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

March 15, 2013

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, UNIT 1 – REQUEST FOR RELIEF NO. B-2 FROM REACTOR VESSEL HOT-LEG NOZZLE WELD EXAMINATION REQUIREMENTS FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. MF0507)

Dear Mr. Flores:

By letter dated January 16, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13029A592), as supplemented by letter dated February 7, 2013 (ADAMS Accession No. ML13046A054), Luminant Generation Company LLC (the licensee) submitted Request for Relief No. B-2, to the U.S. Nuclear Regulatory Commission (NRC) for use of an alternative to certain requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, related to inservice inspection (ISI) of welds for the third 10-year ISI interval at Comanche Peak Nuclear Power Plant (CPNPP), Unit 1. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(g)(5)(iii), the licensee requested to use alternatives on the basis that complying with the specified requirement is impractical.

The NRC staff has reviewed the request and concludes, as set forth in the enclosed safety evaluation, that the proposed alternatives for weld ISI would provide reasonable assurance of leak-tightness and structural integrity of the welds identified in the relief request and that complying with the specified ASME Code, Section XI, requirements, is impractical. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), the NRC staff grants the licensee's proposed Request for Relief No. B-2 for the duration of the third 10-year ISI interval, currently scheduled to end on August 12, 2020.

All other ASME Code, Section XI, requirements for which relief has not been specifically requested, remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact Balwant K. Singal at 301-415-3016 or by e-mail at Balwant.Singal@nrc.gov.

Sincerely,

CF Lyon for

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-445

Enclosure:
As stated

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF NO. B-2

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL PROGRAM

LUMINANT GENERATION COMPANY LLC

COMANCHE PEAK NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-445

1.0 INTRODUCTION

By letter dated January 16, 2013 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML13029A592), as supplemented by letter dated February 7, 2013 (ADAMS Accession No. ML13046A054), Luminant Generation Company LLC (Luminant, the licensee) requested relief from certain weld examination requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Appendix VIII, for the third 10-year inservice inspection (ISI) interval, at the Comanche Peak Nuclear Power Plant (CPNPP), Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(g)(5)(iii), the licensee requested to use the alternative described in Request for Relief No. B-2 to examine hot-leg welds on the basis that the ASME Code requirement is impractical. Request for Request No. B-2 provides an alternative for the depth-sizing of ultrasonic examination for the reactor coolant system hot-leg dissimilar metal (DM) welds.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The regulations in 10 CFR 50.55a(g)(5)(iii) state that

> If the licensee has determined that conformance with a code requirement is impractical for its facility, the licensee shall notify the NRC and submit, as specified in § 50.4, information to support the determinations. Determinations of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the code requirements during the inservice inspection interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought.

The regulations in 10 CFR 50.55a(g)(6)(i) state that

> The Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Based on the above, and subject to the following technical evaluation, the NRC staff concludes that regulatory authority exists for the licensee to request and the NRC staff to grant the relief requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 RELIEF REQUEST B-2

3.1.1 ASME Code Components Affected

The affected components are the Class 1, R-A, R1.15 (formerly Code Examination Category B-F, B5.10) (Code Case N-770-1 Category A-2) Reactor Pressure Vessel (RPV) nozzle to safe-end dissimilar metal (DM) butt welds, as follows:

> TBX 1-4100-1 Loop 1 Hot Leg Nozzle to Safe End DM Weld
> TBX 1-4200-1 Loop 2 Hot Leg Nozzle to Safe End DM Weld
> TBX 1-4300-1 Loop 3 Hot Leg Nozzle to Safe End DM Weld
> TBX 1-4400-1 Loop 4 Hot Leg Nozzle to Safe End DM Weld

In its letter dated January 16, 2013, the licensee stated that the outlet nozzle safe-end dimensions are 35.35 inches outside diameter (OD) by 27.88 inches inside diameter (ID) by 3.13 inches long. The material is SA-182 Type F-316. By letter dated February 7, 2013, the licensee clarified that the actual outlet nozzle safe-end dimensions are 34.82 inches OD by 27.88 inches ID with a wall thickness of 2.93 inches. In addition, the licensee stated that the pipe material is cast stainless steel, SA-351-CF8A; the weld is stainless steel; the safe end is

stainless steel, F-316L; the DM weld is Alloy 182; the nozzle is carbon steel, SA-508; and the nozzle cladding is stainless steel.

