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

July 11, 2016

Mr. Ken J. Peters
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 REQUESTS B-3, B-9, B-10, AND B-11 FOR THE SECOND 10-YEAR INSERVICE INSPECTION INTERVAL (CAC NOS. MF6553, MF6554, MF6555, AND MF6556)

Dear Mr. Peters:

By four letters dated August 3, 2015, as supplemented by four letters dated December 14, 2015, and two letters dated March 2, 2016, Luminant Generation Company LLC (the licensee) submitted Relief Requests (RRs) B-3, B-9, B-10, and B-11 to the U.S. Nuclear Regulatory Commission (NRC) for Comanche Peak Nuclear Power Plant (CPNPP), Unit 2, for the second 10-year inservice inspection (ISI) interval. The second 10-year ISI interval began on August 3, 2004, and ended on August 2, 2014.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from the examination requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, and to implement a reduced examination coverage for the following welds since the ASME Code-required examination coverage was not achieved due to physical interferences:

- Reactor coolant system pipe to flange weld (RR B-3)
- Reactor pressure vessel outlet nozzle safe-end to piping welds and inlet nozzle safe-end to elbow welds (RR B-9)
- Safety injection system elbow to pipe weld (RR B-10)
- Reactor coolant system pipe to valve weld (RR B-11)

The NRC staff has reviewed the subject requests and based on the enclosed safety evaluation, the staff concludes that it is impractical for the licensee to comply with the ASME Code, Section XI requirement and that the proposed examinations provide reasonable assurance of structural integrity or leak tightness of the subject welds. The NRC staff further concludes that granting relief 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 RRs B-3, B-9, B-10, and B-11 at CPNPP, Unit 2, for the second 10-year ISI interval.

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

If you have any questions, please call Ms. Watford at 301-415-1233 or via e-mail at Margaret.Watford@nrc.gov.

Sincerely,

Robert J. Pascarelli, 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
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS B-3, B-9, B-10, AND B-11

SECOND 10-YEAR INSERVICE INSPECTION INTERVAL

LUMINANT GENERATION COMPANY LLC

COMANCHE PEAK NUCLEAR POWER PLANT, UNIT 2

DOCKET NO. 50-446

1.0 INTRODUCTION

By four letters dated August 3, 2015,[1] as supplemented by four letters dated December 14, 2015,[2] and two letters dated March 2, 2016,[3] Luminant Generation Company LLC (the licensee) submitted Relief Requests (RRs) B-3, B-9, B-10, and B-11 to the U.S. Nuclear Regulatory Commission (NRC) for Comanche Peak Nuclear Power Plant (CPNPP), Unit 2, for the second 10-year inservice inspection (ISI) interval.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from the examination requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI and to implement a reduced examination coverage for the following welds since the ASME Code-required examination coverage was not achieved due to physical interferences:

- Reactor coolant system (RCS) pipe to flange weld (RR B-3)
- Reactor pressure vessel (RPV) outlet nozzle safe-end to piping welds and inlet nozzle safe-end to elbow welds (RR B-9)
- Safety injection system elbow to pipe weld (RR B-10)
- RCS pipe to valve weld (RR B-11)

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1 Agencywide Documents Access and Management System (ADAMS) Accession No. ML15224B361 (RR B-3), ML15224B362 (RR B-9), ML15224B363 (RR B-10), and ML15224B364 (RR B-11).
2 ADAMS Accession Nos. ML16020A067 (RR B-3), ML16020A063 (RR B-9), ML16020A061 (RR B-10), and ML16020A066 (RR B-11).
3 ADAMS Accession Nos. ML16074A144 (RR B-3) and ML16076A414 (RR B-9).

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(g)(4)(ii), inservice examination of components during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in paragraph (a) of 10 CFR 50.55a 12 months before the start of the 120-month inspection interval (or the optional ASME Code Cases listed in NRC Regulatory Guide (RG) 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," dated August 2014 (ADAMS Accession No. ML13339A689), when using Section XI, that are incorporated by reference in paragraphs (a)(3)(ii) and (iii) of 10 CFR 50.55a), subject to the conditions listed in paragraph (b) of 10 CFR 50.55a.

Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with the ASME Code requirement is impractical for its facility, the licensee must notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determinations. Determinations of impracticality in accordance with 10 CFR 50.55a must be based on the demonstrated limitations experienced when attempting to comply with the ASME 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.

Pursuant to 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations under paragraph (g)(5) of 10 CFR 50.55a that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, and will not endanger life or property or the common defense and security, and are 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 concluded that regulatory authority exists for the licensee to request and the NRC to authorize the alternatives requested by the licensee.

3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the subject RRs has been evaluated and the bases for disposition are documented in the following sections. The RRs have been evaluated according to ASME Code examination category and information provided by the licensee in its letters dated August 3, 2015 (one each in support of RRs B-3, B-9, B-10, and B-11), and supplemented by letters dated December 14, 2015 (one each in support of RRs B-3, B-9, B-10, and B-11), and March 2, 2016 (one each in support of RRs B-3 and B-9).

By letter dated October 5, 2006 (ADAMS Accession No. ML062750371), the NRC approved implementation of the risk-informed inservice inspection (RI-ISI) program for the Class 1 piping

welds (Examination Categories B-F and B-J) and the Class 2 piping welds (Examination Categories C-F-I and C-F-2) in the second 10-year ISI interval of CPNPP, Unit 2. The licensee developed the CPNPP RI-ISI program in accordance with the NRC-approved methodology of the Electric Power Research Institute (EPRI) Topical Report (TR)-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure (PWRMRP-05)," dated December 1999 (ADAMS Accession No. ML013470102).

3.1 RR B-3, Reactor Coolant System Pipe to Flange Weld

3.1.1 Component Affected

The affected component is ASME Code Class 1 piping weld. This weld is classified as Examination Category R-A, Item Number R1.11 (elements subject to thermal fatigue), in accordance with EPRI TR-112657, Revision B-A (Table 1 of ASME Code Case N-578-1).

