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TXX-13091

Ref. # GL 2004-02

May 16, 2013

Attn: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

**SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT
DOCKET NOS: 50-445 AND 50-446
CLOSURE OPTIONS FOR GENERIC SAFETY ISSUE 191 (GSI-191),
ASSESSMENT OF DEBRIS ACCUMULATION ON PRESSURIZED
WATER REACTOR SUMP PERFORMANCE
(TAC NOS. MC4676 AND MC4677)**

Dear Sir or Madam:

Consistent with SECY-12-0093, dated July 9, 2012 and related Staff Requirements Memorandum (SRM) dated December 14, 2012 [Agencywide documents Access and Management System (ADAMS) Accession numbers ML121310648 and ML12249A378 respectively], and NRC letter dated November 21, 2012, from the Director, Division of Safety Systems, Office of Nuclear Reactor Regulation, to the Nuclear Energy Institute, Luminant Generation Company LLC (Luminant Power) is submitting the selected option and schedule for resolution of GSI-191 for Comanche Peak Nuclear Power Plants (CPNPP) Units 1 and 2.

The attachment to this letter documents that Luminant Power has selected Option 2a, Deterministic Resolution Path, from SECY-12-0093 and provides a description of the existing mitigation measures that justify the expected time frame for resolution of GSI-191. In addition, the enclosure provides the schedule for submittals to support resolution of GSI-191.

This letter contains the following new licensing commitments regarding CPNPP Units 1 and 2, which supersede Commitment No. 3641550 as discussed in the attachment.

| <u>Commitment #</u> | <u>Description</u> |
|---------------------|---|
| 4641403 | Within six months of establishing a final determination of the scope of insulation replacement or remediation (if required), Luminant Power will submit a final updated supplemental response to support closure of GL 2004-02 for Comanche Peak. If no modifications are required, the |

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submittal will be made three months after the NRC approval of the PWR Owners Group (PWROG) testing programs for in-vessel effects and completion of the final bypass test reports.

4641431 Luminant Power will update the current licensing basis (UFSAR) following NRC acceptance of the updated supplemental response for Comanche Peak and completion of any identified removal or modification of insulation debris sources in containment per plant modification procedures and processes in accordance with 10 CFR 50.71(e).

Should you have any questions, please contact Mr. J. D. Seawright at (254) 897-0140.

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

Executed on May 16, 2013.

Sincerely,

Luminant Generation Company LLC

Rafael Flores

By: R. B. Mays
R.B. Mays
Vice President
Nuclear Engineering and Support

Attachment - Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191),
Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

c - Arthur T. Howell III, Region IV
Balwant K. Singal, NRR
Resident Inspectors, Comanche Peak

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

Background

Generic Safety Issue - 191 Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance (GSI-191) remains a long-standing open issue. GSI-191 concluded that debris could clog the containment sump strainers in pressurized water reactors (PWRs), leading to the loss of net positive suction head for the emergency core cooling system (ECCS) and containment spray system (CSS) pumps. The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors", dated September 13, 2004, [Reference 1] requesting that licensees address the issues raised by GSI-191. GL 2004-02 was focused on demonstrating compliance with 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors."

On July 9, 2012, the NRC staff issued SECY-12-0093 [Reference 2], Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance, presenting three options to the Commission all of which are considered to be viable paths for resolving GSI-191. The NRC Commissioners approved the Staff's recommendations in December 2012 [Reference 3].

SECY-12-0093 stated that upon Commission approval, the staff will ensure that each plant's GSI-191 chosen resolution option and associated implementation schedule are submitted to the NRC by December 31, 2012. However, by letter [Reference 4] from Bill Ruland (NRC) to John Butler (NEI), the NRC accepted the NEI proposed revised schedule for these submittals until January 31, 2013, or 30 days following the NRC making the final safety evaluation (SE) [Reference 5] associated with the review of WCAP-16793 [Reference 6], and the NRC Commissioner's approval of the Staff Requirements Memorandum (SRM) [Reference 3] associated with SECY-12-0093 [Reference 2] publicly available. The final SE associated with the review of WCAP-16793 was made publically available April 16, 2013. Therefore, the schedule for submittal of the chosen resolution option and associated implementation schedule is on or before May 16, 2013.

