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

September 15, 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, UNIT 2 – RELIEF REQUEST 2C3-1 FOR REACTOR PRESSURE VESSEL HEAD FLANGE SEAL LEAK-OFF PIPING FOR RELIEF FROM CERTAIN ASME CODE INSPECTION REQUIREMENTS FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. MF5780)

Dear Mr. Flores:

By letter dated February 24, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15065A042), as supplemented by letter dated May 13, 2015 (ADAMS Accession No. ML15146A053), Luminant Generation Company LLC (the licensee) submitted Relief Request 2C3-1 to the U.S. Nuclear Regulatory Commission (NRC) for Comanche Peak Nuclear Power Plant, Unit 2, for the third 10-year inservice inspection (ISI) interval.

The licensee requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI for the reactor pressure vessel (RPV) head flange seal leak-off piping system leakage test. Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(z)(2), the licensee proposed an alternative system leakage test for the RPV head flange leak-off piping on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in level of quality and safety.

The NRC staff has reviewed the request and determined, as set forth in the enclosed safety evaluation, that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the RPV head flange seal leak-off piping and that complying with the specified ASME Code requirement would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of this alternative for the third 10-year ISI interval, which began on August 3, 2014, and is scheduled to end on August 2, 2023.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

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

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-446

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST 2C3-1

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

LUMINANT GENERATION COMPANY LLC

COMANCHE PEAK NUCLEAR POWER PLANT, UNIT 2

DOCKET NO. 50-446

1.0 INTRODUCTION

By letter dated February 24, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15065A042), as supplemented by letter dated May 13, 2015 (ADAMS Accession No. ML15146A053), Luminant Generation Company LLC (the licensee) submitted Relief Request 2C3-1 to the U.S. Nuclear Regulatory Commission (NRC) for Comanche Peak Nuclear Power Plant (CPNPP), Unit 2, for the third 10-year inservice inspection (ISI) interval.

The licensee requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI for the reactor pressure vessel (RPV) head flange seal leak-off piping system leakage test. Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(z)(2), the licensee proposed an alternative system leakage test for the RPV head flange leak-off piping on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), the 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.

Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements of this Section would

Enclosure

result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Component Affected

The component affected is ASME Code Class 2 RPV flange seal leak-off ¾-inch nominal pipe size (NPS) piping. In accordance with IWC-2500 (Table IWC-2500-1), this component is classified as Examination Category C-H, Item Number C7.10.

The licensee stated that the material of construction of the seal leak-off piping (Line Numbers: RC-2-080, RC-2-081, and RC-2-082) is SA376 Type 304 or Type 316 stainless steel.

3.2 Applicable Code Edition and Addenda

The Code of record for the third 10-year ISI interval is the 2007 Edition through 2008 Addenda of the ASME Code.

3.3 Duration of Relief Request

The licensee submitted this request for the third 10-year ISI interval, which started on August 3, 2014, and is scheduled to end on August 2, 2023.

3.4 ASME Code Requirement

The ASME Code, Section XI, IWC-2500, Table IWC-2500-1, Examination Category C-H, Item No. C7.10 requires the system leakage test be conducted according to IWC-5220 and the associated VT-2 visual examination according to IWA-5240 during each inspection period. As required by IWC-5221, the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy technical specification surveillance requirements).

3.5 Proposed Alternative

The licensee proposed an alternative to IWC-5221 requirements. To conduct the system leakage test and associated VT-2 visual examination of the RPV head flange seal leak-off piping during each inspection period, the licensee proposed to subject the piping to the static pressure head, developed from the elevation of at least 24 feet and 5.5 inches of normal refueling water above the reactor vessel closure flange when the reactor cavity is flooded for refueling (i.e., 10.6 pounds per square inch (psi)).

3.6 Basis for Use

The licensee has stated that it will follow the IWA-5213 requirements for test condition holding time and the IWA-5240 requirements for conducting the associated VT-2 visual examinations.