By letter dated March 2, 2016, the licensee identified this weld as Weld No. TCX-1-4501-11, which is a pipe to flange weld. The materials specification for the subject weld and its associated components are:

- Schedule 160 austenitic stainless steel SA-376 Type 304/316 pipe - Nominal pipe size (NPS) of 6 inches
- SA-182 F316 flange
- ER-308 weldment material
- Wall thickness of 0.719 inches

3.1.2 Applicable Code Edition and Addenda

The Code of record for the second 10-year ISI interval is the 1998 Edition through 2000 Addenda of the ASME Code.

3.1.3 Duration of Relief Request

The licensee submitted this relief request for the second 10-year ISI interval, which started on August 3, 2004, and ended on August 2, 2014.

3.1.4 ASME Code Requirement

The ASME Code requirements applicable to this request originate in ASME Code, Section XI, Table IWB-2500-1. An alternative to these requirements is the RI-ISI program for CPNPP, Unit 2, which was developed by the licensee in accordance with the NRC-approved methodology in EPRI TR-112657, Revision B-A. In both the ASME Code requirements and the NRC safety evaluation dated October 5, 2006, the welds under the request are required to be volumetrically examined during each 10-year ISI interval, and 100 percent coverage of the required examination volume must be achieved. The extent of required examination coverage is reduced to essentially 100 percent by ASME Code Case N-460, "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1." This code case has been incorporated by reference into 10 CFR 50.55a by inclusion in RG 1.147, Revision 17.

3.1.5 Impracticality of Compliance

The licensee stated that it was not possible to obtain greater than 90 percent of the ASME Code-required examination volume due to design configuration (i.e., a flange is welded to a pipe) and physical interferences from the flange.

The licensee stated that the burden caused by compliance includes major plant modifications and replacement of components.

3.1.6 Basis for Relief

The licensee stated that it performed ultrasonic testing (UT) of the subject component weld using shear wave search units with nominal angles of 45 and 60 degrees in two circumferential directions and achieved 100 percent coverage of the required examination volume. The licensee also stated that it performed the axial scanning using 45- and 60-degree search units from the upstream side and achieved 100 percent coverage of the required examination volume. The pipe flange geometry prevented axial scan of the weld from the downstream side. The licensee determined the aggregate coverage to be 75 percent of the required examination volume. The licensee did not identify any indications in the volume inspected. The licensee performed the UT to the maximum extent possible.

The licensee stated that it utilized the requirements in Appendix VIII to Section XI of 1998 Edition through 2000 Addenda of the ASME Code for the UT procedures demonstration and personnel qualification.

The licensee stated that Weld No. TCX-1-4501-11 was first examined using UT during refueling outage 2RF02 in the first 10-year ISI interval in 1996 and no flaws were identified. This weld was also subjected to UT and surface examination during refueling outage 2RF09 in the second 10-year ISI interval in 2006 and again, no flaws were identified. The construction examinations (radiographic testing (RT) and surface examination) and the preservice examination (surface examination) were all satisfactorily performed with no identified flaws.

The licensee also stated that Weld No. TCX-1-4501-11 is within the examination scope of the Boric Acid Control Program walk down prior to each refueling outage. This weld is also included in the scope of the Class 1 system leakage test prior to plant startup following each refueling outage as required by the ASME Code, Section XI. As stated by the licensee, CPNPP has leakage detection systems with design objectives in accordance with the requirements of 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 30, "Quality of reactor coolant pressure boundary," and RG 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage," Revision 1, dated May 2008 (ADAMS Accession No. ML073200271). These systems are capable of detecting leakage as low as 0.1 gallon per minute (gpm) using the air particulate monitor and as low as 1 gpm using the condensate flow rate and the sump level alarm. In addition, the containment environment is procedurally monitored (e.g., containment humidity high or increasing, containment radiation levels high or increasing, containment temperature high or increasing, containment pressure high or increasing, and containment dew point increasing are plant indications of evidence of leakage). An RCS water inventory balance is also performed daily by operations for evidence of RCS leakage.

The licensee stated that the RT could not be performed due to the configuration limitations and radiological conditions. The phased array UT techniques would not have increased examination coverage due to the pipe to flange design configuration.

In addition, the licensee stated that it performed the VT-2 visual examinations during system leakage testing in accordance with IWB-2500 (Examination Category B-P in Table IWB-2500-1) and found no evidence of a through-wall leakage for this weld.

3.1.7 Proposed Examination Coverage

In RR B-3, the licensee reported 75 percent of coverage was achieved by the UT in the examination performed for Weld No. TCX-1-4501-11. The licensee proposed this examination coverage for the volumetric examination of this weld in lieu of essentially 100 percent coverage required by the ASME Code.

3.1.8 NRC Staff Evaluation

The NRC staff has evaluated RR B-3 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the ASME Code-required examinations would result in a burden to the licensee; and (3) that the licensee's proposed reduced examination coverage provides reasonable assurance of structural integrity and leak tightness of the subject weld. The NRC staff concluded that if these three criteria are met, the requirements of 10 CFR 50.55a(g)(6)(i) (i.e., granting the requested relief 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") will also be met.

Impracticality of Compliance

As described and demonstrated in Attachments 1 and 2 to RR B-3, the pipe to flange design configuration was the predominant limitation that prevented the licensee's UT to achieve essentially 100 percent coverage of the ASME Code requirements. The NRC staff confirmed that this design configuration prevented the licensee from scanning the weld axially from the downstream side and would also limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff concluded that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

Burden of Compliance

The licensee proposed that making the weld accessible for examination from both sides would require replacement or significant design modification to the pipe and the flange. The NRC staff concluded that replacing or reconfiguring the components of this weld is the only reasonable means to achieve dual-sided coverage of this weld and thus, determined that replacement or reconfiguration of the pipe and the flange would constitute a burden on the licensee.

Structural Integrity and Leak Tightness

The NRC staff considered whether the licensee's proposed reduced examination coverage provided reasonable assurance of structural integrity and leak tightness of the subject weld based on: (1) the examination coverage achieved and (2) safety significance of unexamined volumes - unachievable coverage (e.g., the presence or absence of known active degradation mechanisms, the significance of a leak and/or structural failure of the subject weld, and essentially 100 percent coverage achieved for similar welds in similar environments subject to similar degradation mechanisms).