In accordance with the May 4, 2012, NEI letter to the NRC [Reference 7], Comanche Peak Nuclear Power Plant (Comanche Peak) herein submits its resolution option and associated implementation schedule to the NRC. SECY-12-0093 considered and expanded upon the options provided in Reference 7. The options identified in SECY-12-0093 provide approaches that can be used to address plants with minimal fibrous insulation, low to medium fibrous insulation, and substantial amounts of fibrous insulation.

SECY-12-0093 identifies three resolution paths (options).

Option 1: Compliance with 10 CFR 50.46 Based on Approved Models

Option 2: Deterministic or Risk-Informed

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

Option 2a: Deterministic Resolution Path

Option 2b: Full Risk-Informed Resolution Path

Option 3: Different Regulatory Treatment for Suction Strainer and In-Vessel Effects (Deterministic for Strainer Head Loss /Risk-Based for In-Vessel Effects Resolution Path)

Comanche Peak will follow Option 2a: Deterministic Resolution Path.

Option 2a: Deterministic Resolution Path

Introduction

Luminant Power has selected Option 2a and intends to pursue refinements to evaluation methods and acceptance criteria. To support use of this path, and continued operation for the period required to complete the necessary analysis and testing, Luminant Power has evaluated the design and procedural capabilities that exist to identify and mitigate in-vessel blockage. A description of these detection and mitigative measures are provided later in this document. Additionally, a summary of the existing margins and conservatisms that exist for Comanche Peak are also included in this document.

Characterization of Current Containment Fiber Status

From the debris generation and debris transport analysis, Luminant Power has conservatively determined that approximately 191 lbs of fibrous debris could be transported to the strainers, as documented in ER-ESP-001 [Reference 8].

The fibrous debris sources considered in these analyses include: latent fiber, low density fiberglass insulation, Min-K insulation, lead shielding blanket covers, and fiberglass tape (i.e., Glass 69 tape).

The fiberglass tape was identified after testing for transport and strainer blockage by labels and tapes. Therefore, Luminant Power intends to perform supplemental testing to address a small quantity of fiberglass tape. This testing will address the impact of the fiberglass tape on the strainer sacrificial area for blockage.

Acceptable fiberglass tape bypass testing has not yet been performed.

Characterization of Strainer Head Loss Status

Luminant Power previously provided the results of strainer head loss testing, including the impact of chemical effects, in ER-ESP-001 [Reference 8]. The results of this testing

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

demonstrate acceptable results with regard to allowable head loss. Strainer head loss has been resolved for Comanche Peak as documented in Reference 9.

Characterization of In-Vessel Effects

Luminant Power intends to follow the resolution strategy proposed by the PWROG for establishing in-vessel acceptance criteria for the type of plant design that exists at CPNPP Units 1 and 2. The PWROG Comprehensive GSI-191 Program is designed to develop acceptance criteria to support resolution under Option 2a (Deterministic) as described in SECY 12-0093. The PWROG Program includes LOCA analyses and corroborative testing that will develop acceptance criteria that is intended to provide less restrictive in-vessel debris limits than WCAP-16793, Revision 2, or preclude the need for specific in-vessel debris limits altogether.

Luminant Power intends to perform bypass testing utilizing a test approach similar to that currently being utilized by other licensees. The results of this testing will then establish the quantity of fiber that is conservatively expected to be transported to the reactor fuel.

The testing will be done in accordance with a test protocol which has been reviewed by the NRC [e.g. References 10 and 11]. The test protocol will identify hold points in the testing where it is expected to have additional discussions with the NRC before proceeding. As was done prior to the original prototype testing and the original large flume testing for head loss, we intend to seek NRC input and comments prior to testing and to address lessons learned from previous testing. The first of these meetings was held February 28, 2013 [Reference 12]. As a result of that meeting, Luminant Power is evaluating the tank bypass test protocol as an alternative to the flume bypass test.

Licensing Basis Commitments

Luminant Power currently has a commitment to provide the NRC with a revision to Reference 8 as follows.

Commitment No. 3641550, "The Comanche Peak analysis and licensing basis are in accordance with WCAP-16793. When the NRC final Safety Evaluation on WCAP-16793 is issued, it will be reviewed for impact and the evaluation of long term cooling will be revised as appropriate. The supplemental response will be revised and submitted within 90 days after issuance of the final Safety Evaluation."

As a result of the remaining open issues associated with GL 2004-02 for Comanche Peak, and the information contained within this document, the previously established commitment is considered to be superseded based on the intended direction to be taken as described in this document. New commitments as a result of this document are described in the transmittal letter.

