideration) does not explain how system design features, operating procedures, and periodic surveillance testing provide adequate assurance that the UHS safety functions will not be compromised by waterhammer events. Consequently, the applicant is requested to provide additional information to address waterhammer vulnerabilities that apply to the UHS and revise the FSAR needs as appropriate to reflect this information. Also, if system valves are relied upon to prevent excessive back-leakage, the UHS description in the FSAR needs to fully explain and justify the maximum amount of back-leakage that is allowed, and specify the leakage acceptance criteria that will be established in the in-service testing program for these valves and the basis for this determination.

ANSWER:

The ESWS and the UHS layout, the ESW pump design, and operating procedures minimize water hammer vulnerabilities. The ESW pump house floor elevation is 828 feet, approximately 6 feet above grade elevation. ESW discharge pipe(s) from the pump house drops into the ESW pipe tunnel (ESWPT) and runs to the Reactor Building. The pipe tunnel is located at an elevation below grade. The CCW heat exchanger(s) and the essential chiller unit(s) are located at an elevation below grade in the Reactor Building. Discharge pipes from these components pass through the ESWPT and then to the cooling towers. The discharge pipes are connected to the cooling tower risers and distribution piping (spray nozzles). There are no loop seals in the layout. Vents are provided at all high points in the piping. The ESW pump is designed to provide positive pressure at the highest point (spray nozzles supply header) in the system. This together with the maximum operating temperature assures water remains above saturation conditions at all locations in the system. The motor-operated pump discharge valve located in the pump house remains closed in the standby train. A check valve is also located in the pump discharge line. The layout assures that most of the idle ESW train remains water solid. Portions of the discharge pipe in the pump house and the riser and spray nozzle distribution pipe at the cooling tower from the standby train may encounter voids. The MOV and the check valve in the discharge piping prevent back-leakage to the basin. All other system valves in the train are locked open. Excessive back leakage prevention is not relied upon to prevent system drain down. No back-leakage criteria are required for any valves in this system. The system valve lineup and periodic inservice testing of the idle train, including high point vents, help minimize voiding in the system piping.

On loss of off site power (LOOP), the discharge MOV of the operating train is closed by DC power. Tripping the pump will not drain the ESW piping. The ESW pump start logic interlocks the discharge MOV operation with the pump operation. The re-start of the tripped pump or start of the standby pump opens the discharge valve slowly after a pre-determined time delay, sweeping out voids from the discharge piping and cooling tower riser and distribution piping. This minimizes the impact of potential water hammer forces.

Per COL 9.2(25), operating and maintenance procedures are developed addressing ESWS and UHS water hammer issues in accordance with NUREG-0927. Also per COL 9.2(27), a milestone schedule is developed to implement these procedures for water hammer prevention. COLA Revision 1 FSAR Subsection 9.2.1.2.1 requires adherence to filling and venting procedures to minimize the occurrence of water hammer. These procedures are included in the Operating and Maintenance procedures described in general in FSAR Subsection 13.5.2.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 page 9.2-10.

Impact on S-COLA

None.

Impact on DCD

None.

9.2.5.2.2 System Operation

The ESWPs take suction from the basin as described in Subsection 9.2.1. The water flows through the CCW heat exchangers and essential chiller units and then is cooled by the cooling tower before being returned to the basin.

Heat rejection to the environment is effected by direct contact with the cooling tower forced airflow, which provides evaporative cooling of the ESW return flow. During normal operation, evaporation, drift and blowdown losses are replaced with the makeup from Lake Granbury. Water level controllers provided in each basin automatically open and close the makeup control valves. Low and high water level annunciation in the main control room (MCR) indicates a malfunction of the makeup control valve or the blowdown control valve.

Adequate NPSH is maintained under all operating modes, including loss-of-coolant accident (LOCA) and LOOP, with one train out of service for maintenance, when the source of makeup water is assumed lost for a period of thirty days after the accident. During such conditions, the combined inventory of three basins provides a thirty-day cooling water supply assuming the worst combination of meteorological conditions and accident heat loads.

The ESWS together with the UHS are designed, arranged and operated to minimize the effects of water hammer forces. RCOL2_09.02.05-9

The ESW discharge pipe from the pump house passes to the pipe tunnel located at an elevation below grade. The ESWS flows to the CCW heat exchanger and the essential chiller unit located at an elevation below grade in the Reactor Building. The discharge pipe is connected to the cooling tower riser and spray nozzles located above grade. The ESW pump is designed to provide positive pressure at the spray nozzle headers. This together with the high point vents minimize system drain down in the idle trains or upon loss of offsite power and subsequent pump trip.

The following features preclude or minimize water hammer forces:

- On loss of off-site power (LOOP), the discharge MOV of the operating train is closed by DC power. This, together with the discharge check valve, prevents draindown to the basin.
- The ESW pump start logic interlocks the discharge MOV operation with the pump operation. The re-start of the tripped pump or start of the stand-by pump, opens the discharge valve slowly after a pre-determined time delay, sweeping out voids from the discharge piping and CT riser and distribution piping.
- The system valve lineup and periodic inservice testing of the idle trains, including testing of the high point vents, help minimize potential voids and water hammer forces.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-10

The UHS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. Over time, debris such as spalled concrete, spray nozzles, and objects that are introduced by the makeup water source have accumulated in the cooling tower water basins at some operating nuclear power plants. These objects can be drawn into the suctions of pumps that are in the cooling tower basin and pose a hazard for pump operation. Typically, screens are provided to protect pump suctions from this sort of hazard. The NRC staff noted that there is no discussion in FSAR Section 9.2.5 to explain how the transfer pump suctions are protected from the intrusion of debris and how much distance from the bottom of the pump well is needed to allow for silt accumulation such that pump performance is not impacted. Therefore, the applicant is requested to provide additional information in FSAR Section 9.2.5 as appropriate to address this consideration.

ANSWER:

As noted in FSAR Subsection 9.2.5.2.1, Subsection 10.4.5 describes makeup water to the UHS.

The makeup water intake structure is located on Lake Granbury and is designed to meet the requirements of the Clean Water Act, Section 316(b). The submersed intakes are fitted with fine-mesh passive screens designed for a low velocity of 0.5 fps, minimizing debris entry in the makeup water intake structure. The long makeup water pipe run from the intake structure to the plant (greater than 10 miles) also reduces debris carry over to the plant. Thus, the amount of debris entering the UHS basin via makeup water is expected to be insignificant.

The UHS ESW pump ESW intake basin floor is located at a lower elevation (779 feet) as compared to the UHS basin floor (791 feet). Basin layout assures that most of the debris accumulates on the UHS basin floor. An insignificant quantity of debris is expected to accumulate on the UHS ESW pump intake basin floor. As shown in FSAR Figure 3.8-208, a vaned basket provided at the transfer pump inlet prevents large pieces of debris from entering the pump suction which could affect the pump operation. The pump impeller is located approximately two feet above the UHS ESW pump intake basin floor.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 page 9.2-9.

Impact on S-COLA

None.

Impact on DCD

None.

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.0 2.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.0 2.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.0 2.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.0 2.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.0 2.05-10 RCOL2_09.0 2.05-11

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-11

The UHS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with the requirements of GDC 44. FSAR Section 9.2.5 indicates that the makeup water source for the cooling tower basins is Lake Granbury. Lake water can cause silt accumulation and the introduction of fish, clams, algae, grass, and other aquatic organisms and biofouling agents. These things can degrade the operation of ESWS pumps, heat exchangers, and UHS transfer pumps; cause clogging of spray nozzles and fill material; and ultimately degrade the capability of the ESWS and UHS to remove heat. While chemical treatment can address corrosion and biofouling issues to some extent, it does not address all of the problems that can occur. Therefore, the applicant is requested to provide additional information in FSAR Section 9.2.5 to address these considerations.