Examination Coverage Achieved

In evaluating the licensee's proposed reduced examination coverage, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From its review of Attachment 2 of RR B-3, the NRC staff confirmed that licensee obtained the maximum coverage achievable (i.e., the percentage of the required examination volume covered by the UT using applicable ultrasonic modes of propagation, probe angles, and scanning directions). The coverage obtained represents the aggregate coverage of the required UT performed (axial and circumferential scanning directions combined). The licensee performed the UT with the procedure developed and qualified in accordance with Supplement 2 of Appendix VIII to the ASME Code, Section XI, under the Performance Demonstration Initiative (PDI) program. In the volume examined by the ASME Code-required UT, the licensee did not identify any unacceptable indications in the weld. The NRC staff confirmed that the physical access, the design configuration, or the material type would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff determined that the licensee made every effort to obtain as much coverage as reasonably possible with the ASME Code-required UT.

Safety Significance of Unexamined Volumes - Unachievable Coverage

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of weld - unachievable coverage. From its review of the submittal and the sketches in Attachment 2 of RR B-3, the NRC staff verified that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and the heat affected zone (HAZ) of the base material near the inside diameter (ID) surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. The NRC staff notes that the coverage obtained for axial scans was limited to the volume up to the weld centerline (near-side or upstream side), because claiming coverage for the volume on the opposite side of the weld centerline (far-side or downstream side) requires meeting the 10 CFR 50.55a(b)(2)(xv)(A)(2) far-side UT qualifications, which have not been demonstrated in any qualification attempts to date. Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT and the examination of the weld root and its HAZ to the extent possible, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

In performing this analysis, the NRC staff noted that the weld under consideration is made of stainless steel, its examination is governed by the CPNPP, Unit 2, RI-ISI program, and could be

subject to degradation by thermal fatigue. The common forms of thermal fatigue cracking is due to low-cycle fatigue (i.e., a weld is subjected to a relatively low number of cycles at a higher stress (e.g., plant operational cycles)) or due to high-cycle fatigue (i.e., a weld is subjected to a high number of cycles at low stress amplitude (e.g., local leakage effects or cyclic stratification)). Generally, the low-cycle thermal fatigue cracking has been considered in the original design analysis during the plant normal operational cycles and is known to have relatively slow growth. The high-cycle thermal fatigue cracking of unisolable piping connected to the RCS is managed by an augmented program under the CPNPP RI-ISI program. The high-cycle fatigue cracks are known to be initiated as many small cracks. Therefore, it is expected that any significant degradation of the weld under consideration would be detected by the volume covered.

In this analysis, the NRC staff also concluded that, in addition to the required volumetric examinations, this weld has received the required system leakage test according to the ASME Code, Section XI, IWB-2500 (Table IWB-2500-1, Examination Category B-P) during each refueling outage. Despite reduced coverage of the required examination volume, the NRC determines that the licensee's supplemental and other examinations will provide additional assurance that any pattern of degradation, if it were to occur, would be detected and the licensee will take appropriate correction actions.

In this analysis, the NRC staff also notes that if in an unlikely event this weld developed a through-wall flaw and a leak, the existing plant leakage monitoring system (e.g., drain sump and containment environment) will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in accordance with the plant technical specifications.

Therefore, the NRC staff concludes that the volumetric examinations performed to the extent possible and accompanied by other examinations (visual, walked down, and/or augmented) provide a reasonable assurance of structural integrity and leak tightness of the subject weld. Compliance with the ASME Code requirements for these welds would result in a burden to the licensee.

3.2 RR B-9, RPV Outlet Nozzle Safe-End to Piping Welds and Inlet Nozzle Safe-End to Elbow Welds

3.2.1 Component Affected

The affected components are ASME Code Class 1 outlet nozzle safe-end to piping welds and inlet nozzle safe-end to elbow welds. These welds are classified as Examination Category R-A, Item No. R1.20 (elements not subject to a damage mechanism), in accordance with EPRI TR-112657, Revision B-A (Table 1 of ASME Code Case N-578-1).

The licensee identified these welds as Weld Nos. TCX-1-4300-2 and TCX-1-4400-2, which are the RPV outlet nozzle safe-end to pipe welds, and Weld Nos. TCX-1-4400-13, TCX-1-4100-13, and TCX-1-4200-13, which are the RPV inlet nozzle safe end to elbow welds.

By letter dated December 14, 2015, the licensee provided materials specification for the subject components which are:

Weld Nos. TCX-1-4300-2 and TCX-1-4400-2:

- Cast stainless steel SA-351 Type CF8A pipe - NPS of 27.5 inches
- SA-182 F316 safe end
- ER-308 weldment material
- Minimum wall thickness of 2.33 inches

Weld Nos. TCX-1-4400-13, TCX-1-4100-13, and TCX-1-4200-13:

- Cast stainless steel SA-351 Type CF8A elbow
- SA-182 F316 safe end
- ER-308 weldment material
- Minimum wall thickness of 2.21 inches

3.2.2 Applicable Code Edition and Addenda

The Code of record for the second 10-year ISI interval is the 1998 Edition through 2000 Addenda of the ASME Code.

3.2.3 Duration of Relief Request

The licensee submitted this relief request for the second 10-year ISI interval, which started on August 3, 2004, and ended on August 2, 2014.

3.2.4 ASME Code Requirement

The ASME Code requirements applicable to this request originate in ASME Code, Section XI, Table IWB-2500-1. An alternative to these requirements is the RI-ISI program for CPNPP, Unit 2, which was developed by the licensee in accordance with the NRC-approved methodology in EPRI TR-112657, Revision B-A. In both the ASME Code requirements and the NRC safety evaluation dated October 5, 2006, the welds under this request are required to be volumetrically examined during each 10-year ISI interval, and 100 percent coverage of the required examination volume must be achieved. The extent of required examination coverage is reduced to essentially 100 percent by ASME Code Case N-460. This code case has been incorporated by reference into 10 CFR 50.55a by inclusion in RG 1.147, Revision 17.

3.2.5 Impracticality of Compliance

The licensee stated that it was not possible to obtain greater than 90 percent of the ASME Code-required examination volume due to the ID configuration (i.e., counter-bore and protruding weld root) of pipe that limited scanning from the ID surface.