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

Resolution Schedule

Luminant Power will achieve closure of GSI-191 and address GL 2004-02 per the following schedule:

- Supplemental testing of fiberglass tape for impact on the strainer sacrificial area for blockage will be completed by the end of 2014.
- Strainer bypass testing will be completed by the end of 2015. Note: PWROG testing programs for in-vessel effects are scheduled to be submitted to the NRC by the summer of 2014 with the Staff's safety evaluations expected the summer of 2015.
- If required, complete the necessary insulation replacements, remediation, or model refinements by the completion of the third refueling outage following the submittal of this letter (fall 2017 for Unit 1 and spring 2017 for Unit 2). [Note: this schedule is contingent on completion and NRC approval of the PWROG testing programs for in-vessel effects on the schedule above.]
- Within six months of establishing a final determination of the scope of insulation replacement or remediation (if required), Luminant Power will submit a final updated supplemental response to support closure of GL 2004-02 for Comanche Peak. If no modifications are required, the submittal will be made three months after the NRC approval of the PWR Owners Group (PWROG) testing programs for in-vessel effects and completion of the final bypass test reports.
- If Luminant Power determines that a proposed testing or analysis resolution path will not be viable, then an alternate resolution path will be discussed with the NRC to gain acceptance of the proposed path and to establish an acceptable completion schedule.
- Luminant Power will update the current licensing basis (UFSAR) following NRC acceptance of the updated supplemental response for Comanche Peak and completion of any identified removal or modification of insulation debris sources in containment per plant modification procedures and processes in accordance with 10 CFR 50.71(e).

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

Summary of Actions Completed To Address GL 2004-02

To support closure of GSI-191 and to address GL 2004-02, Luminant Power has completed the following actions for Comanche Peak, Units 1 and 2:

- Replaced Train A and Train B emergency sump screens that had a simple geometry and a filtering surface area of 200 ft² (each) with nominal 1/8 in square openings, with complex geometry strainers having a filtering surface area of 3947 ft² (each) with nominal 0.095 in diameter circular openings.
- Other physical plant changes included:
 - Refueling Water Storage Tank (RWST) switchover setpoints were revised to ensure the new strainers are fully submerged at the completion of switchover from RWST injection to sump recirculation.
 - Modified RWST suction motor operated valves to increase sump inventory and NPSH margins.
 - Installed debris screens and strainers for drains in the refueling cavity to prevent delay of drainage to the sumps.
 - Drain holes added to the reactor vessel head stand shield wall to reduce water holdup.
 - Modified toe plates and other features to minimize water holdup on floors and miscellaneous items.
 - Installed debris interceptors to stop tumbling debris from reaching the strainers.
 - Installed water control features to optimize sump performance by reducing turbulence in the near field approach to the strainers (e.g., blocked containment spray drainage paths in proximity of the strainers).
 - ECCS and CSS pump suction pressure monitoring instrumentation was upgraded to meet Regulatory Guide 1.97, Revision 2.
- Walk downs were performed using guidance provided in NEI 02-01, “Condition Assessment Guidelines, Debris Sources inside Containment,” Revision 1 [Reference 13]. In addition, the Unit 2 walk down included extensive sampling for latent debris (dust and lint) considering guidance in NEI 04-07 Volume 2 (i.e., the NRC SER) [Reference 14]. Supplementary walk downs to assess containment conditions have been performed in each subsequent refueling outage.
- Completed debris generation and debris transport analyses.
[Reference 8, Sections 3.b and 3.e]
- Completed ex-vessel downstream effects analysis.
[Reference 8, Section 3.m]
- Completed NPSH analysis.
[Reference 8, Section 3.g]

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

Programmatic and procedural changes established to maintain acceptable configuration and protect the newly established design and licensing basis were completed in 2009.

Summary of Margins and Conservatism for Completed Actions For GL 2004-02

The following provides a summary description of the pertinent margins and major conservatisms associated with the actions taken to date and documented in Reference 8. These margins and conservatisms provide support for the extension of time required to address GL 2004-02 for Comanche Peak.