3.1.2 Applicable Code Edition and Addenda

The applicable edition and addenda of Section XI of the ASME Code is the 1998 Edition through the 2000 Addenda. In addition, as required by 10 CFR 50.55a, the ASME Code, Section XI, 2001 Edition is used for Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems."

3.1.3 Applicable Code Requirements (as stated by the licensee)

> The volumetric examination specified by Examination Category R-A, Item R1.15, "RPV nozzle to safe-end DM butt welds" will be performed using the ultrasonic (UT) examination method described in IWA-2232 and Appendix I. Appendix I, I-2220 requires that ultrasonic examination procedures, equipment, and personnel be qualified by performance demonstration in accordance with Appendix VIII. Instead of the Appendix VIII qualification requirements, Luminant is using NRC-approved Code Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds."
>
> Code Case N-695 provides an alternative to the Appendix VIII, Supplement 10 requirements for the qualification requirements of DM welds. Paragraph 3.3(c) [of Code Case N-695] indicates examination procedures, equipment, and personnel are qualified for depth-sizing when the Root Mean Square (RMS) error of the flaw depth measurements, as compared with the true depths, does not exceed 0.125 inches.

3.1.4 Reason for Request (as stated by the licensee)

> Luminant will be performing volumetric examinations of the RPV nozzle-to-safe end dissimilar metal welds from the inside surface during the upcoming 1RF16 outage (April 2013) and will implement the alternative requirements of ASME Code Case N-695. Code Case N-695 requires that qualified procedures and personnel shall demonstrate a flaw depth-sizing error less than or equal to 0.125 inch root mean square (RMS). This relief request is being submitted due to the impracticality of meeting the required 0.125 inch RMS error value required by Code Case N-695. The nuclear power industry has attempted to qualify personnel and procedures for depth-sizing examinations performed from the inside surface of dissimilar metal welds since November 2002. To date, no inspection vendor has met RMS error requirements of Code Case N-695.
>
> The inability of examination procedures to achieve the required RMS error value is primarily due to a combination of factors such as surface condition (e.g., roughness), scan access, base materials, and the dendritic structure in the welds themselves. The combination of these factors has proven too difficult for vendors to achieve an RMS error value that meets the established requirements.

In its letter dated January 16, 2013, the licensee also stated that:

> The most recent attempt at achieving 0.125 inch RMS error was in early 2008. This attempt, as well as previous attempts, did not achieve the required RMS error value. The qualification attempts have been substantial. The attempts have involved multiple vendors, ultrasonic instruments, personnel, and flaw depth-sizing methodologies, all of which have been incapable of achieving the 0.125 inch RMS error value.

3.1.5 Proposed Alternative and Basis for Use (as stated by the licensee)

Luminant proposes using an alternative depth-sizing RMS error value greater than the 0.125 inch RMS error value stated in ASME Code Case N-695 for the examination of [the subject welds]. Luminant proposes to use an RMS error of 0.189 inches (based on the results achieved by Luminant's examination vendor) instead of the 0.125 inches required for Code Case N-695.

In the event a flaw is detected that requires depth sizing, Luminant proposes that the following method for reporting flaw through-wall sizes shall be used:

- For flaw(s) detected and measured as less than 50% through-wall in depth, the depth shall be adjusted by adding the difference between the required RMS error and the demonstrated RMS error to the measured through-wall extent for comparison with applicable ASME Section XI acceptance criteria. The practice of adjusting the measured RMS error value by adding the difference between the required RMS error value and the vendor demonstrated RMS error value is further supported by Electrical Power Research Institute (EPRI) Materials Reliability Program (MRP) document MRP 2012-046 [Enclosure to letter dated January 16, 2013]. This document utilizes a statistical approach to provide a technical justification that validates the aforementioned RMS error adjustments.

