



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

April 24, 2015

Mr. Rafael Flores  
Senior Vice President and  
Chief Nuclear Officer  
Attention: Regulatory Affairs  
Luminant Generation Company LLC  
P.O. Box 1002  
Glen Rose, TX 76043

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2 – REVIEW OF COMPLIANCE WITH NRC ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER EA-12-051) (TACS NOS. MF0862 AND MF0863)

Dear Mr. Flores:

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13071A344), Luminant Generation Company, LLC (Luminant) submitted an Overall Integrated Plan (OIP) for Comanche Peak Nuclear Power Plant, Units 1 and 2 (CPNPP) in response to the March 12, 2012, U.S. Nuclear Regulatory Commission (NRC), "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (Order EA-12-051; ADAMS Accession No. ML12054A679). Additionally, on June 7, 2013 (ADAMS Accession No. ML13141A626), the NRC staff issued a request for additional information (RAI). By letters dated July 3, 2013, August 28, 2013, February 27, 2014, and August 28, 2014 (ADAMS Accession Nos. ML13193A014, ML13252A078, ML14071A009, and ML14253A186, respectively), Luminant submitted its RAI response and first three six-month updates to the OIP. The NRC staff issued the CPNPP interim staff evaluation and RAI on November 4, 2013 (ADAMS Accession No. ML13295A674). By letter dated December 16, 2014 (ADAMS Accession No. ML15016A188), Luminant submitted a report to the NRC staff stating that it had achieved full compliance with the requirements of Order EA-12-051.

The NRC staff has reviewed Luminant's December 16, 2014, compliance report and has determined that additional information is needed to complete its review. The NRC staff's questions are provided in the Enclosure. The NRC staff requests a response to the RAI within 30 days of the date of the letter. If any part of the requested information is not available within 30 days, please provide a date by which the information will be provided.

R. Flores

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If you have any questions, please contact me at 301-415-1544 or by e-mail at [Stephen.Monarque@nrc.gov](mailto:Stephen.Monarque@nrc.gov).

Sincerely,

A handwritten signature in cursive script that reads "Stephen Monarque".

Stephen Monarque, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos.: 50-445 and 50-446

Enclosure:  
Audit plan

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

NRC ORDER EA-12-051, "ISSUANCE OF ORDER TO MODIFY LICENSES WITH REGARD  
TO RELIABLE SPENT FUEL POOL INSTRUMENTATION"

COMPLIANCE REPORT

LUMINANT GENERATION COMPANY, LLC

COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 1 AND 2

DOCKET NOS. 50-445 AND 50-446

The NRC staff has reviewed Luminant Generation Company, LLC's (Luminant, the licensee) December 16, 2014, compliance report for Comanche Peak Nuclear Power Plant, Units 1 and 2 (CPNPP) and has determined additional information is needed in order for the NRC staff to complete its review. Please provide a response to the following requests for additional information (RAIs).

**RAI No. 1**

NRC Order EA-12-051, "Issuance of Order to Modify Licenses with regard to Reliable Spent Fuel Pool Instrumentation [SFPI]," Attachment 2, "Requirements for Reliable Spent Fuel Pool Level Instrumentation at Operating Reactor Sites and Construction Permit Holders," Section 1.2 states:

*Arrangement: The spent fuel pool level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the spent fuel pool. This protection may be provided by locating the primary instrument channel and fixed portions of the backup instrument channel, if applicable, to maintain instrument channel separation within the spent fuel pool area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the spent fuel pool structure.*

By letter dated November 4, 2013, the NRC staff issued the CPNPP interim staff evaluation (ISE) and RAI. The NRC staff stated in RAI No.2b:

Additional information describing how the proposed arrangement of the sensor probe assembly and routing of the cabling between the sensor probe assembly and the electronics in the Auxiliary Building meets the Order requirement to arrange the SFP level instrument channels in a manner that provides

Enclosure

reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

By letter dated December 16, 2014, Luminant provided the following response to RAI No. 2b:

Physical separation of the primary and backup instrument channel signal cables, to the extent practicable, is used to provide reasonable protection of the level indication function against missiles that may result from the damage to the structure over the SFP. This arrangement initially separates the raceway containing the signal cables by a distance comparable to the shortest length of a side of the pool. The sensors are located close to the side walls of the SFP and below the floor elevation to utilize the pool walls as inherent protection. In addition, the primary and backup signal and power cables are routed continuously in rigid steel conduit or flexible steel conduit and spaced in such a manner as to meet site requirements for Class 1E separation.

The spent fuel pool X-01 primary instrument channel sensor is mounted on the south side of the pool, near the east end. From the primary sensor, the primary coaxial signal cable raceway is routed west along the south side of the pool until it enters a fire/radiation barrier wall penetration to the adjacent Auxiliary Building 852' elevation, room X-235.