- **Debris Generation:**
 - 1) The break selection methodology results in identifying the worst debris generation break for each type of debris rather than some combination of debris,
 - 2) The break selection was performed to bound both units for each debris source,
 - 3) No credit for shadowing by platforms, grating, supports, or other equipment was taken,
 - 4) Conservative debris generation assumptions were made for encapsulated Min-k and lead shielding blankets,
 - 5) A conservative assumption of 200 lbs. of latent debris in combination with a 15% fiber assumption for latent debris by weight results in a significant conservatism in the quantity and characteristics of latent fiber.
[Reference 8, Section 3.a and 3.b]

- **Debris Transport:**

Although it was not credited, the presence of Reflective Metal Insulation (RMI) and other less transportable debris in the recirculation pool would tend to trap more readily transportable debris during pool fill reducing the overall recirculation transport.
[Reference 8, Section 3.e]

- **Strainer Head Loss:**
 - 1) Although Sodium Aluminum Silicate ($\text{NaAlSi}_3\text{O}_8$) makes up 83% of the precipitate, Aluminum Oxyhydroxide (AlOOH), which causes higher head losses, was used as the surrogate for testing.
 - 2) Head loss was extrapolated to a 30 day sump mission time. However, the CSS mission time for LOCA is less than 30 days and spray termination will reduce flow and head loss through the strainers. The Containment Spray System is capable of returning the post-LOCA environment to non-harsh temperatures in less than 14 days.
[Reference 8, Section 3.f]

- **Chemical Effects:**

Conservatism were identified in the generic chemical model which could be addressed through the inclusion of more plant-specific inputs. For example, corrosion rates of

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

aluminum alloys are lower than the pure aluminum used to establish corrosion rates.
[Reference 8, Section 3.f]

- The quantity of aluminum assumed [502 lbs] for chemical effects was conservative. The actual quantity of aluminum is estimated to be 485 pounds.
[Reference 8, Section 3.o]
- ECCS Flow:
Debris transport was calculated for both one and two train ECCS conditions and the bounding transport fraction was used. Each case was evaluated for Single Train (Sump A only and Sump B only) and two train (to Sump A and to Sump B). Therefore, four transport cases were calculated for each of the nine cases. The bounding debris load was conservatively determined for each sump by comparing all break locations and using the maximum amount transported for each debris type.
[Reference 8, Section 3.e]
- In-vessel Fuel assembly test program conservatisms are described in OG-12-287 [Reference 15] and OG-11-395 [Reference 16].
- The calculation of NPSH margin was performed considering the minimum flood level corresponding to the initiation of recirculation with the debris loaded head loss after 30 days of recirculation.
[Reference 8, Section 3.g]

Summary of Defense-In-Depth (DID) Measures

Defense in depth measures are not required for strainer head loss and blockage due to the robust design of the strainers and the large design and operating margins. Defense in depth measures for inadequate reactor core flow are described in the NEI letter dated March 5, 2012 [Reference 17].

The following describes the plant specific design features and procedural capabilities that exist for detecting and mitigating fuel blockage condition:

- Detection of Inadequate Reactor Core Flow – Core Exit Thermocouple (CET)
Temperature and Reactor Vessel Level Indication System (RVLIS) instrumentation are provided to monitor core cooling. To provide the capability for measurement of the reactor coolant inventory in the upper head and plenum regions of the reactor vessel, Comanche Peak utilizes a heated junction thermocouple (HJTC) system. This instrumentation is used in the following emergency operating procedures:

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

- Emergency Operating Procedure (EOP) - RESPONSE TO INADEQUATE CORE COOLING PROCEDURE NO. FRC-0.1A (Unit 1) and FRC-0.1B (Unit2)
- Emergency Operating Procedure (EOP) - RESPONSE TO DEGRADED CORE COOLING PROCEDURE NO. FRC-0.2A (Unit 1) and FRC-0.1B (Unit 2)
- The instrumentation and procedures discussed above provide the current guidance to the operators for detecting and responding to inadequate core cooling. Increasing CET temperature and/or decreasing reactor water level could be indications of fuel inlet blockage. The Emergency Response Organization would be monitoring this instrumentation and advising the operators.
- Luminant Power is currently evaluating the recommendations made by Westinghouse in guidance regarding the potential for debris to block core flow after transfer to cold leg recirculation, and will also evaluate any other recommendations made for mitigative strategies. After these evaluations are complete, revisions to EOPs or Operations/ERO training will be made if necessary.

Although these DID measures are not expected to be required based on the very low probability of an event that would result in significant quantities of debris being transported to the reactor vessel that would inhibit the necessary cooling of the fuel, they do provide additional assurance that the health and safety of the public would be maintained. These measures provide support for the extension of time required to completely address GL 2004-02 for Comanche Peak.

Conclusion

Luminant Power concludes that the GSI-191 resolution path for Comanche Peak is acceptable based on the information provided in this document. The execution of the actions identified in this document will result in successful resolution of GSI-191 and closure of GL 2004-02.