- For flaw(s) detected and measured as 50% through-wall in depth or greater, the depth shall also be adjusted by adding the difference between the required RMS error and the demonstrated RMS error to the measured through-wall extent for comparison with applicable ASME Section XI acceptance criteria. Additionally, for flaw(s) detected and measured as 50% through-wall in depth or greater which are to remain in service without mitigation or repair, Luminant shall submit flaw evaluations including ID profiling information of the weld, pipe, and nozzle at and in the region of the flaw, and confirmation whether the flaw)s) are surface breaking, as determined by eddy current, to the NRC for review and approval prior to reactor startup.

If the examination vendor demonstrates an improved depth sizing RMS error prior to the examination, the excess of that improved RMS error over the 0.125 inch RMS error requirement, if any, will be added to the measured value for comparison with applicable acceptance criteria. In the event that an

indication is detected that requires depth sizing, a process will be used where the difference between the required RMS error and vendor demonstrated RMS error will be added to the measured through-wall depth. This amended through-wall depth will then be used to determine the acceptability of the indication, as follows:

- For planar indications that are not connected to the inside surface, the amended through-wall depth will be compared with the Section IWB-3500 acceptance criteria.

- For planar indications that are connected to the inside surface, an IWB-3600 evaluation will be performed.

The proposed alternative assures that the DM nozzle-to-safe-end welds will be fully examined by procedures, personnel and equipment qualified by demonstration in all aspects except depth sizing. Therefore, it will assure that there is reasonable assurance of structural integrity and thus, will provide an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(g)(5)(iii), relief is requested to use this alternative depth-sizing error due to impracticality.

3.1.6 Duration of Proposed Alternative

In the January 16, 2013, submittal, the licensee stated that the proposed relief request is applicable to the CPNPP, Unit 1 third 10-year ISI interval, refueling outage 1RF16. By letter dated February 7, 2013, the licensee clarified that the proposed relief request is applicable for the 1RF16 refueling outage and for future similar examinations of the reactor vessel hot-leg nozzle DM welds that may occur during the third 10-year ISI interval for CPNPP, Unit 1. The end date for the third 10-year ISI interval for Unit 1 is August 12, 2020. Refueling outage 1RF16 is scheduled to begin on March 30, 2013. The reactor vessel nozzle DM weld examinations are scheduled to occur in April 2013.

3.2 NRC Staff Evaluation

The licensee has requested relief from the requirements of the ASME Code, Section XI, Appendix VIII, Supplement 10. The licensee proposed to use Code Case N-695 to satisfy the requirements of the ASME Code, Section XI, Appendix VIII, Supplement 10. Code Case N-695 requires that procedures used to inspect welds from the inside surface of the pipe be qualified by performance demonstration. The acceptance criterion in Code Case N-695 specifies that the RMS error of the examination procedures shall not be greater than 0.125 inches. The licensee could not meet the RMS error value in Code Case N-695 and proposed an alternative to meet the acceptance criterion in Code Case N-695.

The NRC staff has confirmed that since 2002, the industry has not been able to satisfy the RMS error acceptance criterion of less than 0.125 inches when qualifying the UT inspection procedures performed from the inside surface of a pipe. The NRC staff concludes that this inability to qualify inside surface UT inspection techniques in accordance with ASME Code Case N-695 constitutes an impracticality as described in 10 CFR 50.55a(g)(5)(iii).