As stated by the licensee in its letter dated February 24, 2015, in part;

> The Reactor Pressure Vessel (RPV) head flange seal leak detection piping is separated from the reactor coolant pressure boundary by a passive membrane, which is an O-ring located on the inner vessel flange as shown in Attachment 2 [of licensee's letter dated February 24, 2015]. A second O-ring is located on the outside of the tap in the vessel flange. Failure of the inner O-ring is the only condition under which this line is pressurized. Therefore, the line is not expected to be pressurized during the system pressure test following a refueling outage.
>
> During normal operation, the inner O-ring isolation valve is open. Should the inner O-ring leak, a high temperature alarm actuates at 140 degrees[Fahrenheit (°F)] in the control room, informing the operator of the leak. The operator monitors reactor vessel flange leak-off temperature in accordance the CPNPP alarm procedures (ALM-053Afor Unit 1 and ALM-053B for Unit 2) and closes the valve, isolating the leak. The procedure directs shutting the manual isolation valve and opening another valve, transferring the reactor coolant system (RCS)] pressure boundary maintenance to the outer O-ring. Opening the valve then transfers leak detection to the outer O-ring. All drainage/leakage is piped to the reactor coolant drain tank. The plant procedure also addresses notifying chemistry department to increase monitoring of the containment atmosphere to detect possible outer O-ring failure; perform an operations test to determine leakage rate as applicable; and initiating corrective action documents to identify the condition and correct the condition as applicable.

In its letter dated February 24, 2015, the licensee further stated, in part;

> [T]he flange seal leak-off line is essentially a leakage collection/detection system and the line would only function as a Class 2 pressure boundary if the inner O-ring fails, thereby pressurizing the line. If any significant leakage does occur in the leak-off line piping itself during this time of pressurization then it would clearly exhibit boric acid accumulation and be discernable during the proposed VT-2 visual examination that will be performed unpressurized as proposed in this request.
>
> There has been no known evidence of corrosion, stress corrosion cracking, or fatigue in the subject flange leak-off piping at [CPNPP]. Database searches for the subject lines in the [CPNPP] Corrective Action Program identified no historical instances of degradation.

The subject lines are also not insulated.

3.7 Basis for Hardship

In its letter dated February 24, 2015, the licensee stated, in part, that

> The configuration of [RPV head flange seal leak-off] piping precludes [the ASME Code required] system pressure testing while the vessel head is removed because the time required by personnel for the installation and removal of a threaded plug in the flange face to act as a pressure boundary for the test would incur significant dose (estimated 20 - 40 [milli roentgen equivalent man (mrem)]/minute), which would be an ALARA [as low as reasonably achievable] concern. This activity would also present a Foreign Material Exclusion issue for the 1/8" plug that would be required to be installed to complete a leakage test at pressure.
>
> The configuration also precludes pressurizing the line externally with the head installed at the start of an outage. The top head of the vessel contains two grooves that hold the O-rings. The O-rings are held in place by a series of retainer clips that are housed in recessed cavities in the flange face. If a pressure test were to be performed with the head on, the inner O-ring would be pressurized in a direction opposite to its design function. This test pressure would result in a net inward force on the inner O-ring that would tend to push it into the recessed cavity that houses the retainer clips. The thin O-ring material would likely be damaged by the inward force. The inner O-ring failure would prevent pressure build-up by allowing water to pass by and enter the reactor vessel. To ensure that it was in fact an O-ring failure and not a leak in the leak-off piping, the portion of piping in the reactor vessel nozzle inspection areas ("sandboxes") would have to be inspected. The conditions inside the "sandboxes" at the beginning of the outage prior to removing the head would be considered unsafe with extremely high temperatures and dose ratings ranging from 150 to 250 mRem/hr. The leak-off piping travels through three of the eight "sandboxes". It is felt that performing the examination in this manner would result in an unnecessary hardship without a sufficient compensating increase in the level of quality and safety. Therefore, the only time, other than O-ring failure, that the leak-off lines are fluid filled under any type of pressure is when the head is removed and the cavity flooded.