ANSWER:

See the response to Question 09.02.05-10 above. As noted in FSAR Subsection 10.4.5, the makeup water intake structure is located on Lake Granbury and is designed to meet the requirements of the Clean Water Act, Section 316(b). The submersed intakes are fitted with fine-mesh passive screens that exclude fish and other aquatic life from impingement and direct entrainment through the pumps. As stated in revised FSAR Subsection 9.2.5.2.1, the long makeup water pipe run from the lake to the plant will help diminish carryover of algae, grass, and other aquatic organisms and biofouling agents.

As noted in response to Question 09.02.05-12 below and described in revised FSAR Subsection 9.2.5.2.1, a chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin to limit biological film formation. Chemicals, such as biocide, algaecide, pH adjuster, corrosion inhibitor, and silt dispersant are injected into the UHS basin to maintain non-scale forming conditions and to limit biological growth. Chemical injection is also provided for in the makeup water system.

Strainers located in the ESW pump discharge and CCW heat exchanger (bulk of the water flow path) provide additional protection against the potential for debris carry over to degrade heat exchangers or clog spray nozzles. These strainers are described in DCD Subsection 9.2.1.2.2.2.

Inservice testing of ESW pumps and transfer pumps monitors pump degradation. The maintenance program addresses pump degradation and assures pump operability. The performance of CCW heat exchangers, cooling towers and essential chiller units are monitored per GL 89-13 requirements. Corrective actions will be taken to address any degradation. Accumulated debris will be removed from the basin floor per the maintenance program. FSAR Subsection 9.2.5.4 has been revised to address GL 89-13 requirements in response to Questions 09.02.05-12 and 09.02.05-13 below.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 page 9.2-9.

Impact on S-COLA

None.

Impact on DCD

None.

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.02.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.02.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.02.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.02.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.02.05-10 RCOL2_09.02.05-11

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-12

The UHS must be designed so that periodic inspections of piping and components can be performed to assure that the integrity and capability of the system will be maintained over time in accordance with the requirements of GDC 45. The NRC staff finds the design to be acceptable, if the FSAR describes inspection program requirements that will be implemented are considered to be adequate for this purpose. FSAR Section 9.2.5.4 indicates that periodic inspection of mechanical cooling tower components, including fans, motors, and reducing gears will be performed in accordance with manufacturer's recommendations and is part of the monitoring that is required in Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment." The NRC staff considers the information that was provided to be incomplete in that it does not specify programmatic requirements and procedural controls that will be implemented for performing inspections; it does not describe the extent and nature of inspections that will be conducted; it does not include all of the UHS-related structures and components, such as the tower structure, basin (general condition and silt buildup), ESWS tunnel (general area inspections), fill material, and spray nozzles; industry experience was not considered and addressed; and specific provisions of GL 89-13 are not described. Therefore, the applicant is requested to provide additional information in FSAR Section 9.2.5 to address these considerations.

ANSWER:

FSAR Subsection 9.2.5.2.1 has been revised to include a description of the chemical injection system.

FSAR Subsection 9.2.5.4 has been revised to include details of the GL 89-13 program.

<u>Impact on R-COLA</u>

See attached mark-up of FSAR Revision 1 pages 9.2-9, 9.2-15, and 9.2-16.

<u>Impact on S-COLA</u>

None.

Impact on DCD

None.

95° F, ambient wet bulb temperature of 80° F, and DBA design heat load of 196.00x106 Btu/hr. RCOL2_09.0 2.05-5

As noted in DCD Subsection 5.4.7.1, "Design Bases," and DCD Subsection 5.4.7.3, "Performance Evaluation," with ESW water temperature of 95° F, the RHRS is capable of reducing the reactor coolant temperature from 350° F to 200° F within 36 hours after shutdown. As the Technical Specifications surveillance ensures that the UHS basin water temperature to be 93° F or less, the evaluation provided in DCD Section 5.4.7 is bounding.

Inside dimensions of each basin are approximately 123 feet x 123 feet and 31 feet deep at normal water level. The cooling towers utilize the basins for structural foundation.

The ESW intake basin located underneath the ESW pump house occupies the southwest corner of the UHS basin. The ESW intake basin is 12 feet deeper than the UHS basin. Water volume occupying this 12 feet depth in the ESW intake basin is not included in the UHS basin inventory. The UHS basin floor elevation (791 feet) is the reference point for measuring the basin water level. RCOL2_09.0 2.05-1

The UHS operates in conjunction with the ESWS. The ESWS is described in Subsection 9.2.1. P&IDs of the UHS are provided in Figure 9.2.5-201. The UHS design and process parameters are provided in Table 9.2.5-201. The normal makeup water to the UHS inventory is from Lake Granbury via the circulating water system descried in Subsection 10.4.5. A control valve with instrumentation located in each makeup line maintains basin water level during normal operation. The blowdown water is discharged to Lake Granbury via the circulating water system.

The normal maintained water level in the UHS basin is elevation 822 feet. Grade elevation in the vicinity of the basin is 822 feet. A four feet thick basin wall extends four feet above grade level to elevation 826 feet providing a curb around the basin. The basin is not expected to overflow. In the unlikely event of water level reaching the top of the curb wall, it will spill over and flow to site drainage. No special design for the spillway or drain pipe is deemed necessary. RCOL2_09.0 2.05-4

A chemical injection system is designed to provide non-corrosive, non-scale forming conditions in the UHS basin and ESWS piping to limit biological film formation. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor and silt dispersant is determined by the Lake Granbury water quality. RCOL2_09.0 2.05-12

The mechanical draft cooling towers are the UHS. Hence, no discharge structure is necessary.

The makeup water intake structure design and location at Lake Granbury minimize debris, algae, grass into the makeup water and prevent the impingement and entrainment of fish and other aquatic life. The long makeup water pipe run diminishes the carryover of debris and other fouling agents to the UHS basin. RCOL2_09.0 2.05-10 RCOL2_09.0 2.05-11

95° F discharge water at a peak heat load of 196 million Btu/hr, the basin water temperature will not exceed 95° F. LOCA peak heat loads are less than the safe shutdown peak heat loads. Thus, the safe shutdown analysis bounds the LOCA case. RCOL2_09.02.05-5

During accident conditions, including LOCA and LOOP, makeup to the basin is presumed lost. During such conditions, the UHS transfer pump operates to permit the use of three of the four basin water volumes. The power supply for each transfer pump is from a different division than the ESWP and cooling tower in that basin. Therefore, loss of one electrical train does not compromise the ability to satisfy the short-term accident requirements.

A description and provision to prevent freezing of the ESWS and the UHS is provided in Subsection 9.2.1.

9.2.5.4 Inspection and Testing Requirements

CP COL 9.2(23) Replace the content of DCD Subsection 9.2.5.4 with the following.

Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, and is included in Section 6.6.

Inservice testing of pumps and valves is performed to ensure operational readiness and is included in Subsection 3.9.6.

Periodic inspections and testing of the mechanical cooling tower components, including fan, motors, and reducing gears, are performed in accordance with cooling tower manufacturer's recommendations, industry operating experience, and as a part of the monitoring required in Generic Letter 89-13 to maintain acceptable system performance. RCOL2_09.02.05-12

Periodic cooling tower fan testing in accordance with Technical Specifications provides a means of detecting and correcting motor failure or excessive vibration. RCOL2_09.02.05-14

A test program is developed to verify and monitor heat exchanger performance. Baseline performance and acceptance criteria for heat transfer capability for all heat exchangers are established. CCW heat exchangers, essential chiller cooling units and cooling towers are included in the program. Tests are performed during normal plant operation per an established schedule. Heat transfer capability at operating conditions is calculated and then prorated to accident mitigation heat transfer capability. Performance of each heat exchanger is trended to determine degradation. RCOL2_09.02.05-13

An inspection program and test procedures are developed to monitor fouling and degradation of the ESW and UHS and to maintain acceptable system performance. The inspection program includes the following:

- Inspect piping for corrosion, erosion and bio-fouling on a regular basis. RCOL2_09.02.05-12

- Perform visual inspection of ESWS and UHS piping for leakage. RCOL2_09.02.05-12

- Perform visual inspection of the ESW intake basin and the UHS basin for microscopic biological fouling organism, sedimentation and corrosion once every refueling cycle.