To address the issue of increased potential for under sizing of flaws by inside surface UT inspection procedures which do not meet the ASME Code Case N-695 acceptance criterion, the NRC staff, in July 2012, in conjunction with personnel from the Performance Demonstration Initiative, examined the proprietary UT examination data set compiled from all attempts to date to qualify inside surface UT inspection procedures to the acceptance criterion contained in ASME Code Case N-695. Based on this examination, the NRC staff concluded that:

(a) For flaw depths less than or equal to 50 percent pipe wall thickness, a flaw could be appropriately depth sized if a correction factor is added to the measured flaw depth such that the adjusted flaw depth is equal to the measured flaw depth plus the difference between the vendor procedure qualification RMS error and 0.125 inches (procedure qualification RMS error - 0.125).

(b) For flaw depths greater than 50 percent wall thickness, the variability of sizing errors is sufficiently large that no single mathematic flaw size adjustment formula is sufficient to provide reasonable assurance of appropriate flaw depth sizing. As a result, the NRC staff finds it necessary to evaluate the flaws that have depth greater than 50 percent through wall on a case-by-case basis.

To address the measurement uncertainty in flaw depth sizing when examining welds from the inside surface and to provide reasonable assurance of the structural integrity of examined welds, the NRC staff determined that the following compensatory measures shall be applied to any proposed alternative examination:

(1) Examine the welds under consideration using a UT technique, which is qualified for flaw detection and length sizing.

(2) For flaw(s) with measured depth of less than 50 percent of the wall thickness, the depth shall be adjusted by adding the measured flaw depth to the difference between the procedure qualification RMS error and 0.125 inches (i.e., procedure qualification RMS error - 0.125).

(3) For flaw(s) with measured depth of greater than 50 percent of the wall thickness, either the degraded weld needs to be repaired in accordance with the ASME Code, or, a flaw evaluation needs to be submitted to the NRC for review and approval prior to reactor startup. In addition, the flaw depth reported and analyzed in the flaw evaluation shall also be adjusted by adding the measured flaw depth to the difference between the procedure qualification RMS error and 0.125 inches (i.e., procedure qualification RMS error - 0.125).

(4) In addition to information normally contained in flaw evaluations performed in accordance with the ASME Code, Section XI, IWB-3600, the submitted flaw evaluation shall include: (a) information concerning the degradation mechanism which caused the crack, (b) information concerning the surface roughness and/or profile in the area of the examined pipe and/or weld, and (c) information concerning areas in which the UT probe may "lift off' from the surface of the pipe and/or weld.

(5) Perform eddy current examination(s) to confirm whether a flaw is connected to the inside surface of the pipe and/or weld.

Section 6 of Attachment 1 of the licensee's letter dated January 16, 2013, states that the measured flaw size will be adjusted by adding the difference between the demonstrated RMS error (i.e., 0.189 inches) and the required RMS error (i.e., 0.125 inches) to the measured flaw size. This implies that the measure flaw depth will be increased by a correction factor of 0.064 inches (0.189-0.125). ASME Code, Section XI, IWA-3310 provides requirements under which a subsurface flaw must be considered as a surface-breaking flaw based on the flaw's proximity to the pipe surface. If a subsurface flaw is detected in the affected welds, nozzle, safe end, or pipe, the flaw would have two ends (crack tips). One end would be located closer to the inside surface of the pipe and/or weld and the other end would be located closer to the outside surface of the pipe. In a request for additional information (RAI) dated January 29, 2013 (ADAMS Accession No. ML13029A738), the NRC staff requested that the licensee discuss how the correction factor of 0.064-inch would be added to the measured flaw depth. The NRC staff also requested the licensee to confirm whether eddy current testing would be used to verify whether any subsurface flaw regardless of depth is surface-breaking.

By letter dated February 7, 2013, the licensee clarified that for an embedded planar flaw, the 0.064-inch correction factor will be added to the bottom tip (nearest to the ID) response. The total through-wall extent and near surface tip or "S" dimension, used for determination of surface proximity, will also add the adjusted conservative measurement value of 0.064-inches to the computed flaw depth. In addition, the licensee stated that eddy current is used for the examination of the entire ID surface of the inspection area during the detection scans. The eddy current results will be used to help verify the ID surface connectivity of all reported flaws.