3.8 NRC Staff Evaluation

The NRC staff has evaluated this relief request pursuant to 10 CFR 50.55a(z)(2). The NRC staff evaluated whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Hardship

The NRC staff determined that requiring the licensee to comply with IWC-5221 and conduct system leakage test of the RPV head flange seal leak-off piping at the RCS operating pressure would result in hardship. When the reactor head is removed during refueling, the licensee

would have to modify the existing RPV head flange taps to install plugs and/or test pressure connections to facilitate for pressurizing the piping by use of a hydro pump. The activities associated with installing the plugs and/or the test connections, pressurizing the piping to the RCS pressure and conducting the ASME Code-required system leakage test, and removing the plugs after completion of test would cause personnel to incur additional radiation dose, and could introduce foreign materials into the reactor pool as well as the lines. Pressurizing the lines when the RPV head is installed would not be possible due to design and configuration of the RPV head flange and the inner O-ring. The inner O-ring is designed to withstand pressure in one direction only, pressurizing in the opposite direction could damage the inner O-ring, and result in an unsuccessful test. In addition, at the beginning of the refueling outage when the RPV head is on, high temperatures and high radiation doses create unsafe conditions for personnel to conduct the VT-2 visual examinations of the portion of piping in the reactor vessel nozzle inspection areas after pressurization of the lines. Therefore, the NRC staff determined that ALARA and Foreign Material Exclusion program concerns constitute a hardship.

Test Pressure

In evaluating the licensee's proposed alternative, the NRC staff assessed if the licensee proposed to use the highest achievable test pressure to conduct system leakage test, and the manner in which the licensee proposed to perform the testing and the associated VT-2 visual examinations of the piping for leakage. The NRC staff determined that the licensee is proposing to use the highest pressure that is obtainable without major modifications to the existing configuration of the vessel flange and the lines to test the RPV leak-off piping for leakage each inspection period. Specifically, the licensee's proposed system leakage test will subject the piping to the static pressure of 10.6 psi (i.e., pressure head developed from the elevation of refueling water above the vessel flange during the refueling cavity flood-up), which eliminates a need for major design modifications to existing configurations of both the vessel flange and the leak-off lines. By performing the associated VT-2 visual examinations of the subject piping according to IWA-5240 after pressurizing the lines to static pressure of 10.6 psi and maintaining the static test pressure according to IWA-5213, the licensee will be able to detect any leakage if it originated from an existing flaw in the piping and its welded connections. Therefore, the NRC staff concluded that the licensee's alternative system leakage test subjects the piping under consideration to a test pressure that is as high as reasonably achievable.

Safety Significance of Alternative Test Pressure

In addition to the analysis described above, the NRC staff evaluated the safety significance of performance of the system leakage test at an alternative reduced pressure. The NRC staff notes that the leak-off piping is made of stainless steel. The degradation mechanism could be fatigue and stress corrosion cracking (SCC). However, a fatigue crack is known to have relatively slow growth, and field experience has shown that SCC under normal operating conditions is not expected to be a problem. Significant degradation would likely be detected by the system leakage test performed under proposed maximum obtainable static pressure head.

The NRC staff notes that if, in an unlikely event, the piping developed a through-wall flaw and a leak, the plant's existing reactor coolant leakage detection systems will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in

accordance with the plant's technical specifications. Therefore, based on the proposed alternative system leakage test that subjects the leak-off piping to the maximum obtainable static pressure head and the performance of the ASME Code-required VT-2 visual examinations, it is reasonable to conclude that if significant service induced degradation had occurred, evidence of it would be detected either by the examinations that the licensee performed or the RCS leakage detection systems.

Therefore, the NRC staff concludes that the proposed system leakage testing using the proposed test pressure is adequate to provide a reasonable assurance of structural integrity and leak tightness of the RPV flange seal leak-off piping.

4.0 CONCLUSION

The NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the RPV head flange seal leak-off piping and complying with the specified ASME Code requirement would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of this alternative for the third 10-year ISI interval, which began on August 3, 2014, and is scheduled to end on August 2, 2023.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Ali Rezai, NRR/DE/EPNB

Date: September 15, 2015

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

Sincerely,

/RA Lisa Regner for/

Michael T. Markley, Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-446

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Safety Evaluation

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