- Analyze water samples on a regular basis.

A preventive maintenance program is developed to remove excessive bio-fouling agents, corrosion products, silt etc. This program will address visual as well as hands-on inspection of fill material and supports, drift eliminators, panels, riser piping, spray nozzles, fans, motors and associated components.

Two ESWS and UHS trains are operating during normal plant operations. Operation of the standby trains is alternated per operating procedures. Thus, the performance of all trains is monitored. RCOL2_09.02.05-13

The system operation, established inspection, testing and maintenance program assure the integrity and capability of the system over time in accordance with the requirements of GDC 45.

Continuous system operation at pressures and flows near accident conditions, periodic heat exchanger performance tests, surveillance tests and monitoring of various parameters assure that the ESWS and UHS perform their safety functions in accordance with the requirements of GDC 46.

The inspection and testing provisions described above are subject to programmatic requirements and procedural controls as described in FSAR Section 13.5. RCOL2_09.02.05-12 RCOL2_09.02.05-13

Manholes, handholes, inspection ports, ladder, and platforms are provided, as required, for periodic inspection of system components.

9.2.5.5 Instrumentation Requirements

CP COL 9.2(24) Replace the sentence in DCD Subsection 9.2.5.5 with the following.

Water level in each of the basins is controlled by level instrumentation that opens or closes the automatic valves in the makeup lines.

Two level transmitters and associated signal processors are provided for each basin to indicate water level in the basin and annunciate in the MCR for both the high and low water levels in the basin.

A water level signal at six inches below the normal water level causes the makeup water control valve to open. A signal at normal water level then causes the makeup control valve to close. A low level alarm annunciates in the MCR whenever the water level falls one foot below the normal water level.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-13

The UHS must be designed so that periodic pressure and functional testing of components can be performed to assure the structural and leak tight integrity of system components, the operability and performance of active components, and the operability of the system as a whole and performance of the full operational sequences that are necessary for accomplishing the UHS safety functions in accordance with the requirements of GDC 46. The NRC staff finds the design to be acceptable, if the FSAR describes pressure and functional test program requirements that will be implemented and are considered to be adequate for this purpose. FSAR Section 9.2.5.4 indicates that periodic testing of mechanical cooling tower components, including fans, motors, and reducing gears will be performed in accordance with manufacturer's recommendations and is part of the monitoring that is required in Generic Letter 89-13. The NRC staff considers the information that was provided to be incomplete in that it does not specify programmatic requirements and procedural controls that will be implemented for performing tests, it does not describe the extent and nature of tests that will be performed; it does not include all of the UHS-related components, such as spray nozzles, transfer pumps and headers; industry experience was not considered and addressed; periodic functional testing of the cooling tower is not specified to confirm adequate performance; and specific provisions of GL 89-13 are not described. Therefore, the applicant is requested to provide additional information in FSAR Section 9.2.5 to address these considerations.

ANSWER:

The ESWS and UHS operate continuously during normal plant operation and shutdown. The pressure and flow conditions during normal operation approximate accident conditions. The operating trains are alternated during normal plant operation per established operating procedure. These operations demonstrate the operability, performance, structural and leak-tight integrity of the system and components.

ESW pumps, UHS transfer pumps and all active valves in the system are included in the IST program and are tested per ASME OM Code requirements. The system is periodically functional, pressure and leak tested per ASME OM Code requirements. Specific UHS pump and valve IST requirements are listed in FSAR Tables 3.9-202 and 3.9-203, respectively.

Per surveillance requirements: 1) ESWS pumps are automatically started on simulated or actual signals; 2) Valves are operated with actuation signals; 3) UHS basin water level and temperature are verified; 4) CT fans are automatically started with actuation signals; and 5) transfer pump operation is verified.

FSAR Subsection 9.2.5.4 has been revised to describe a test program to verify and monitor heat exchanger performance.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 pages 9.2-15 and 9.2-16.

Impact on S-COLA

None.

Impact on DCD

None.

95° F discharge water at a peak heat load of 196 million Btu/hr, the basin water temperature will not exceed 95° F. LOCA peak heat loads are less than the safe shutdown peak heat loads. Thus, the safe shutdown analysis bounds the LOCA case. RCOL2_09.02.05-5

During accident conditions, including LOCA and LOOP, makeup to the basin is presumed lost. During such conditions, the UHS transfer pump operates to permit the use of three of the four basin water volumes. The power supply for each transfer pump is from a different division than the ESWP and cooling tower in that basin. Therefore, loss of one electrical train does not compromise the ability to satisfy the short-term accident requirements.

A description and provision to prevent freezing of the ESWS and the UHS is provided in Subsection 9.2.1.

9.2.5.4 Inspection and Testing Requirements

CP COL 9.2(23) Replace the content of DCD Subsection 9.2.5.4 with the following.

Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, and is included in Section 6.6.

Inservice testing of pumps and valves is performed to ensure operational readiness and is included in Subsection 3.9.6.

Periodic inspections and testing of the mechanical cooling tower components, including fan, motors, and reducing gears, are performed in accordance with cooling tower manufacturer's recommendations, industry operating experience, and as a part of the monitoring required in Generic Letter 89-13 to maintain acceptable system performance. RCOL2_09.02.05-12

Periodic cooling tower fan testing in accordance with Technical Specifications provides a means of detecting and correcting motor failure or excessive vibration. RCOL2_09.02.05-14

A test program is developed to verify and monitor heat exchanger performance. Baseline performance and acceptance criteria for heat transfer capability for all heat exchangers are established. CCW heat exchangers, essential chiller cooling units and cooling towers are included in the program. Tests are performed during normal plant operation per an established schedule. Heat transfer capability at operating conditions is calculated and then prorated to accident mitigation heat transfer capability. Performance of each heat exchanger is trended to determine degradation. RCOL2_09.02.05-13

An inspection program and test procedures are developed to monitor fouling and degradation of the ESW and UHS and to maintain acceptable system performance. The inspection program includes the following:

- Inspect piping for corrosion, erosion and bio-fouling on a regular basis. RCOL2_09.02.05-12

- Perform visual inspection of ESWS and UHS piping for leakage. RCOL2_09.02.05-12
- Perform visual inspection of the ESW intake basin and the UHS basin for microscopic biological fouling organism, sedimentation and corrosion once every refueling cycle.
- Analyze water samples on a regular basis.

A preventive maintenance program is developed to remove excessive bio-fouling agents, corrosion products, silt etc. This program will address visual as well as hands-on inspection of fill material and supports, drift eliminators, panels, riser piping, spray nozzles, fans, motors and associated components.

Two ESWS and UHS trains are operating during normal plant operations. Operation of the standby trains is alternated per operating procedures. Thus, the performance of all trains is monitored. RCOL2_09.02.05-13

The system operation, established inspection, testing and maintenance program assure the integrity and capability of the system over time in accordance with the requirements of GDC 45.

Continuous system operation at pressures and flows near accident conditions, periodic heat exchanger performance tests, surveillance tests and monitoring of various parameters assure that the ESWS and UHS perform their safety functions in accordance with the requirements of GDC 46.

