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

February 19, 2019

Mr. Robert S. Bement
Executive Vice President Nuclear/
Chief Nuclear Officer
Arizona Public Service Company
P.O. Box 52034, Mail Station 7602
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNIT 2 – RELIEF REQUEST NO. 58 FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL, REQUEST FOR RELIEF FROM THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FOR CERTAIN CLASS 1 AND CLASS 2 WELDS (EPID L-2018-LLR-0028)

Dear Mr. Bement:

By letter dated March 17, 2018, as supplemented by letter dated September 6, 2018, Arizona Public Service Company (the licensee) submitted Relief Request (RR) No. 58 to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2001 Edition through 2003 Addenda, for the Palo Verde Nuclear Generating Station (PVNGS), Unit 2 third 10-year inservice inspection (ISI) interval.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 paragraph 50.55a(g)(5)(iii), the licensee requested relief for the third 10-year ISI interval for certain Class 1 and 2 welds on the basis that the ASME Code requirements are impractical.

The NRC staff has reviewed the relief request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, in accordance with 10 CFR 50.55a(g)(6)(i), the NRC grants RR No. 58 for PVNGS, Unit 2 for the third 10-year ISI interval, which ended on March 17, 2017.

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 the Project Manager, Siva P. Lingam, at 301-415-1564 or via e-mail at Siva.Lingam@nrc.gov.

Sincerely,

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

Docket No. STN 50-529

Enclosure:
Safety Evaluation

cc: Listserv

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

RELIEF REQUEST NO. 58

REGARDING CERTAIN CLASS 1 AND 2 WELDS

FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

ARIZONA PUBLIC SERVICE COMPANY

PALO VERDE NUCLEAR GENERATING STATION, UNIT 2

DOCKET NO. STN 50-529

1.0 INTRODUCTION

By letter dated March 17, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18079A725), as supplemented by letter dated September 6, 2018 (ADAMS Accession No. ML18250A235), Arizona Public Service Company (the licensee), submitted Relief Request (RR) No. 58 to request relief from the requirements in Subarticles IWB-2500 and IWC-2500 of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2001 Edition through 2003 Addenda, regarding the examination of some welds at the Palo Verde Nuclear Generating Station (PVNGS), Unit 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 paragraph 50.55a(g)(5)(iii), the licensee requested relief for the third 10-year inservice inspection (ISI) interval for certain Class 1 and 2 welds on the basis that the ASME Code requirement is impractical.

2.0 REGULATORY EVALUATION

The regulation at 10 CFR 50.55a(g)(1), "Inservice inspection requirements for older plant (pre-1971 CPs)," states, in part, that "a boiling or pressurized water-cooled nuclear power facility whose construction permit was issued before January 1, 1971, components (including supports) must meet the requirements of paragraphs (g)(4) and (g)(5) of this section to the extent practical."

The regulation at 10 CFR 50.55a(g)(2), "Accessibility requirements," requires, in part, that a boiling or pressurized water-cooled nuclear power facility whose construction permit was on or after July 1, 1974, components that are classified as ASME Class 2 must be designed and be provided with access to enable the performance of ISI.

Adherence to Section XI of the ASME Code is mandated by 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," which requires, in part, that ASME Code Class 1, 2, and 3 components must meet the requirements, except design and access provisions and the preservice examination requirements, set forth in ASME Code, Section XI.

The regulation at 10 CFR 50.55a(g)(5)(iii), "ISI program update: Notification of impractical ISI code requirements," requires that "[i]f the licensee has determined that conformance with a [ASME] Code requirement is impractical for its facility, the licensee must 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 ASME Code requirements during the ISI 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 regulation at 10 CFR 50.55a(g)(5)(iv), "ISI program Update: Schedule for completing impracticality determinations," requires that where an examination requirement by the ASME Code or Addenda is determined to be impractical by a licensee, the basis for this determination must be demonstrated to the satisfaction of the Commission not later than 12 months after the expiration of the initial 120-month period of operation from the start of facility commercial operation and each subsequent 120-month period of operation during which the examination is determined to be impractical.

The regulation at 10 CFR 50.55a(g)(6)(i), "Impractical ISI requirements: Granting of relief," requires, in part, that the Commission will evaluate determinations, under paragraph 10 CFR 50.55a(g)(5), that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request the use of an alternative and the NRC to grant relief and the use of the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Relief Request

ASME Code Components Affected

Components:	Pressurizer Nozzle to Vessel Welds, Steam Generator Main Steam Nozzle Inner Radius Section, and Pressure Retaining Austenitic Stainless Steel Piping Welds (See Table 1 below)
Code Classes:	Class 1 and Class 2
Reference:	Table IWB 2500-1 and Table IWC 2500-1
Examination Categories:	B-D, C-B, and C-F-1
Code Item Numbers:	B3.110, C2.22, and C5.11

Table 1

Weld Number	System	Pipe Size (in)	Thickness (in)	Configuration	Pipe Material	Valve Material	Exam Coverage
76-14	LPSI	12	1.125	Pipe-to-Valve	SA-312 Gr. TP 304	SA-351 GR. CF8M	50%
77-14	LPSI	12	1.125	Pipe-to-Valve	SA-312 Gr. TP 304	SA-351 GR. CF8M	50%
77-16	LPSI	12	1.125	Pipe-to-Valve	SA-312 Gr. TP 304	SA-351 GR. CF8M	50%
86-8	RWS	20	0.375	Elbow-to-Valve	SA-312 Gr. TP 304	SA-351 GR. CF8M	50%