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

REFERENCES

1. Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors", dated September 13, 2004. [ADAMS Accession No. ML042360586]
2. SECY-12-0093, "Closure Options for Generic Safety Issue - 191, Assessment of Debris Accumulation On Pressurized-Water Reactor Sump Performance", dated July 9, 2012. [ADAMS Accession No. ML121310648]
3. SRM-SECY-12-0093, "STAFF REQUIREMENTS – SECY-12-0093 – CLOSURE OPTIONS FOR GENERIC SAFETY ISSUE - 191, ASSESSMENT OF DEBRIS ACCUMULATION ON PRESSURIZED-WATER REACTOR SUMP PERFORMANCE" dated December 14, 2012. [ADAMS Accession No. ML12349A378]
4. Letter from William Ruland (NRC) to John Butler (NEI), NUCLEAR REGULATORY COMMISSION REVIEW OF GENERIC SAFETY ISSUE-191 NUCLEAR ENERGY INSTITUTE REVISED SCHEDULE FOR LICENSEE SUBMITTAL OF RESOLUTION PATH, dated November 21, 2012. [ADAMS Accession No. ML12326A497]
5. Final Safety Evaluation for Pressurized Water Reactor Owners Group Topical Report WCAP-16793-NP, Revision 2, "EVALUATION OF LONG-TERM COOLING CONSIDERING PARTICULATE FIBROUS AND CHEMICAL DEBRIS IN THE RECIRCULATING FLUID", dated April 8, 2013. [ADAMS Accession Nos. ML13084A152 and ML13084A154]
6. WCAP-16793, Revision 2, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid", dated October, 2011. [ADAMS Accession No. ML11292A021]
7. Letter from John Butler (NEI) to Bill Ruland (NRC), GSI-191 – Current Status and Recommended Actions for Closure, dated May 4, 2012. [ADAMS Accession No. ML12142A316]
8. Letter TXX-09128 from Rafael Flores to the NRC dated October 13, 2009, [ADAMS Accession No. ML ML093080003] transmitting ER-ESP-001, Generic Letter 2004-02 Supplemental Response, Rev. 2 [ADAMS Accession No. ML ML093080004].

Comanche Peak Closure Option for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance

9. Letter dated April 19, 2010, from Balwant K. Singal (NRC) to Rafael Flores, COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2 -GENERIC LETTER 2004-02 SUPPLEMENTAL RESPONSE (TAC NOS. MC4676 AND MC4677) [ADAMS Accession No. ML100950564].
10. Letter from Timothy J. McGinty (NRC) to James M. Bleigh, Performance Contracting, Inc., "Performance Contracting, Inc., Large Flume Test Protocol" dated April 26, 2012. [ADAMS Accession No. 120480092]
11. SFSS-TD-2011-001 Rev. 0, SURE-FLOW® SUCTION STRAINER – LARGE FLUME TEST PROTOCOL (LFTP) ELEMENT ISSUES & RESOLUTION, February 13, 2012. [PROPRIETARY PCI Document]
12. Summary of February 28, 2013, Pre-licensing Conference Call Public Meeting with Luminant Generation Company LLC to Discuss the Generic Safety Issue (GSI)-191 Sump Strainer Test Protocols for Bypass and Head Loss Testing and Related Topics (TAC NOS. MC4676 AND MC4677) dated March 15, 2013. [ADAMS Accession No. ML130367A029]
13. NEI 02-01, "Condition Assessment Guidelines, Debris Sources inside Containment," Revision 1, dated September 2002. [ADAMS Accession No. ML 030420318]
14. NEI 04-07, "Pressurized Water Reactor Sump Performance Methodology," Revision 0, dated December 2004.
Volume 1 - Pressurized Water Reactor Sump Performance Evaluation Methodology. [aka, the Guidance Report (GR)]. [ADAMS Accession No. ML 050550138]
Volume 2 - Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Revision 0, December 6, 2004. [ADAMS Accession No. ML 050550138]
15. PWROG OG-12-287 dated July 20, 2012. [ADAMS Accession No. ML 12207A115]
16. PWROG OG-11-395 dated December 14, 2011. [ADAMS Accession No. ML 11354A248]
17. Letter from John Butler (NEI) to Stewart Bailey (NRC), Defense-In-Depth Measures in Support of GSI-191 Resolution Options, dated March 5, 2012. [ADAMS Accession No. ML120730654]