The inspection and testing provisions described above are subject to programmatic requirements and procedural controls as described in FSAR Section 13.5. RCOL2_09.02.05-12 RCOL2_09.02.05-13

Manholes, handholes, inspection ports, ladder, and platforms are provided, as required, for periodic inspection of system components.

9.2.5.5 Instrumentation Requirements

CP COL 9.2(24) Replace the sentence in DCD Subsection 9.2.5.5 with the following.

Water level in each of the basins is controlled by level instrumentation that opens or closes the automatic valves in the makeup lines.

Two level transmitters and associated signal processors are provided for each basin to indicate water level in the basin and annunciate in the MCR for both the high and low water levels in the basin.

A water level signal at six inches below the normal water level causes the makeup water control valve to open. A signal at normal water level then causes the makeup control valve to close. A low level alarm annunciates in the MCR whenever the water level falls one foot below the normal water level.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-14

Technical Specification (TS) 3.7.9, "Ultimate Heat Sink (UHS)," provides limiting conditions for operation (LCO) and surveillance requirements (SR) for the UHS. The NRC staff reviewed UHS design and operational requirements that are specified to confirm that they are adequately reflected in the proposed TS requirements and to assure that the TS Bases are reflective of the TS requirements that are proposed and the UHS description that is provided in FSAR Section 9.2.5. Based on a review of the proposed TS requirements, the NRC staff requests the applicant address the following items and revise TS 3.7.9 as appropriate:

- Proposed SR 3.7.9.1 requires operators to verify that the required UHS basin water level is ≥ 2,850,000 gallons. While this may be the minimum amount of water that is required, the requirement should be expressed in terms that the operators can verify, such as a level in the cooling tower basin.

- Proposed SR 3.7.9.2 requires operators to verify that water temperature of the UHS is ≤ 95 °F. Because the maximum allowed temperature for the ESWS is 95 °F, analyses would have to demonstrate that this temperature will not be exceeded during the most limiting safe shutdown transient conditions. If the water temperature is already at 95 °F at the start of the safe shutdown transient, it is doubtful that the temperature can be maintained below this value unless the normal operating heat loads exceed the limiting heat loads that exist for the safe shutdown transient. Usually, the maximum allowed temperature in the basin must be limited to something less than the maximum allowed ESWS temperature to accommodate the limiting safe shutdown heat loads without exceeding the ESWS temperature limit.

- Proposed SR 3.7.9.3 requires operators to operate each cooling tower fan for ≥ 15 minutes, but no requirement is specified to monitor vibration as discussed in FSAR Section 9.2.5.

- There is no SR to verify that the blowdown valves isolate on an actual or simulated actuation signal.

- Page B 3.7.9-2, under "Applicable Safety Analyses" and "LCO," the bases indicate that the operating limits are based on the worst case LOCA. Contrary to this, FSAR Section 9.2.5

indicates that the limiting heat load is based on the safe shutdown transient while the limiting inventory is based on the worst case LOCA.

ANSWER:

- As described in Luminant's response to RAI No. 3113 (CP RAI # 90) Question 16-2, sent by Luminant letter TXNB-09064 dated November 11, 2009 (ML093200501):

  > [Technical Specification Surveillance Requirement] SR 3.7.9.1 requires verification of a minimum usable volume of 2.85 million gallons in each UHS basin. Plant procedures require the water level to be verified corresponding to the surveillance water volume of 2.85 million gallons. This includes trending of sedimentation and instrument uncertainties. Technical Specifications Bases Subsection 3.7.9 has been revised to clarify water level requirements to ensure adequate NPSH and usable volume of 2.85 million gallons per UHS basin.

  Marked-up Technical Specifications Draft Revision 1 pages B 3.7.9-1, B 3.7.9-3 and B 3.7.9-4 from that response are attached.

- As noted in response to Question 09.02.05-5 above, heat loads during safe shutdown with LOOP conditions are significantly higher than the normal operating heat loads. During normal power operation, the UHS basin water temperature is expected to be below 93°F under the worst-case ambient condition. Technical Specification SR 3.7.9.2 has been revised to verify that water temperature of the UHS is ≤ 93°F.

- Vibration monitoring sensors are provided with each cooling tower fans. The Bases for SR 3.7.9.3 describe parameters observed or monitored during this surveillance test. Fans will be observed for excessive vibration and corrective action will be taken as required to ensure operability of the cooling tower fans or motors. FSAR Subsection 9.2.5.4 has been revised to describe the periodic fan surveillance test as a means of detecting and correcting motor failure or excessive vibration.

- The response to RAI No. 3113 (CP RAI # 90) Question 16-5 includes the addition of TS SR 3.7.9.7 as follows:

  > Verify each UHS automatic valve and each control valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.

  Marked-up Technical Specifications Draft Revision 1 pages 3.7.9-3 and B 3.7.9-6 from that response are attached.

- As noted in the response to Question 09.02.05-5 above, the cooling tower design is based on peak heat loads during safe shutdown with LOOP. Total accumulative heat loads for 30 days are higher for the safe shutdown with LOOP conditions than the LOCA conditions. Therefore, UHS basin water inventory is based on the safe shutdown with LOOP heat loads. "Applicable Safety Analysis" and "LCO" in TS Bases Subsection 3.7.9 have been revised to clarify the design basis.

<u>Impact on R-COLA</u>

See attached mark-up of FSAR Revision 1, page 9.2-15.

See attached mark-up of COLA Part 4 Technical Specifications Revision 1 pages 3.7.9-2, B 3.7.9-2, and B 3.7.9-5

<u>Impact on S-COLA</u>

None.

<u>Impact on DCD</u>

None.

<u>Attachments</u>

Marked-up Technical Specifications Draft Revision 1, pages 3.7.9-3, B 3.7.9-1, B 3.7.9-3, B 3.7.9-4 and B 3.7.9-6 from the response to RAI No. 3113 (CP RAI # 90) (ML093200501).

SURVEILLANCE REQUIREMENTS

SR 3.7.9.6	Verify each UHS manual, power-operated, and automatic valve in the flow path servicing safety related equipment, that is not locked, sealed or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program	RCOL4_16-5
SR 3.7.9.7	Verify each UHS automatic valve and each control valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	RCOL4_16-5

B 3.7 PLANT SYSTEMS

B 3.7.9 Ultimate Heat Sink (UHS)

BASES

BACKGROUND

The UHS provides a heat sink for processing and operating heat from safety related components during a transient or accident, as well as during normal operation. This is done by utilizing the Essential Service Water System (ESWS) and the Component Cooling Water (CCW) System.

The UHS consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train. Each cooling tower consists of two cells with one fan per cell. The combined inventory of three of the four UHS basins provides a 30-day storage capacity as discussed in FSAR Chapter 9 (Ref. 1). Each unit is provided with its own independent UHS with no cross connection between the two units. The two principal functions of the UHS are the dissipation of residual heat after reactor shutdown, and dissipation of residual heat after an accident.

The basic performance requirements are that an adequate inventory of cooling water be available for 30 days without makeup, and that the design basis temperatures of safety related equipment not be exceeded. Each UHS basin provides 33-1/3 percent of the combined inventory for the 30-day storage capacity to satisfy the short-term recommendation of Regulatory Guide 1.27 (Ref. 2). There is one safety-related UHS transfer pump per UHS basin which is used to transfer water between the UHS basins.

The stored water level provides adequate net positive suction head (NPSH) to the ESW pump during a 30-day period of operation following the design basis LOCA without makeup. RCOL4_16-2

Additional information on the design and operation of the system, along with a list of components served, can be found in Reference 1.