The spent fuel pool X-01 backup instrument channel sensor is mounted on the west end of the pool, near the south side wall. This places the backup sensor between the south side wall and the gate to the transfer canal, and a least 30 feet from the primary sensor. From the backup sensor, the backup coaxial signal cable raceway is routed west around the transfer canal until it enters a second fire/radiation barrier wall penetration to the adjacent Auxiliary Building 852' elevation, room X-235.

The spent fuel pool level instrumentation for pool X-02 is a mirror image of the instrument layout in X-01. In the Auxiliary Building the raceway for both pools maintain physical separation of the primary and backup instrument channel signal cables and power cables that meet site standards for separation for Class 1E conduit.

Based on the response, the NRC staff found that the SFP level instrument channel arrangement does not satisfy the separation requirement of the NRC Order EA-12-051. According to Attachment 2 of the letter, within the Fuel Building, the X-01 primary and backup signal cables are routed side by side from the southwest corner of the south pool to the wall penetration to the Auxiliary Building (AB). Similarly, the X-02 primary and backup signal cables are routed side by side from the northwest corner of the north pool to the wall penetration to the AB. In addition, the pull boxes for each instrument channel are mounted side by side. It is not clear whether the cable routing portions and the pull boxes described above have missile barriers installed.

The NRC staff requests additional information demonstrating that the SFP level instrument channels within the Fuel Building are either physically separated (other than 1E electrical separation) or missile protected to minimize the probability that damage due to internal missiles.

**RAI No. 2**

Order EA-12-051, Attachment 2, Section 1.3 states:

*Mounting: Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.*

In its November 4, 2013, ISE and RAI letter to CPNPP, the NRC staff stated the following in RAI No. 3:

Please provide the results of the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including, design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

By letter dated December 16, 2014, Luminant provided the following response to RAI No 3:

Using the Level Transmitter maximum weight provided by Westinghouse drawing 10116D44 (VDRT-4749939) and the coaxial cable weight provided by Westinghouse specification WNA-DS-02957-GEN (VDRT-4770033), a conservative total load was taken. This load was compared to the allowable bolt loads per DBD-CS-015. Through the result of this comparison, the mounting was determined to adequately meet Seismic Category II requirements. The support and mounting for the Remote Display panels is qualified per site calculation CS-CA-0000-55 19, Revision 0.

The SFPLIS conduit is field run and is supported with 0210-TC0-0002 drawing series typical supports. These supports are pre-qualified by calculation CS-CND-TC-TC0-0002 for Seismic Category II requirements.

Based on the response, the NRC staff found that the CPNPP Seismic Category II mounting for SFP level instrument does not meet the Order EA-12-051 mounting requirement. Even though the SFP level instrumentation system is non-safety related, the mounting shall be designed considering the maximum seismic ground motion to the design-basis of the SFPI structures to meet the requirements of the order.

The NRC staff requests additional information demonstrating that the SFP level instrument mountings meet the mounting requirements of Order EA-12-051. For each mounting and

mounting support, information should be provided including CPNPP documentation with site-specific conditions/assumptions, such as the site's design-basis response spectrum for each elevation, pool sizes (hydraulic/sloshing calculation for the probe and mounting bracket), etc. accounted for. Please make available on e-portal for NRC staff review the site-specific seismic calculations (not Westinghouse's generic calculations) for the following:

- Probes and mounting brackets including sloshing calculation
- Pull Boxes
- Transmitter mountings
- Electronics enclosures
- Conduit supports

**RAI No. 3**

Order EA-12-051, Attachment 2, Section 1.3 states:

*Mounting: Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.*

In its November 4, 2013, ISE and RAI letter to CPNPP the NRC staff stated the following in RAI No. 4:

For each of the mounting attachments required to attach SFP Level equipment to plant structures, please describe the design inputs, and the methodology that was used to qualify the structural integrity of the affected structures/equipment.

By letter dated December 16, 2014, Luminant provided the following response RAI No 4:

The design input and qualification methodology will be consistent with the current seismic design for existing plant structures/ equipment.

The mounting attachments are qualified by analysis. With the exception of the level sensor probe mounting bracket, all the system equipment is seismically qualified by testing. The outputs of the seismic test of all equipment were used as the design input for the qualification of the mounting for that specific equipment.