The NRC staff concludes that the licensee is consistent with the NRC staff suggested compensatory measures as discussed because (1) the licensee will add the correction factor to the crack tip that is closer to the ID surface, and (2) the licensee will use eddy current testing to verify whether an embedded flaw is connected to inside surface.

Section 6 of the licensee's letter dated January 16, 2013, states, in part, that "for planar indications that are connected to the inside surface, an IWB-3600 evaluation will be performed." The Code of record, 1998 Edition through 2000 Addenda of the ASME Code, Section XI, permits a detected flaw to be dispositioned by the acceptance standards of IWB-3514. The ASME Code does not require the licensee to perform a flaw evaluation if the flaw is accepted by IWB-3514. However, if the flaw is connected to the inside surface of the nickel-based dissimilar metal weld, the NRC staff believes that the flaw needs to be evaluated regardless of size, even if it is accepted by IWB-3514. The NRC staff is concerned regarding crack growth of primary water stress-corrosion cracking (PWSCC) affecting the structural integrity of the nickel-based DM weld. Also, starting from the 2007 Edition of the ASME Code, Section XI, the acceptance standards of IWB-3514 are not applicable to flaws connected to the inside surface of the nickel-based DM welds. Therefore, the NRC staff requested the licensee to confirm that an IWB-3600 evaluation will be performed for any size flaw as long as it is connected to the inside surface of the nickel based DM weld. The NRC staff also requested the licensee to confirm that when performing a flaw evaluation based on IWB-3600 for an inside surface-connected flaw, the flaw growth will be calculated based on the degradation mechanisms of PWSCC and fatigue.

In a letter dated February 7, 2013, the licensee clarified that the statement in Section 6 of the relief request is not meant to suggest that ID surface connected flaws will not be compared to the acceptance standards of IWB-3500. The intent is that all flaws, either ID connected or embedded, will be compared to the acceptance standards of IWB-3500. Additionally, the licensee will evaluate any flaw determined to be ID surface-connected per IWB-3600, whether or not an evaluation per IWB-3500 requires an IWB-3600 analytical evaluation. The licensee stated that a flaw evaluation based on IWB-3600 for an inside surface-connected flaw will calculate flaw growth based on the degradation mechanisms of PWSCC and fatigue.

The NRC staff notes that a flaw evaluation will provide information regarding the structural integrity of a weld degraded by PWSCC. The NRC staff concludes that the licensee will evaluate an inside surface-connected flaw per the ASME Code, Section XI, IWB-3600 regardless of the size of the flaw.

In summary, the NRC staff concludes that the proposed alternative in Request for Relief No. B-2 does satisfy the NRC staff's suggested compensatory measures as described above. Therefore, the NRC staff determines that the proposed alternative to the RMS error acceptance criterion of ASME Code Case N-695 does not degrade the ability of the examination to identify a loss of structural integrity or leak tightness in the subject welds.

4.0 CONCLUSION

Based on the above, the NRC staff concludes that the licensee will follow the NRC suggested compensatory measures when dispositioning flaws detected in the subject welds. The NRC staff determines that granting Request for Relief No. B-2 pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants the licensee's Request for Relief No. B-2 for the duration of the third 10-year ISI interval, currently scheduled to end on August 12, 2020, at CPNPP, Unit1.

All other ASME Code, Section XI, requirements for which relief has not been specifically requested, remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: John Tsao, NRR/DE/EPNB

Date: March 15, 2013

If you have any questions, please contact Balwant K. Singal at 301-415-3016 or by e-mail at Balwant.Singal@nrc.gov.

Sincerely,

/RA by CFLyon for/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-445

Enclosure:
As stated

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ADAMS Accession No. ML13056A503 ***Memo dated 2/15/13**

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