BASES

ACTIONS (continued)

Required Action A.2 allows the option to apply the requirements of Specification 5.5.18 to determine a Risk Informed Completion Time (RICT). This Required Action is not applicable in MODE 4. The 72-hour~~-day~~ Completion Time is based on the capability of the OPERABLE cooling towers to provide the UHS cooling capability and the low probability of an accident occurring during the 72 hours~~-days~~ that one required cooling tower and associated fans are inoperable. RCOL4_16-8 RCOL4_16-8

B.1 RCOL4_16-4

With water temperature of the UHS > 95°F, the design basis assumption associated with initial UHS temperature is bounded provided the temperature of the UHS averaged over the previous 24-hour period is ≤ 95°F. With the water temperature of the UHS > 95°F, long-term cooling capability of the ECCS loads may be affected. Therefore, to ensure long-term cooling capability is provided to the ECCS loads when water temperature of the UHS is > 95°F, Required Action B.1 is provided to monitor the water temperature of the UHS more frequently and verify the temperature is ≤ 95°F when averaged over the previous 24 hour period. The once per hour Completion Time takes into consideration UHS temperature variations and the increased monitoring frequency needed to ensure design basis assumptions and equipment limitations are not exceeded in this condition. If the water temperature of the UHS exceeds 95°F when averaged over the previous 24 hour period, Condition E must be entered immediately.

~~B~~C.1

If one or more required UHS basins have a ~~water temperature and/or~~ water level not within the limits, action must be taken to restore the water ~~temperature and~~ level to within limits within 72 hours. RCOL4_16-4

The 72 hour Completion Time is reasonable based on the low probability of an accident occurring during the 72 hours, the considerable cooling capacity still available in the basin(s), and the time required to reasonably complete the Required Action. Furthermore, there would be no significant loss in the UHS cooling capacity when the water level drops below the normal level during a 72-hour period because of sufficient cooling tower basin inventory. The UHS has a combined design heat removal capacity of approximately 20 days from two operable cooling tower basins and 30 days from three operable cooling tower basins. RCOL4_16-4

~~C~~D.1, ~~C~~D.2.1, and ~~C~~D.2.2

If one or more required UHS transfer pump(s) are inoperable, action must

ACTIONS (continued)

be taken to restore the pump(s) to OPERABLE status or implement an alternate method of transferring the affected basin within 7 days. If an alternate method is utilized, action still must be taken to restore the transfer pump(s) to OPERABLE status within 31 days.

The Completion Times are reasonable based on the low probability of an accident occurring during the time allowed to restore the pump(s) or implement an alternate method, the availability of alternate methods, and the amount of time available to transfer the water from one basin to the other under the worst case accident assumptions. Furthermore, the inoperability of all required transfer pumps leaves only two cooling tower basins with a combined design heat removal capacity of approximately 20 days. This cooling period bounds and justifies the 7-day completion time to restore the transfer pumps to operable status. RCOL4_16-3

~~D~~E.1 and ~~D~~E.2 RCOL4_16-4

If the Required Actions and Completion Times of Condition A, B, or C are not met, or the UHS is inoperable for reasons other than Condition A, B, or C, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.9.1

This SR verifies that adequate long term (30 day) cooling can be maintained. The specified level also ensures that sufficient NPSH is available to operate the ESWS pumps. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. This SR verifies that each required UHS basin water level is ≥ 2,850,000 gallons. Plant procedures provide the corresponding water level to be verified to assure a usable volume of 2,850,00 gallons, accounting for unusable volume and measurement uncertainty. RCOL4_16-2

SR 3.7.9.2

This SR verifies that the ESWS is available to cool the CCW System and essential chiller unit to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a

BASES

ACTIONS (continued)

SR 3.7.9.6 RCOL4_16-5

This SR verifies the correct alignment for manual, power-operated, and automatic valves in the UHS flow path to assure that the proper flow paths exist for UHS operation. This SR does not apply to valves that are locked, sealed or otherwise secured in position, since they are verified to be in the correct position prior to being locked, sealed, or secured. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk, and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.7

This SR verifies proper manual and automatic operation of the UHS valves on remote manual or on an actual or simulated actuation signal. The ESWS is a normally-operating system that cannot be fully actuated as part of normal testing. This Surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls.

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk, and is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. FSAR Subsection 9.2.5. RCOL4_16-7
2. Regulatory Guide 1.27.

95° F discharge water at a peak heat load of 196 million Btu/hr, the basin water temperature will not exceed 95° F. LOCA peak heat loads are less than the safe shutdown peak heat loads. Thus, the safe shutdown analysis bounds the LOCA case. RCOL2_09.02.05-5

During accident conditions, including LOCA and LOOP, makeup to the basin is presumed lost. During such conditions, the UHS transfer pump operates to permit the use of three of the four basin water volumes. The power supply for each transfer pump is from a different division than the ESWP and cooling tower in that basin. Therefore, loss of one electrical train does not compromise the ability to satisfy the short-term accident requirements.

A description and provision to prevent freezing of the ESWS and the UHS is provided in Subsection 9.2.1.

9.2.5.4 Inspection and Testing Requirements

CP COL 9.2(23) Replace the content of DCD Subsection 9.2.5.4 with the following.

Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI, and is included in Section 6.6.

Inservice testing of pumps and valves is performed to ensure operational readiness and is included in Subsection 3.9.6.

Periodic inspections and testing of the mechanical cooling tower components, including fan, motors, and reducing gears, are performed in accordance with cooling tower manufacturer's recommendations, industry operating experience, and as a part of the monitoring required in Generic Letter 89-13 to maintain acceptable system performance. RCOL2_09.02.05-12

Periodic cooling tower fan testing in accordance with Technical Specifications provides a means of detecting and correcting motor failure or excessive vibration. RCOL2_09.02.05-14

A test program is developed to verify and monitor heat exchanger performance. Baseline performance and acceptance criteria for heat transfer capability for all heat exchangers are established. CCW heat exchangers, essential chiller cooling units and cooling towers are included in the program. Tests are performed during normal plant operation per an established schedule. Heat transfer capability at operating conditions is calculated and then prorated to accident mitigation heat transfer capability. Performance of each heat exchanger is trended to determine degradation. RCOL2_09.02.05-13

An inspection program and test procedures are developed to monitor fouling and degradation of the ESW and UHS and to maintain acceptable system performance. The inspection program includes the following:

- Inspect piping for corrosion, erosion and bio-fouling on a regular basis. RCOL2_09.02.05-12

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
~~D~~E. Required Action and associated Completion Time of Condition A, B, or C not met. OR UHS inoperable for reasons other than Condition A, B, or C.	~~D~~E.1 Be in MODE 3. AND ~~D~~E.2 Be in MODE 5.	6 hours 36 hours	RCOL4_16-4 RCOL4_16-4

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY	
SR 3.7.9.1	Verify each required UHS basin water level is ≥ ~~2,850,000~~2,800,000 gallons.	In accordance with the Surveillance Frequency Control Program	RCOL2_09.02.05-5
SR 3.7.9.2	Verify water temperature of UHS is ≤ ~~95~~93°F.	In accordance with the Surveillance Frequency Control Program	RCOL2_09.02.05-14
SR 3.7.9.3	Operate each cooling tower fan for ≥ 15 minutes.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.4	Verify each cooling tower fan starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program	
SR 3.7.9.5	Verify each UHS transfer pump starts on manual actuation~~operation~~.	In accordance with the ~~Inservice Testing Program~~ Surveillance Frequency Control Program	RCOL4_16-1 RCOL4_16-7

BASES

APPLICABLE SAFETY ANALYSES

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation.

The operating limits are based on safe shutdown with LOOP. A conservative heat transfer ~~analyses~~analysis for the worst case LOCA was performed to ensure that the cooling tower capacity and the basin water inventory adequately remove the heat load for the worst case LOCA. RCOL2_09.02.05-14 Reference 1 provides the details of the assumptions used in the analysis, which include worst expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst case single active failure (e.g., single failure of a manmade structure). The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 2), which requires a 30 day supply of cooling water in the UHS.