The mounting bracket for the sensing probe was designed according to the plant design basis for SSE seismic hazard curve at the appropriate plant elevation. Loads that were considered in the evaluation of the bracket and its mounting are: 1- Static loads including the dead weight of the mounting bracket in addition to the weight of the level sensing instruments, pipe guard and cabling; 2- Dynamic loads including the seismic load due to excitation of the dead weight of the system in addition to the hydrodynamic

effects resulting from the excitation of the Spent Fuel Pool Water. A response spectra analysis was performed for the seismic evaluation of the mounting bracket using a Finite Element Analysis (GTSTRUDL software) and using floor response spectrum at the operating deck elevation. Hydrodynamic effects on the mounting bracket were evaluated using TID-7024 and added to the GTSTRUDL model. Plant acceptance criteria and applicable codes were used for the design of the bracket and its anchorage. CPNPP- specific analyses were completed, with the results provided in Westinghouse documents CN-PEUS-13-29 and CN-PEUS-13-30 (proprietary).

As to the concern the NRC staff raised in Follow-up RAI No. 3 above, CPNPP Seismic Category II mounting for SFP level instrument does not meet the mounting requirements of Order EA-12-051. Even though the SFP level instrumentation system is non-safety related, the mounting shall be designed considering the maximum seismic ground motion to the design-basis of the SFP structures to meet the order requirement.

The NRC staff requests additional information demonstrating that the SFP level instrument mountings meet the mounting requirements of the order. For each mounting and mounting support, information should be provided including CPNPP documentation with site-specific conditions/assumptions such as the site's design-basis response spectrum for each elevation, pool sizes (hydraulic/sloshing calculation for the probe and mounting bracket), etc. accounted for. Please make available on e-portal for NRC staff review the site-specific seismic calculations (not Westinghouse's generic calculations) for the following:

- Probes and mounting brackets including sloshing calculation
- Pull Boxes
- Transmitter mountings
- Electronics enclosures
- Conduit supports

**RAI No. 4**

Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation", Section 3.4 states, in part:

*The instrument channel reliability shall be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters, as described in the paragraph[s] below:*

- *effects of shock and vibration on instrument channel components used during any applicable event for only installed components*

In its letter November 4, 2013, the NRC staff issued the CPNPP ISE and RAI, in particular, RAI No. 7.

By letter dated December 16, 2014, Luminant submitted a response to RAI No 7. The NRC staff evaluated Luminant's response and has determined that since shock and vibration testing was not performed by Westinghouse, Luminant needed to demonstrate that the transportation and installation of the SFP level instrument did not impact the system designed configuration and performance. Luminant is requested to make available on e-portal for NRC staff review the Site Acceptance Test report, including the following:

- The system's post installation as-found accuracy and tolerance

**RAI No 5**

Order EA-12-051, Attachment 2, Section 1.3 states:

*Mounting: Installed instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure.*

In its November 4, 2013, ISE and RAI letter to CPNPP the NRC staff stated in RAI No. 8:

Please provide analysis of the seismic testing results and show that the instrument (including wireless technology) performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at CPNPP has been adequately demonstrated. Include information describing the design inputs and methodology used in any analyses of the mountings of electronic equipment onto plant structures, as requested in RAI #4 above.



By letter dated December 16, 2014, Luminant provided the following response to RAI No 8, in part:

The Westinghouse SFPIS, including the four pool-side brackets, is qualified as Seismic Category I per IEEE [Institute of Electrical and Electronics Engineers] Std 344-2004. The testing and analysis demonstrate that the SFPIS meets the seismic performance requirements of Westinghouse design specification WNA-DS-02957-GEN (proprietary). The Required Response Spectra (RRS) for this program includes the 10% margin recommended by IEEE Std 323-2003. The seismic test and analysis results are documented in the proprietary Westinghouse test reports, EQ- QR-269 and WNA-TR-03 149-GEN (proprietary). Even though the Westinghouse SFPIS is qualified to Seismic Category I, as noted in the Response to RAI #3, the system as a whole (e.g., display units, transmitter units, conduit routing) is considered Seismic Category II.

Based on the response, the NRC staff found that the CPNPP Seismic Category II mounting for SFP level instrument does not meet the mounting requirements of Order EA-12-051. Even though the SFP level instrumentation system is non-safety related, the mounting shall be designed considering the maximum seismic ground motion to the design-basis of the SFP structures to meet the order requirement.

The NRC staff requests additional information demonstrating that the SFP level instrument mountings meet the order mounting requirement. For each mounting and mounting support, information should be provided including CPNPP documentation with site-specific conditions/assumptions such as the site's design basis response spectrum for each elevation, pool sizes (hydraulic/sloshing calculation for the probe and mounting bracket), etc. accounted for. Please make available on e-portal for NRC staff review the site-specific seismic calculations (not Westinghouse's generic calculations) for the following:

- Probes and mounting brackets including sloshing calculation
- Pull Boxes
- Transmitter mountings
- Electronics enclosures
- Conduit supports

**RAI No 6**

Order EA-12-051, Attachment 2, Section 1.6 states:

*Power supplies: Permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant ac and dc power distribution systems, such as portable generators or replaceable batteries. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.*

In its November 4, 2013, ISE and RAI letter to CPNPP, the NRC Staff stated the following in RAI No. 9:

Please provide the NRC staff with the final configuration of the power supply source for each channel so that the staff may conclude that the two channels are independent from a power supply assignment perspective.