The licensee stated that plant modifications, including redesign and replacement of components to allow for the ASME Code-required coverage, would be needed. This would result in a burden to the licensee.

3.2.6 Basis for Relief

The licensee stated that it performed the UT from the ID surface of the weld in four scanning directions (circumferential and axial) using the 70-degree longitudinal (L)-wave transducer. The licensee did not identified any recordable indications in any of the subject welds examined. The licensee performed the UT to the maximum extent practical with consideration of the access available to the required examination volume and within the limitation of the component's geometry.

The licensee stated that it performed a supplemental surface examination of the ID surface of the subject welds by a qualified eddy current testing (ET). The license's ET qualification process included personnel qualification, procedures demonstration, and blind testing that were approved by the Swedish Qualification Center. The ET fully examined all the required examination area and no surface indications were detected.

The licensee stated that it utilized the requirements in Supplements 2 and 10 of Appendix VIII to Section XI of 1998 Edition through 2000 Addenda of the ASME Code for the UT procedures demonstration and personnel qualification.

The licensee stated that Weld Nos. TCX-1-4300-2, TCX-1-4400-2, TCX-1-4100-13, TCX-1-4200-13, and TCX-1-4400-13 were examined from the ID surface during 2RF06 refueling outage in the spring of 2002. There were no flaws or indications identified. The subject welds were also examined from the ID during 2RF11 refueling outage in the fall of 2009. There were no flaws or indications identified.

The licensee stated that during construction, Weld Nos. TCX-1-4300-2, TCX-1-4400-2, TCX-1-4100-13, TCX-1-4200-13, and TCX-1-4400-13 were inspected. The surface indications detected in Weld No. TCX-1-4100-13 and a lack of fusion detected in Weld No. TCX-1-4400-13 were repaired. The reexamination of Weld No. TCX-1-4100-13 and TCX-1-4400-13 did not identify any indications. The preservice examinations of the subject welds identified a minor surface indication in Weld No. TCX-1-4200-13, which was repaired and reexamined with no flaws identified.

The licensee stated that the subject welds are located inside the "sandboxes" on the reactor cavity floor. During each refueling outage, these welds are accessed when the adjacent dissimilar metal welds are inspected by the bare metal VE visual examinations according to ASME Code Case N-722-1, "Additional Examinations for PWR [Pressurized Water Reactor] Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials, Section XI, Division 1." The bare metal VE visual examinations are specifically looking for evidence of pressure boundary leakage and corrosion on the adjacent dissimilar metal welds. Therefore, in an unlikely event of a through-wall leak in the subject welds, it would be identified during the VE visual examinations of adjacent dissimilar metal welds.

The licensee stated that CPNPP has leakage detection systems with design objectives in accordance with the requirements of 10 CFR Part 50, GDC 30, and NRC RG 1.45. As stated earlier, these systems are capable of detecting leakage as low as 0.1 gpm using the air particulate monitor and as low as 1 gpm using the condensate flow rate and the sump level

alarm. In addition, the containment environment is procedurally monitored and an RCS water inventory balance is performed daily by operations for evidence of RCS leakage.

The licensee stated that a review of industry and plant-specific operating experience (OE) databases did not identify any OE regarding potential degradation and potential severe loading for the subject weld.

The licensee stated that the RT could not be performed due to the configuration limitations and radiological conditions. The phased array UT techniques would not have increased examination coverage.

The licensee stated that the surface examination performed by the ET essentially covered 100 percent of the ID surface of the required examination area. The UT performed in the circumferential directions achieved essentially 100 percent coverage of the required examination volume. The UT performed in the axial directions were limited to the percent coverage shown in Table B-9 of the RR B-9 submittal.

In addition, the licensee stated that it performed the VT-2 visual examinations during system leakage testing in accordance with IWB-2500 (Examination Category B-P in Table IWB-2500-1) and found no evidence of a through-wall leakage in these welds.

3.2.7 Proposed Examination Coverage

In RR B-9, the licensee reported for each weld the percentage of coverage achieved by the UT in the examination performed in Table B-9 in the submittal.

TCX-1-4300-2	84.96 percent
TCX-1-4400-13	85.69 percent
TCX-1-4400-2	87.37 percent
TCX-1-4100-13	81.50 percent
TCX-1-4200-13	85.74 percent

The licensee proposed the above examination coverage for the volumetric examination of the subject welds in lieu of the ASME Code-required essentially 100 percent coverage.

3.2.8 NRC Staff Evaluation

The NRC staff has evaluated RR B-9 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the ASME Code-required examinations would result in a burden to the licensee; and (3) that the licensee's proposed reduced examination coverage provides reasonable assurance of structural integrity and leak tightness of the subject weld. The NRC staff concluded that if these three criteria are met that the requirements of 10 CFR 50.55a(g)(6)(i) (i.e., granting the requested relief 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") will also be met.

Impracticality of Compliance

As described and demonstrated in Attachments 1 and 2 to RR B-9, the predominant limitations that prevented the licensee's UT to achieve essentially 100 percent coverage of the ASME Code-required volume was the counter-bore and protruding weld root on the ID surface of the pipe. The NRC staff confirmed that this ID surface configuration prevented the licensee to achieve essentially 100 percent coverage in the circumferential directions. This surface configuration would also limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff concluded that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

Burden of Compliance

The licensee proposed that making the ID surface of the pipes, elbows, and welds suitable for scanning by the UT probes to achieve the required coverage would require redesign and replacement of the welds and their associated components. The NRC staff concluded that the redesign and replacement of these welds is the only reasonable means to achieve essentially 100 percent coverage and that redesign and replacement would constitute a burden on the licensee.

Structural Integrity and Leak Tightness

The NRC staff considered whether the licensee's proposed reduced examination coverage provided reasonable assurance of structural integrity and leak tightness of the subject weld based on: (1) the examination coverage achieved and (2) safety significance of unexamined volumes - unachievable coverage (e.g., the presence or absence of known active degradation mechanisms and the significance of a leak and/or structural failure of the subject welds).