The UHS satisfies Criterion 3 of 10 CFR 50.36(d)(2)(ii).

LCO

The UHS is required to be OPERABLE and is considered OPERABLE if it contains a sufficient volume of water at or below the maximum temperature that would allow the ESWS to operate for removing the heat load during a safe shutdown with LOOP and cooling at least 30 days following ~~the design basis~~a LOCA without makeup water and provide adequate net positive suction head (NPSH) to the ESWS pumps, and without exceeding the maximum design temperature of the equipment served by the ESWS. RCOL2_09.02.05-14 To meet this condition, three UHS cooling towers with the UHS temperature not exceeding ~~95~~93°F during MODES 1, 2, 3 and 4 and the level in each of three basins being maintained above ~~2,850,000~~2,800,000 gallons are required—a volume correspondent to the safe shutdown with LOOP conditions that bounds the LOCA condition. RCOL2_09.02.05-14 RCOL2_09.02.05-5 Additionally, three of the UHS transfer pumps shall be OPERABLE, with each pump capable of transferring flow from a UHS basin meeting water inventory and temperature limits, and powered from an independent Class 1E electrical division.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

In MODE 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

A.1 and A.2

If one of the required cooling towers and associated fans is inoperable (i.e., one or more fans per cooling tower inoperable), action must be taken to restore the inoperable cooling tower and associated fan(s) to OPERABLE status within 72 hours ~~days~~. In this Condition, the remaining OPERABLE RCOL4_16-8 cooling towers with associated fans are adequate to perform the heat

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.9.2

This SR verifies that the ESWS is available to cool the CCW System and essential chiller unit to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a Design Basis Accident. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. This SR verifies that the water temperature of the UHS is ≤ ~~95~~93°F. RCOL2_09.02.05-14

SR 3.7.9.3

Operating each cooling tower fan for ≥15 minutes ensures that all fans are OPERABLE and that all associated controls are functioning properly. It also ensures that fan or motor failure, or excessive vibration, can be detected for corrective action. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.4

This SR verifies that each UHS fan starts and operates on an actual or simulated actuation signal. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

SR 3.7.9.5

This SR verifies that each UHS transfer pump starts and operates on ~~an actual or simulated~~a manual actuation signal. Verification of the UHS transfer pump operation includes testing to verify the pump's developed head at the flow test point is greater than or equal to the required developed head. Testing also includes verification of required valve position. RCOL4_16-1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-15

Tier 1 of the US-APWR DCD specifies a safety significant interface requirement in Section 3.2 for the UHS that COL applicants must address by preparing site-specific ITAAC. The COL applicant proposed ITAAC for the Comanche Peak UHS in Part 10 of the COL application. The balance-of-plant areas are included in Appendix A.1 of Part 10, and the ITAAC are specified in Table A.1-1. Based on a review of the Comanche Peak ITAAC that are proposed for balance-of-plant areas, the NRC staff requests the applicant address the following items and revise the proposed ITAAC as appropriate to reflect this information:

- The listing of seismic category 1 equipment on Table A.1-2 does not include the cooling tower structure and related equipment, such as fill material, risers and spray piping, spray nozzles, drift eliminators, and so forth. The cooling tower and related components are safety-related and must satisfy seismic category 1 specifications in order to be credited for LOCA mitigation.

- Item 7 requires tests and analyses of the as-built system to be performed to demonstrate adequate heat removal capability. Because ITAAC must be completed before fuel load, an explanation is needed for how the specified test will be performed to account for limiting conditions, and how enough heat will be generated to perform tests that are sufficient for this purpose. Similarly, an explanation is needed for how the analyses will be completed based on the test data that is obtained to ensure conservative results.

- Important design features did not have corresponding ITAAC, such as placement of tornado missile barriers relative to components that are being protected, routing of transfer piping to confirm protection from tornado missiles, application of cementitious membrane on basin inner surfaces to prevent seepage, location of basin "mostly below grade," the fire barrier between transfer pumps and ESWS pumps; alternate power supplies for transfer pumps from respective cooling tower trains, tornado missile protection for pumps from outside missiles, depth of pump well as well as depth of ESWS and transfer pump suctions (sufficient to allow for silt buildup without impacting capability); and transfer pump design flow rate.

ANSWER:

Seismic Category I Equipment in COLA Part 10 Table A.1-2

The ultimate heat sink related structures (UHSRS), including the cooling towers, are addressed in Appendix A.3 of COLA Part 10. ITAAC item 9 in Table A.3-1 requires design reports to demonstrate that the as-built UHSRS are designed in accordance with structural design basis loads, which include seismic loads for the seismic Category I UHSRS.

ITAAC Item 7 in Table A.1-1

Item 7 in Table A.1-1 was revised in response to RAI No. 3293 (CP RAI #81) Question 14.03.07-5 (ML093210468) to clarify the ITAAC that require demonstration of adequate UHS heat removal capability. This includes the addition of quantitative acceptance criteria for UHS outlet temperature. ITAAC closure relies on a combination of testing and design analyses, including vendor data. UHS preoperational testing, summarized in FSAR Subsection 14.2.12.1.113, includes verification of component performance, including ESW pump design flow at minimum basin level. An ITAAC closure report summarizing design analyses supported by vendor test and preoperational test data as applicable, will demonstrate the as-built UHS is capable of maintaining acceptable UHS outlet temperature under design conditions. Marked-up COLA Part 10 Draft Revision 1 page 12 from that response is attached.

ITAAC for Important Design Features

1. Placement of tornado missile barriers relative to components that are being protected

   ITAAC Item 1 in Table A.3-1 requires that the safety-related, site-specific structures (UHSRS, ESWPT and PSFSV) conform to the structural configurations as shown in FSAR Figures 3.8-201 through 3.8-214 and as described in FSAR Table A.3-2. These FSAR figures include dimensions and locations of structural design features that provide protection from tornado missiles. FSAR Table A.3-2 defines the wall thicknesses for safety-related structures, including exterior walls. ITAAC Item 9 in Table A.1-1 requires verification that the as-built UHRS, ESWPT and PSFSV are designed in accordance with structural design-basis loads. Structural design basis loads include tornado missile loads. Therefore, ITAAC to specifically identify the placement of tornado missile barriers are not considered necessary.

2. Routing of transfer piping to confirm protection from tornado missiles

   The arrangement of transfer piping with respect to protective structures is depicted in FSAR Figures 3.8-206, 3.8-208, 3.8-209 and 3.8-211. Conformance of the as-built structural configuration to these figures is addressed by ITAAC Item 1 in Table A.3-1.

3. Application of cementitious membrane on basin inner surfaces to prevent seepage

   Luminant submitted Update Tracking Report Revision 0 for COLA Part 10 Revision 1 attached to letter TXNB-09080 dated December 10, 2009. The revision included a description for each system in the COLA ITAAC to be consistent with DCD Tier 1 system descriptions. The system description for the UHS basin includes the cementitious membrane as seen on attached page 25 from the submittal.

4. Location of basin "mostly below grade"

   This feature is addressed by ITAAC Item 1 in Table A.3-1, which includes verification of the as-built basins' conformance to FSAR Figures 3.8-202, 3.8-208, 3.8-209, 3.8-210 and 3.8-211. These figures include section views of the UHS basins with respect to grade elevation.

5. The fire barrier between transfer pumps and ESWS pumps

   This item is addressed by ITAAC Item 7 in Table A.3-1, which requires redundant safe shutdown components and associated electrical divisions of the as-built UHSRS to be separated by 3-hour rated fire barriers as required by the Fire Hazards Analysis.

6. Tornado missile protection for pumps from outside missiles

   This item is addressed as described in #1above.