By letter dated December 16, 2014, Luminant provided the following response to RAI No 9:

Each SFPIS channel of equipment has an independent power supply and an independent UPS with 24V battery backup. The SFP level can be monitored for a minimum of 3 days under station blackout conditions with battery power only.

The primary and backup level instruments in each pool receive normal power from dedicated breakers in separate Class Non-IE lighting panels, AB20 and AB19. These lighting panels are fed from different buses, independent back to the 480V switchgear crossties, reducing the occasions when both are de-energized at the same time. See below.

<u>CHANNEL</u>	<u>NORMAL PWR</u>	<u>480V MCC</u>	<u>480V SWGR</u>
X-01 Primary Loop	AB20	MCC XB1-3	480V SWGR 1B1/SWGR 2B1
X-01 Backup Loop	AB19	MCC XB3-4	480V SWGR 1B3/SWGR 2B3
X-02 Primary Loop	AB20	MCC XB1-3	480V SWGR 1B1/SWGR 2B1
X-02 Backup Loop	AB19	MCC XB3-4	480V SWGR 1B3/SWGR 2B3

If power is not restored to the normal power sources before batteries are depleted, all four SFP level instruments can be powered from either Class 1E Train A lighting panel EAB1 or Class 1E Train B lighting panel EAB2, using the bulkhead connector in each SFPLIS remote display panel. NOTE: EAB1 or EAB2 are included in the panels to be supplied by a portable generator as part of the mitigating strategies in response to NRC Order EA-12-049.

The NRC staff needs further information on how the SFP level instruments are powered from Train A lighting panel EAB1 and Train B lighting panel EAB2. Please make available on e-portal for the NRC staff review procedure(s) containing the instructions for powering SFP level instruments before the batteries deplete.

**RAI No. 7**

Order EA-12-051, Attachment 2, Section 1.8 states:

*Testing: The instrument channel design shall provide for routine testing and calibration.*

In its November 4, 2013, ISE and RAI letter to CPNPP, the NRC Staff stated the following in RAI No. 12b:

A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.

By letter dated December 16, 2014, Luminant provided the following response to RAI No 12b:

Periodic recording of SFP level readings during normal operating conditions, using the SFPIS instrumentation, will be included in Operator rounds to assist in early detection of any "off normal" readings which may indicate channel adjustment is required.

The channel accuracy requirements are identified in WNA-DS-02957-GEN (proprietary) and demonstrated by the channel accuracy calculation, WNA-CN-00301-GEN (proprietary). Both SFP primary and backup redundant sensor electronics require periodic calibration verification to check that the channel's measurement performance is within the specified tolerance ( $\pm 3$  inches). If the difference is larger than the allowable tolerance during the verification process, an electronic output verification/ calibration will be required. If the electronic output verification/calibration does not restore the performance, a calibration adjustment will be required.

The electronic output verification/ calibration will verify electronics are

working properly using simulated probe signals.

The calibration adjustment is performed to restore level measurement accuracy be within the acceptance criteria at 0%, 25%, 50%, 75%, and 100% points of the full span.

The calibration acceptance criteria and procedures are defined in the proprietary Westinghouse procedure WNA-TP-04709-GEN.

The Westinghouse proprietary documents described above can be made available upon request.

The SFPLI probe mounting brackets for each side may have different profiles and therefore requires a specific calibration procedure for in-situ testing. Please make available on e-portal for NRC staff review the CPNPP calibration procedure, which includes, but is not limited to, the following:

- In-situ testing
- Acceptance criteria for accuracy and tolerance
- Functional check
- Channel check

**RAI No. 8**

Please provide an analysis with a table listing all possible pool interconnections and separation conditions with gate combinations, and the available number(s) of level indication for each pool under those conditions. The analysis should also consist the following:

- Assuming one instrument is out-of-service, describe in detail the compensatory measures to assure that reliable level monitoring still exists for each pool under those gate operating conditions.
- Assuming more than one instrument out-of-service, describe in detail the compensatory measures to assure that reliable level monitoring still exists for each pool under those gate operating conditions.

R. Flores

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If you have any questions, please contact me at 301-415-1544 or by e-mail at Stephen.Monarque@nrc.gov.

Sincerely,

*/RA/*

Stephen Monarque, Project Manager  
Orders Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos.: 50-445 and 50-446

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