Examination Coverage Achieved

In evaluating the licensee's proposed reduced examination coverage, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From its review of Attachment 2 to RR B-9, the NRC staff confirmed that licensee obtained the maximum coverage achievable (i.e., percentage of the required examination volume covered by the UT using applicable ultrasonic modes of propagation, probe angles, and scanning directions). The coverage obtained for each weld represents the aggregate coverage of the required UT performed (axial and circumferential scanning directions combined). The licensee performed the UT with the procedure developed and qualified in accordance with Supplements 2 and 10 of Appendix VIII to the ASME Code, Section XI, under the PDI program. In the volume examined by the ASME Code-required UT, the licensee did not identify any unacceptable indications in the welds. The NRC staff confirmed that the physical access, the design configuration, or the material type would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff found that the licensee made every effort to maximize the examination coverage obtained.

Safety Significance of Unexamined Volumes - Unachievable Coverage

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of weld - unachievable coverage. From its review of Attachments 1 and 2 to RR B-9, the NRC staff verified that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and the HAZ of the base material near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. As an extra effort to supplement the volumetric examinations due to limited coverage, the licensee used the qualified ET to look for presence of any surface-connected flaws on the ID. The ET examined the welds and HAZ of the base materials, and achieved essentially 100 percent coverage of the required examination area. The NRC staff notes that the licensee's ET qualification and procedures demonstration process included blind testing and was approved by the Swedish Qualification Center. The licensee did not identify any unacceptable surface-connected flaws in the area examined. Therefore, the NRC staff determined that based on maximum possible coverage achieved by the qualified UT, supplemental surface examinations of the welds and HAZ of base materials by the qualified ET, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

In this analysis, the NRC staff also found that, in addition to the required volumetric examinations, the subject welds have received the required system leakage test according to the ASME Code, Section XI, IWB-2500 (Table IWB-2500-1, Examination Category B-P) during each refueling outage. Despite reduced coverage of the required examination volume, the NRC staff concluded that the licensee's supplemental and other inspections will provide additional assurance that any pattern of degradation, if it were to occur, would be detected and the licensee will take appropriate correction actions.

In this analysis, the NRC staff also notes that if in an unlikely event, the subject welds developed a through-wall flaw and a leak, the existing plant leakage monitoring system (e.g., drain sump) and containment environment monitoring systems will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in accordance with the plant technical specifications.

Therefore, the NRC staff concludes that the volumetric examinations performed to the extent possible and accompanied with supplemental surface examinations and other examinations (visual, walked down, and/or augmented) provide a reasonable assurance of structural integrity and leak tightness of the subject welds. Compliance with the ASME Code requirements for these welds would result in a burden to the licensee.

3.3 RR B-10, Safety Injection (SI) System Elbow to Pipe Weld

3.3.1 Component Affected

The affected component is ASME Code Class 1 piping weld. This weld is classified as Examination Category R-A, Item Number R1.16 (elements subject to intergranular or transgranular stress-corrosion cracking (IGSCC or TGSCC)) in accordance with EPRI TR-112657, Revision B-A (Table 1 of ASME Code Case N-578-1).

The licensee identified this weld as Weld No. TCX-1-4301-10 (pipe to elbow weld). The materials specification for the subject weld and its associated components are:

- Schedule 140 austenitic stainless steel SA-376 Type 316 pipe – NPS of 10 inches and wall thickness of 1 inch
- Schedule 140 austenitic stainless steel SA-403 Type 316 elbow - Wall thickness of 1 inch
- ER-316 weldment material

3.3.2 Applicable Code Edition and Addenda

The Code of record for the second 10-year ISI interval is the 1998 Edition through 2000 Addenda of the ASME Code.

3.3.3 Duration of Relief Request

The licensee submitted this relief request for the second 10-year ISI interval, which started on August 3, 2004, and ended on August 2, 2014.

3.3.4 ASME Code Requirement

The ASME Code requirements applicable to this request originate in ASME Code, Section XI, Table IWB-2500-1. An alternative to these requirements is the RI-ISI program for CPNPP, Unit 2, which was developed by the licensee in accordance with the NRC-approved methodology in EPRI TR-112657, Revision B-A. In both the ASME Code requirements and the NRC safety evaluation dated October 5, 2006, the welds under this request are required to be volumetrically examined during each 10-year ISI interval, and 100 percent coverage of the required examination volume must be achieved. The extent of required examination coverage is reduced to essentially 100 percent by ASME Code Case N-460. This code case has been incorporated by reference into 10 CFR 50.55a by inclusion in RG 1.147, Revision 17.

3.3.5 Impracticality of Compliance

The licensee stated that it was not possible to obtain greater than 90 percent of the ASME Code-required examination volume because this weld is located very close to the SI piping structural restraints attached to the lower beam of the steam generator. This configuration limited portions of the required examination volume of this weld from being inspected. By letter dated December 14, 2015, the licensee described the piping structural restraints as follows:

> The group of structural restraints that are preventing full examination coverage of weld TCX-1-4301-10 is very complex in nature. The main structure is made up of 12" wide by 12" tall beams fabricated with 1" thick steel plate and various 1" thick steel gusset plates all anchored to the steam generator compartment walls with many 1" diameter anchor bolts. Various large bore and small bore pipe supports from various different piping segments are welded to and extend from this main structure. To modify and/or remove any part of the main structure or any of the various pipe supports would require extensive, costly and time consuming engineering design modifications. Also, elaborate scaffolding would need to be erected in order to perform the extensive field modifications all of

which would be located in a high radiation dose area in the steam generator compartment. The burden caused by removing and/or modifying these structural restraints would be significant dose, time and cost.

3.3.6 Basis for Relief

The licensee stated that it performed the UT of the subject component weld using shear wave search units with a nominal angle of 45 degrees in two axial and two circumferential directions. The licensee did not identify any indications in the volume inspected. The licensee performed the UT to the maximum extent practical.