7. Depth of pump well as well as depth of ESWS and transfer pump suctions (sufficient to allow for silt buildup without impacting capability)

   The depth of the pump well, basin layout and relative elevations of the UHS basin and UHS ESW pump house sump floor, are shown in FSAR Figure 3.8-209 and therefore subject to verification by ITAAC Item 1 in Table A.3-1. As stated in response to Question 09.02.05-10 of this RAI, the UHS ESW pump house sump floor is located at a lower elevation (779 feet) as compared to the UHS basin floor (791 feet). Basin layout assures that most of the debris accumulates on the UHS basin floor. An insignificant quantity of debris is expected to accumulate on the UHS ESW pump house sump floor.

8. Transfer pump design flow rate

   Luminant submitted Update Tracking Report Revision 0 for COLA Part 10 Revision 1 attached to letter TXNB-09080 dated December 10, 2009. The revision included a description for each system in the COLA ITAAC to be consistent with DCD Tier 1 system descriptions. Under the subsection heading "Key Design Features," attached page 6 from that submittal addresses transfer pump operation and the capability of the UHS to perform its safety functions under design basis conditions.

Impact on R-COLA

None

Impact on S-COLA

None

Impact on DCD

None.

Attachments

Marked-up COLA Part 10 Revision 1 pages 6 and 25 from Update Tracking Report Revision 0 dated December 10, 2009.

Marked-up COLA Part 10 Draft Revision 1 page 12 from the response to RAI No. 3293 (CP RAI #81) Question 14.03.07-5)

PART 10 - APPENDIX A.1

ULTIMATE HEAT SINK SYSTEM AND ESSENTIAL SERVICE WATER SYSTEM (PORTIONS OUTSIDE THE SCOPE OF THE CERTIFIED DESIGN)

A.1.1 Design Description

RCOL2_14.03.07-28

System Purpose and Functions

The ultimate heat sink system (UHSS) is a safety-related system that is provided to remove the heat transferred from the essential service water system (ESWS) during normal operation, transients, accidents and design basis events. It is used to support achieving and maintaining a safe shutdown condition. The ultimate heat sink (UHS) basin via the safety-related ESWS is also used as a highly reliable water source to provide water to the stand pipe header of the fire protection system. This assures manual fire suppression capability following a safe shutdown earthquake.

Location and Functional Arrangement

Figure A.1-1 shows the functional arrangement of the UHSS and ESWS (portions outside the scope of the certified design). FSAR Table 3.2-201 provides the classification and locations for equipment and piping. Table A.1-2 provides information on the design characteristics of equipment.

Key Design Features

The UHSS consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS division, and four 33 1/3 percent capacity basins to satisfy the thirty day cooling water supply criteria. In addition, a UHS transfer pump is located in each UHS basin to enable water transfer between UHS basins during accident conditions. The UHSS is capable of performing required safety functions assuming that one division is out of service for maintenance coincident with the postulated loss of offsite power and any single failure within the UHSS. Each mechanical division of the system is physically separated from the other divisions, except for the header portion of the transfer line piping.

Seismic and ASME Code Classification

Table A.1-2 identifies the seismic classifications and the ASME Code Section III requirements for the UHSS components. FSAR Table 3.2-201 provides this information for system piping.

System Operation

The UHSS provides adequate removal of heat transferred from the ESWS during all operations. The essential service water is cooled by the UHS cooling tower before being returned to the UHS basin. Heat rejection to the environment is effected by direct contact of the hotter essential service water discharging from the ESWS with the UHS cooling tower forced airflow. During normal operation, the water losses due to evaporation, drift and blowdown are replenished with the

UHS basin. Air intakes serving the cooling towers are located at the north and south faces of the enclosure and configured to protect the safety-related substructures and components from tornado missiles. The north side cooling tower air intake is an integral part of the cooling tower enclosure, whereas the south side cooling tower air intake is an integral part of the ESWPT, which is supported by reinforced concrete piers. These piers are supported by the ESWPT walls and basemat. RCOL2_14.03.07-28

UHS ESW pump house - The pump house is an integral part of the UHS basin supported by UHS basin exterior and interior walls. Each pump house contains one ESW pump and one UHS transfer pump with associated auxiliaries. The pump bay (lowest portion of the pump house required for the pump suction) is deeper than the rest of the UHS basin. A reinforced concrete wall, running east-west, divides the pump house basin from the rest of the UHS basin. This wall is provided with slots for flow of water. Two baffle walls (running east-west) are provided inside the pump house basin, before the pump bay. These baffle walls are provided with slots to maintain the flow of water and are staggered to assure no line-of-sight pathways exist. This prevents postulated direct or deflected design basis tornado missiles from impacting safety related components located within the structure. There is a fire barrier between the UHS transfer pump and the UHS ESW pump of each UHS ESW pump house.

UHS Basin - There are four seismic Category I basins for each unit and each basin has one cooling tower with two cells. Each basin is square in shape, constructed of reinforced concrete and serves as a reservoir for the ESWS. There is a cementitious membrane adhered to the interior faces of the reinforced concrete walls of the basins which minimizes long term seepage of water from the basin. Two basins share a common foundation mat and a reinforced concrete wall divides them. An UHS ESW pump house is located at the south-west corner of each basin. Adjacent to the pump house on the east side of the basin are cooling tower enclosures supported by UHS basin walls. The ESWPT runs east-west along the south exterior wall of the UHS basin, and is separated by a minimum 4 inch expansion joint.

A.3.1.2 ESWPT

The ESWPT is an underground structure constructed with reinforced concrete, and is classified as seismic Category I. The tunnel is divided into two sections by a concrete wall. Each section contains both ESWS supply and return lines. The ESWPT structure starts at the UHS basins and terminates at the R/B. The ESWPT structure is isolated from other structures to prevent any seismic interaction. Access to the tunnel is provided by reinforced concrete manholes.

Comanche Peak Nuclear Power Plant, Units 3 & 4
COL Application

Part 10 - ITAAC and Proposed License Conditions

Appendix A.1

Table A.1-1 (Sheet 5 of 6)

Ultimate Heat Sink System and Essential Service Water System (Portions Outside the Scope of the Certified Design) Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria	
6.b Separation is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E cable.	6.b Inspections of the as-built Class 1E divisional cables ~~and raceways~~ will be ~~conducted~~performed.	6.b ~~The as-built Class 1E electrical cables with only one division are routed in raceways assigned to the same division. There are no other safety division electrical cables in a raceway assigned to a different division~~Physical separation or electrical isolation is provided between the as-built cables of Class 1E divisions and between Class 1E divisions and non-Class 1E cables.	RCOL2_14 .03.07-4
7. The system components identified in Table A.1-2 provides adequate heat removal capability transferred design heat load from the ESWS.	7. An inspection for the existence of a report that determines the capability~~Tests and analyses~~ of the as-built system will be performed.	7. A report exists and concludes that the as-built system provides adequate heat removal capability transferred design heat load from the ESWS and maintains a UHS outlet temperature of ≤ 95°F.	RCOL2_14 .03.07-5
8. Controls exist in the MCR to open and close the remotely operated valves identified in Table A.1-2.	8. Tests will be performed on the as-built remotely operated valves listed in Table A.1-2 using controls in the MCR.	8. Controls in the MCR operate to open and close the as-built remotely operated valves listed in Table A.1-2.	
9.a The remotely operated valves, identified in Table A.1-2 to perform an active safety-related, function to change position as indicated in the table.	9.a.i Tests or type tests of the valves will be performed that demonstrate the capability of the valve to operate under its design conditions.	9.a.i Each valve changes position as indicated in Table A.1-2 under design conditions.	
	9.a.ii Tests of the as-built valves will be performed under pre-operational flow, differential pressure, and temperature conditions.	9.a.ii Each as-built valve changes position as indicated in Table A.1-2 under pre-operational test conditions.	