The licensee stated that selecting other welds that could have provided full coverage was not feasible. The licensee stated there are only 12 welds in four SI segments classified as risk category 5a with a medium consequence and a degradation mechanism of IGSCC. The SI piping welds and support configurations are identical in each of the loop. After reviewing all of the associated piping in the four loops, the licensee determined that Weld Nos. TCX-1-4301-09 and TCX-1-4301-10 are the two welds that provide the most coverage. The licensee stated that Weld No. TCX-1-4301-10 was examined by the UT at refueling outage 2RF11 in the second 10-year ISI interval in fall 2009. There were no flaws identified. Weld No. TCX-1-4301-9 is another pipe to elbow weld that is scheduled to be volumetrically examined in the third 10-year ISI interval in the spring 2020. The construction examinations (RT and surface examination) and the preservice examination (UT and surface examination) were all satisfactorily performed with no identified flaws.

The licensee stated that it utilized the requirements in Appendix VIII to Section XI of 1998 Edition through 2000 Addenda of the ASME Code for the UT procedures demonstration and personnel qualification.

The licensee stated that Weld No. TCX-1-4301-10 is within the examination scope of the Boric Acid Control Program walk down prior to each refueling outage. This weld is also included in the scope of the Class 1 system leakage test prior to plant startup following each refueling outage as required by the ASME Code, Section XI.

The licensee stated that CPNPP has leakage detection systems with design objectives in accordance with the requirements of 10 CFR Part 50, GDC 30, and RG 1.45. These systems are capable of detecting leakage as low as 0.1 gpm using the air particulate monitor and as low as 1 gpm using the condensate flow rate and the sump level alarm. In addition, the containment environment are procedurally monitored. An RCS water inventory balance is also performed daily by operations for evidence of RCS leakage. Based on the containment leakage detection, a potential through-wall flaw of the weld should be detected and the plant would be shut down before significant weld failure could occur.

The licensee stated that a review of industry and plant-specific OE databases did not identify any OE regarding potential degradation and potential severe loading for the subject weld.

The licensee stated that the RT could not be performed due to the configuration limitations and radiological conditions. The phased array UT techniques would not have increased examination coverage due the interference from the pipe's structural restraints.

In addition, the licensee stated that it performed the VT-2 visual examinations during system leakage testing in accordance with IWB-2500 (Examination Category B-P in Table IWB-2500-1) and found no evidence of a through-wall leakage in this weld and its components.

3.3.7 Proposed Examination Coverage

In RR B-10, the licensee reported the 76.5 percent of coverage was achieved by the UT in the examination performed for Weld No. TCX-1-4301-10. The licensee proposed this coverage for the volumetric examination of this weld in lieu of the essentially 100 percent coverage required by the ASME Code.

3.3.8 NRC Staff Evaluation

The NRC staff has evaluated RR B-10 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the ASME Code-required examinations would result in a burden to the licensee; and (3) that the licensee's proposed reduced examination coverage provides reasonable assurance of structural integrity and leak tightness of the subject weld. The NRC staff concluded that if these three criteria are met that the requirements of 10 CFR 50.55a(g)(6)(i) (i.e., granting the requested relief 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") will also be met.

Impracticality of Compliance

As described and demonstrated in in Attachments 1 and 2 to RR B-10, the predominant limitation that prevented the licensee's UT to achieve essentially 100 percent coverage of the ASME Code-required volume was interference from the SI piping structural restraints attached to the steam generator lower beam. The NRC staff confirmed that the piping structural restraints prevented the licensee to scan portions of the examination volume of this weld. This design configuration would also limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff concluded that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

Burden of Compliance

The licensee proposed that making the entire weld accessible for examination from both sides would require significant design modification and removal of the piping structural restraints. The NRC staff concluded that redesigning or reconfiguring the components of this weld is the only reasonable means to achieve the required coverage of this weld and that removal of piping restraint and redesign of the pipe and elbow would constitute a burden on the licensee.

Structural Integrity and Leak Tightness

The NRC staff considered whether the licensee's proposed reduced examination coverage provided reasonable assurance of structural integrity and leak tightness of the subject weld based on: (1) the examination coverage achieved and (2) safety significance of unexamined

volumes - unachievable coverage (e.g., the presence or absence of known active degradation mechanisms, the significance of a leak and/or structural failure of the subject weld, and essentially 100 percent coverage achieved for similar welds in similar environments subject to similar degradation mechanisms).

Examination Coverage Achieved

In evaluating the licensee's proposed reduced examination coverage, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From its review of Attachment 2 to RR B-10, the NRC staff confirmed that licensee obtained the maximum coverage achievable (i.e., percentage of the required examination volume covered by the UT using applicable ultrasonic modes of propagation, probe angles, and scanning directions). The coverage obtained represents the aggregate coverage of the required UT performed (axial and circumferential scanning directions combined). The licensee performed the UT with the procedure developed and qualified in accordance with Supplement 2 of Appendix VIII to the ASME Code, Section XI, under the PDI program. In the volume examined by the ASME Code-required UT, the licensee did not identify any unacceptable indications in the weld. The NRC staff confirmed that the physical access, the design configuration, or the material type would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff found that the licensee made every effort to obtain as much coverage as reasonably possible with the ASME Code-required UT.

Safety Significance of Unexamined Volumes - Unachievable Coverage

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of weld - unachievable coverage. From its review of Attachments 1 and 2 to RR B-10, the NRC staff verified that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and the HAZ of the base materials near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. The NRC staff noted that the weld and its components (pipe and elbow) are made of austenitic stainless steel materials, could be subject to degradation by IGSCC, and their examinations are governed by the CPNPP, Unit 2, RI-ISI program. Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT, and the examination of the weld root and its HAZ to the extent possible, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

In this analysis, the NRC staff also found that, in addition to the required volumetric examinations, this weld has received the required system leakage test according to the ASME Code, Section XI, IWB-2500 (Table IWB-2500-1, Examination Category B-P) during each refueling outage. Despite reduced coverage of the required examination volume, the NRC staff concluded that the licensee's supplemental and other examinations will provide additional assurance that any pattern of degradation, if it were to occur, would be detected and the licensee will take appropriate correction actions.

In this analysis, the NRC staff found that the licensee has made every effort to select the welds with the same risk-significance subject to the same degradation mechanism that could be examined and achieved the required examination coverage or the highest percent coverage.

Also, the NRC staff notes that if in an unlikely event this weld developed a through-wall flaw and a leak, the existing plant leakage monitoring system (e.g., drain sump) and containment environment monitoring systems will be able to identify the leakage during normal operation, and the licensee will take appropriate corrective actions in accordance with the plant technical specifications.

Therefore, the NRC staff concludes that the volumetric examinations performed to the extent possible and accompanied by other examinations (visual, walked down, and/or augmented) provide a reasonable assurance of structural integrity and leak tightness of the subject weld. Compliance with the ASME Code requirements for this weld would result in a burden to the licensee.

3.4 RR B-11, Reactor Coolant System Pipe to Valve Weld

3.4.1 Component Affected

The affected component is ASME Code Class 1 piping weld. This weld is classified as Examination Category R-A, Item Number R1.11 (elements subject to thermal fatigue), in accordance with EPRI TR-112657, Revision B-A (Table 1 of ASME Code Case N-578-1).

The licensee identified this weld as Weld No. TCX-1-4504-11 (pipe to valve weld). The materials specification for the subject weld and its associated components are:

- Schedule 160 austenitic stainless steel SA-376 Type 316 pipe - NPS of 3 inches and minimum wall thickness of 0.437 inch
- Austenitic stainless steel SA-182 F316 valve
- ER-316 weldment material

3.4.2 Applicable Code Edition and Addenda

The Code of record for the second 10-year ISI interval is the 1998 Edition through 2000 Addenda of the ASME Code.

3.4.3 Duration of Relief Request

The licensee submitted this relief request for the second 10-year ISI interval, which started on August 3, 2004, and ended on August 2, 2014.

3.4.4 ASME Code Requirement

The ASME Code requirements applicable to this request originate in ASME Code, Section XI, Table IWB-2500-1. An alternative to these requirements is the RI-ISI program for CPNPP, Unit 2, which was developed by the licensee in accordance with the NRC-approved methodology in EPRI TR-112657, Revision B-A. In both the ASME Code requirements and the NRC safety evaluation dated October 5, 2006, the welds under this request are required to be

volumetrically examined during each 10-year ISI interval, and 100 percent coverage of the required examination volume must be achieved. The extent of required examination coverage is reduced to essentially 100 percent by ASME Code Case N-460. This code case has been incorporated by reference into 10 CFR 50.55a by inclusion in RG 1.147, Revision 17.

3.4.5 Impracticality of Compliance

The licensee stated that it was not possible to obtain essentially 100 percent of the ASME Code-required examination volume due to geometry and design configurations of the weld and associated components (i.e., valve to pipe weld).

The licensee stated that plant modifications including redesign and replacement of components to allow for the ASME Code-required coverage would be needed. This would result in a burden to the licensee.

3.4.6 Basis for Relief

The licensee stated that due to the valve to pipe configuration, the UT was performed using shear wave search units with nominal angles of 45, 60, and 70 degrees from one side of the weld. The single-sided scans allow examination of the required volume up to the weld centerline (50 percent coverage). The licensee did not identify any indications in the volume scanned. The licensee performed the UT to the maximum extent possible.

The licensee stated that it scanned the weld in the circumferential directions with the 45-degree shear waves looking for axial flaws. The 45-, 60-, and 70-degree shear waves were utilized to scan the weld axially looking for circumferential flaws. The 50 percent coverage reported in Section 4 of RR B-11 is the aggregate coverage obtained from scanning the weld in both circumferential and axial directions from the pipe side (single-sided examination).

The licensee stated that the UT procedure demonstration and personnel qualification were in accordance with Appendix VIII to Section XI of the 1998 Edition through 2000 Addenda of the ASME Code.

The licensee stated that based on the EPRI PDI examination techniques, a 70-degree shear wave technique has a better detection capability than a 70-degree refracted longitudinal wave when component thicknesses is less than 0.5 inch. A 70-degree shear wave technique was used to perform the "Best Effort" examination of the far-side (the root of weld and HAZ of base material). The coverage from the "Best Effort" examination was 50 percent. The far side examination "Best Effort" was done to the fullest extent practical.

The licensee stated that Weld No. TCX-1-4504-11 was first inspected by the UT during the refueling outage 2RF12 in the second 10-year ISI interval in 2011. There were no flaws identified. The construction examinations (RT and surface examination) and the preservice examination (surface examination) were all satisfactorily performed with no identified flaws.

The licensee stated that Weld No. TCX-1-4504-11 is within the examination scope of the Boric Acid Control Program walk down prior to each refueling outage. This weld is also included in the scope of the Class 1 system leakage test prior to plant startup following each refueling outage as required by the ASME Code, Section XI.

The licensee stated that CPNPP has leakage detection systems with design objectives in accordance with the requirements of 10 CFR Part 50, GDC 30, and RG 1.45. These systems are capable of detecting leakage as low as 0.1 gpm using the air particulate monitor and as low as 1 gpm using the condensate flow rate and the sump level alarm. In addition, the containment environment are procedurally monitored and an RCS water inventory balance is performed daily by operations for evidence of RCS leakage.

The licensee stated that a review of industry and plant-specific OE databases did not identify any OE regarding potential degradation and potential severe loading for the subject weld.

The licensee stated that the RT could not be performed due to the configuration of the subject weld and radiological conditions. The phased array UT techniques would not have increased examination coverage due to the weld configuration limiting the UT to one side.

In addition, the licensee stated that the performance of VT-2 visual examinations during system leakage testing in accordance with IWB-2500 (Examination Category B-P in Table IWB-2500-1) provides additional assurance that an evidence of through-wall flaws in the weld and HAZ of base materials would be detected.

3.4.7 Proposed Examination Coverage

In RR B-11, the licensee reported 50 percent of coverage achieved by the UT in the examination performed for Weld No. TCX-1-4504-11. The licensee proposed this coverage for the volumetric examination of this weld in lieu of the essentially 100 percent coverage required by the ASME Code.

3.4.8 NRC Staff Evaluation

The NRC staff has evaluated RR B-11 pursuant to 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the ASME Code-required examinations would result in a burden to the licensee; and (3) that the licensee's proposed reduced examination coverage provides reasonable assurance of structural integrity and leak tightness of the subject weld. The NRC staff concluded that if these three criteria are met that the requirements of 10 CFR 50.55a(g)(6)(i) (i.e., granting the requested relief 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") will also be met.