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Comanche Peak, Units 3 and 4

Luminant Generation Company LLC

Docket Nos. 52-034 and 52-035

RAI NO.: 3762 (CP RAI #121)

SRP SECTION: 09.02.05 - Ultimate Heat Sink

QUESTIONS for Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)

DATE OF RAI ISSUE: 10/9/2009

QUESTION NO.: 09.02.05-16

The US-APWR DCD established COL information items to specify supplemental information that is needed in order to describe the UHS that is chosen for a particular site. In reviewing the information that was provided by the applicant to address these COL Information Items, the NRC staff noted that in the following two cases the supplemental information that was provided by the COL applicant appears to involve departures from the US-APWR DCD design basis information and these changes to the DCD need to be addressed and reflected in the COL application accordingly:

- CP COL 9.2(18) replaced the eighth bullet of the second paragraph in DCD Tier 2 Section 9.2.5.1 which eliminated the following design bases information: "The most severe meteorological condition is based upon 30 years maximum historical conditions of dry and wet bulb temperatures." This change to the US-APWR design basis appears to be a departure and the COL applicant is requested to provide a justification accordingly.
- CP COL 9.2(21) changed the 6^{th} paragraph under DCD Tier 2 Section 9.2.5.2 to eliminate "The blowdown discharge is provided as a check point for monitoring and neutralizing chemistry of ESW discharges to the environment." This change to the US-APWR design basis appears to be a departure and the applicant is requested to provide a justification accordingly.

ANSWER:

Part A

CP COL 9.2(18) is not a departure because the requirement of concern, "The most severe meteorological condition is based upon 30 years maximum historical conditions of dry and wet bulb temperatures," is included in the FSAR as described below.

As discussed in FSAR Subsections 2.3.1.2.10 and 9.2.5.2.3, the performance of the UHS was analyzed using meteorological conditions based upon 30 years of historical temperature data. The wet bulb design temperature for the ultimate heat sink was selected to be 80°F based on 30 years (1977 – 2006) of climatological data obtained from the National Climatic Data Center/National Oceanic and Atmospheric Administrator for Dallas/Fort Worth International Airport Station in accordance with RG 1.27. The worst 30 day period was selected from the above climatological data between June 1, 1998 and June 30, 1998, with an average wet bulb temperature of 78.0°F. A 2°F recirculation penalty was added, resulting in the wet bulb design temperature of 80°F. This is consistent with DCD COL Item 9.2(22).

FSAR Subsection 9.2.5.1 is revised to incorporate COL Item 9.2(22).

Part B

CP COL 9.2(21) is not a departure because the DCD requirement of concern, "The blowdown discharge is provided as a check point for monitoring and neutralizing chemistry of ESW discharges to the environment," is included in the FSAR as discussed below.

Blowdown from the ESWS flows through connections to the circulating water system blowdown piping. The combined blowdown is discharged to Lake Granbury. As indicated in FSAR Subsection 9.2.5.2.2, the ESWS blowdown rate is determined using a conductivity cell located at the ESW pump discharge and is based on the total dissolved solids in the UHS basin water and the makeup water source. FSAR Subsection 10.4.5.2.2.8 indicates that chemical injection is also provided for the blowdown system.

The ESWS blowdown treatment and discharge are integral with the circulating water system, and are more described in detail in FSAR Subsection 10.4.5. FSAR Subsection 10.4.5.2.2.11 describes periodic treatment of blowdown to meet waste water discharge requirements. Blowdown treatment and discharge are established to comply with state discharge permit requirements, and on a frequency dictated by conservatively postulated environmental conditions (i.e. makeup water quality). Blowdown discharges to the environment from the ESWS are monitored and controlled in accordance with state regulations.

FSAR Subsection 9.2.5.2 has been revised to reference the Subsection 10.4.5.2.2.11 description of blowdown treatment to meet discharge limits.

Impact on R-COLA

See attached mark-up of FSAR Revision 1 pages 9.2-7 and 9.2-8.

Impact on S-COLA

None.

Impact on DCD

None.

mobile carts below the filter press is then transferred to a dumpster for disposal to class 1 landfill.

9.2.4.4 Inspection and Testing Requirements

CP COL 9.2(13) Replace the content of DCD Subsection 9.2.4.4 with the following.

- The potable water system and the sanitary drainage system is tested hydrostatically for leak-tightness and system inspection is performed in accordance with applicable uniform plumbing code requirement. Periodic testing for microbiological growth including bacteria in the sanitary waste is conducted before discharge.

9.2.4.5 Instrumentation Requirements

CP COL 9.2(13) Replace the second through seventh bullets in DCD Subsection 9.2.4.5 with the following.

- A pressure controller located on each branched off discharge of the potable water system automatically adjusts the valve position based on usage and capacity.

- The instruments associated with the sanitary wastewater treatment system are a part of the treatment plant. Sufficient instrumentation for operation is provided with the treatment plant.

9.2.5.1 Design Bases

CP COL 9.2(18) Replace the eighth bullet of the second paragraph in DCD Subsection 9.2.5.1 with the following.

- The UHS is designed in accordance with Regulatory Guide 1.27 with inventory sufficient to provide cooling for at least 30 days following an accident, with no makeup water. The performance of the UHS is based upon 30 years of site-specific historical wet bulb temperature conditions (refer to Subsection 2.3.1.2.10). RCOL2_09.02.05-16

Replace the last bullet of the second paragraph in DCD Subsection 9.2.5.1 with the following:

- The structures and components of the UHS are designed and constructed as safety-related structures to the requirements of seismic Category I as defined in RG 1.29 and equipment Class 3. RCOL2_09.02.05-4 RCOL2_09.02.05-1

9.2.5.2 System Description

CP COL 9.2(3) CP COL 9.2(4) CP COL 9.2(5) CP COL 9.2(18) CP COL 9.2(19)

Replace the last six paragraphs in DCD Subsection 9.2.5.2 with the following.

Mechanical draft cooling towers with basins, based on site condition and meteorological data, are used for CPNPP Units 3 and 4.

CP COL 9.2(20) CP COL 9.2(21)

A detailed description and drawing of the UHS are provided in Subsection 9.2.5.2.1, Figure 9.2.5-201, and Table 9.2.5-201.

The source of makeup water to the UHS inventory and blowdown discharge location are discussed below. Subsection 10.4.5.2.2.11 describes treatment of blowdown in order to meet wastewater discharge limits. RCOL2_09.02.05-16

9.2.5.2.1 General Description

Each unit is provided with its own independent UHS, with no sharing between the two units. The UHS for each unit consists of four 50 percent capacity mechanical draft cooling towers, one for each ESWS train, and four 33 one-third percent capacity basins to satisfy the thirty day cooling water supply criteria of RG 1.27.

Each cooling tower consists of two cells with fans and motors, drift eliminators, film fills, risers, and water distribution system all enclosed and supported by a seismic category I reinforced concrete structure. Cooling tower components are designed per equipment Class 3 and quality group C requirements. Each basin includes an ESWP intake structure that contains one 50 percent capacity ESWP and one 100 percent capacity UHS transfer pump, and associated piping and components. Tornado missile protection for the cooling tower components, ESWPs and piping is provided by the UHS safety-related seismic category I structures and ESW pipe tunnel as discussed in Subsection 3.8.4. The UHS structural design, including pertinent dimensions, is also discussed in Subsection 3.8.4. RCOL2_09.02.05-1

Each cooling tower consists of two cells, each with a motor driven fan driven with a right-angle gear reducer. The fan motors are powered from the Class 1E normal ac power system. On loss of offsite power (LOOP), the motors are automatically powered from their respective division emergency power source.

The cooling towers are designed for the following conditions: water flow of 12,000 gpm, hot (inlet) water temperature of 128° F, cold (outlet) water temperature of RCOL2_09.02.05-5