Impracticality of Compliance

As described and demonstrated in Attachments 1 and 2 to RR B-11, the predominant limitations that prevented the licensee's UT to achieve essentially 100 percent coverage of the ASME Code-required volume were the valve to pipe configuration (i.e., a single-sided access to the weld). The licensee performed the ultrasonic scanning from only the pipe side of the weld due to the valve geometry. The NRC staff confirmed that the design configurations of this weld would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. To effectively increase the examination coverage, the

licensee would have to make major design modifications or replace the components. Therefore, the NRC staff concludes that a technical justification exists to support the determination that achieving essentially 100 percent coverage is impractical.

Burden of Compliance

The licensee proposed that making the weld accessible for examination from both sides would require major design changes and components replacement. The NRC staff concluded that making design changes and replacing the components of this weld is the only reasonable means to achieve dual sided coverage of this weld, and that replacement and design changes to this weld would constitute a burden on the licensee.

Structural Integrity and Leak Tightness

The NRC staff considered whether the licensee's proposed reduced examination coverage provided reasonable assurance of structural integrity and leak tightness of the subject weld based on: (1) the examination coverage achieved and (2) safety significance of unexamined volumes - unachievable coverage (e.g., the presence or absence of known active degradation mechanisms, the significance of a leak and/or structural failure of the subject weld, and essentially 100 percent coverage achieved for similar welds in similar environments subject to similar degradation mechanisms).

Examination Coverage Achieved

In evaluating the licensee's proposed reduced examination coverage, the NRC staff assessed whether it appeared that the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From its review of Attachment 2 to RR B-11, the NRC staff confirmed that licensee obtained the maximum coverage achievable (i.e., percentage of the required examination volume covered by the UT using applicable ultrasonic modes of propagation, probe angles, and scanning directions). The coverage obtained represents the aggregate coverage of the required UT performed (axial and circumferential scanning directions combined). The licensee performed the UT with the procedure developed and qualified in accordance with Supplement 2 of Appendix VIII to the ASME Code, Section XI, under the PDI program. In the volume examined by the ASME Code-required UT, the licensee did not identify any unacceptable indications in the weld. The NRC staff confirmed that the physical access, the design configuration, or the material type would limit the effectiveness of alternative (or advanced UT) technologies from increasing the coverage of the examination volume. Therefore, the NRC staff determined that the licensee made every effort to obtain as much coverage as reasonably possible with the ASME Code-required UT.

Safety Significance of Unexamined Volumes - Unachievable Coverage

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of weld - unachievable coverage. From its review of Attachments 1 and 2 to RR B-11, the NRC staff verified that the licensee's UT has covered, to the extent possible, the regions (i.e., the weld root and the HAZ of the base materials near the ID surface of the joint) that are typically susceptible to higher stresses and, therefore, potential degradation. The NRC staff notes that the coverage obtained for axial scans was limited to the

volume up to the weld centerline (near-side or pipe side), because claiming coverage for the volume on the opposite side of the weld centerline (far-side or valve side) requires meeting the 10 CFR 50.55a(b)(2)(xv)(A)(2) far-side UT qualifications, which has not been demonstrated in any qualification attempts to date. As an extra effort to interrogate the examination volume on the far-side in a single-sided examination, the licensee conducted a supplemental UT as a "Best Effort" examination which is not included in the aggregate coverage. In the volume examined by the supplemental UT, the licensee did not identify any unacceptable indications in the subject weld. Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT, the supplemental "Best Effort" examinations, and the examination of the weld root and its HAZ to the extent possible, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

In performing this analysis, the NRC staff noted that the weld under consideration is made of stainless steel, its examination is governed by the CPNPP, Unit 2, RI-ISI program, and could be subject to degradation by thermal fatigue. The common forms of thermal fatigue cracking is due to low-cycle fatigue or due to high-cycle fatigue. Generally, the low-cycle thermal fatigue cracking has been considered in the original design analysis during the plant normal operational cycles and is known to have relatively slow growth. The high-cycle thermal fatigue cracking of unisolable piping connected to the RCS is managed by an augmented program under the CPNPP RI-ISI program. The high-cycle fatigue cracks are known to be initiated as many small cracks. Therefore, the NRC staff determined that significant service-induced degradation would likely be detected by the volume covered.

In this analysis, the NRC staff also found that, in addition to the required volumetric examinations, the subject weld has received the required system leakage test according to the ASME Code, Section XI, IWB-2500 (Table IWB-2500-1, Examination Category B-P) during each refueling outage. Despite reduced coverage of the required examination volume, the NRC staff concludes that the licensee's supplemental and other examinations will provide additional assurance that any pattern of degradation, if it were to occur, would be detected and the licensee will take appropriate correction actions.

In this analysis, the NRC staff also notes that if in an unlikely event the subject weld developed a through-wall flaw and a leak, the existing plant leakage monitoring system (e.g., drain sump) and containment environment monitoring system will be able to identify the leakage during normal operation. The licensee will take appropriate corrective actions in accordance with the plant technical specifications.

Therefore, the NRC staff concludes that the volumetric examinations performed to the extent possible and accompanied by other examinations (visual, walked down, and/or augmented) provide a reasonable assurance of structural integrity and leak tightness of the subject weld. Compliance with the ASME Code requirements for this weld would result in a burden to the licensee.

4.0 CONCLUSION

As set forth above, the NRC staff determines that it is impractical for the licensee to comply with the ASME Code, Section XI requirement; that the proposed examinations provide reasonable assurance of structural integrity or leak tightness of the subject weld; and that granting relief

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 for set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants RRs B-3, B-9, B-10, and B-11 at CPNPP, Unit 2, for the second 10-year ISI interval, which began on August 3, 2004, and ended on August 2, 2014.

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

Principal Contributor: A. Rezai, NRR/DE/EPNB

Date: July 11, 2016

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 RRs B-3, B-9, B-10, and B-11 at CPNPP, Unit 2, for the second 10-year ISI interval.

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

If you have any questions, please call Ms. Watford at 301-415-1233 or via e-mail at Margaret.Watford@nrc.gov.

Sincerely,

/RA/

Robert J. Pascarelli, Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-446

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