LPSI- Low Pressure Safety Injection
RWS- Refueling Water Suction

Applicable Code Edition and Addenda

The applicable edition and addenda of the ASME Code for the third 10-year ISI interval for PVNGS, Unit 2, is the ASME Code, Section XI, 2001 Edition through 2003 Addenda. The licensee stated that they use the Electric Power Research Institute Performance Demonstration Initiative and ultrasonic examination procedures for the Section XI, Appendix VIII program to the 2001 Edition of Section XI.

Applicable Code Requirements

ASME Code, Section XI, Subarticle IWC-2500 states in part, "Components shall be examined and pressure tested as specified in Table IWC-2500-1."

Tables IWB-2500-1 and IWC-2500-1 require volumetric examination of applicable ASME Code Class 1 pressurizer nozzle-to-vessel welds and steam generator nozzle inside radius sections, which includes essentially 100 percent of each weld length requiring examination, once during each 10-year interval for ASME Code Examination Categories B-D, Item No. B3.110 and C-B, Item No. C2.22. Additionally, the licensee chose to invoke Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds Section XI, Division 1," defining "essentially 100%" as a minimum of 90% coverage. Table IWC-2500-1 requires a surface and a volumetric examination of applicable ASME Code Class 2 pressure retaining piping welds, which includes 100 percent of each weld requiring examination, once during the 10-year interval for ASME Code Examination Categories C-F-1, Item No. C5.11.

The licensee stated that its third 10-year ISI program utilizes ASME Code Case N-460. Code Case N-460 allows as an alternative when 100 percent of the required examination volume cannot be examined due to interferences, obstructions, or geometrical configuration that the examination can be accepted provided the examination volume achieved is greater than 90 percent of the required volume.

Impracticality of Compliance

The licensee stated that it has determined that compliance with the ASME Code Section XI requirement to obtain essentially 100 percent coverage of the required examination volume of each weld listed in Table 1 above is impractical. This determination is based on actual demonstrated limitations when evaluating or attempting to comply with the code in performance of the examination of the welds in Table 1.

Component design configurations such as geometric configurations of components or their welds result in limitations and do not allow full coverage of the required Code examination volume.

Burden Caused By Compliance

The licensee stated that the components and welds related to this request are constructed of standard design items meeting national standards that specify required configurations and dimensions. Examinations of the welds listed in Table 1 are limited because the ultrasonic testing (UT) examination volume is only accessible from the pipe, or elbow side of the welds. The licensee has determined that obtaining greater than 90 percent coverage is not feasible and is impractical without undue burden, increased radiation exposure, and/or potential damage to the plant or component itself.

Licensee's Proposed Alternative

The licensee proposed the alternative UT examination coverage shown in Table 1 for the volumetric examination of the subject welds in lieu of the ASME Code required essentially 100 percent coverage along with the 100 percent surface examination, the periodic system pressure tests and visual examination for leakage.

The licensee's alternative is to accept the coverage obtained in lieu of the code required coverage.

Duration of Alternative

The licensee stated that the relief request is applicable to the third 10-year ISI Interval, which began on March 18, 2007, and ended on March 17, 2017. The licensee noted that an extension of the third 10-year interval to October 31, 2018, was approved by the NRC in RR No. 56 (ADAMS Accession No. ML18067A073).

3.2 NRC Staff Evaluation

The NRC staff has evaluated RR No. 58 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 Code required inspections would result in a burden to the licensee; and (3) that the licensee's proposed alternative (accepting the reduced inspection coverage in this case) provides reasonable assurance of structural integrity and leak tightness of the subject welds. The NRC staff concludes 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 be met.

Impracticality of Compliance

Examination Category B-D, Item No. B3.110

The licensee was not able to achieve essentially 100 percent volumetric coverage of the following pressurizer nozzle-to-vessel welds as required by Table IWB-2500-1 and defined in Figure IWB-2500-7(a) of the ASME Code: Pressurizer Surge Nozzle-to-Vessel Weld (Weld Identification No. 5-9), Pressurizer Spray Nozzle-to-Vessel Weld (5-10) and four Pressurizer Safety Vessel-to-Nozzle Welds (5-11, 5-12, 5-13 and 5-14). The licensee was able to obtain 65.2 percent coverage of Weld No. 5-9, 80.8 percent coverage of Weld No. 5-10, and 74.7 percent coverage of Weld Nos. 5-11, 5-12, 5-13 and 5-14. As described in Attachment 1 of the submittal dated March 17, 2018, the predominant limitations that prevented the licensee's UT from covering the ASME Code required volume was design and configuration of the welds and associated components. The NRC staff noted that the curvature of the nozzle and the proximity of the subject welds to the nozzle limit the range of the transducer in one direction and completely preclude examination in the opposite direction, which ultimately prohibits the transducer from obtaining full examination coverage. In addition to the geometric limitations, Weld No. 5-10 has additional weld pads installed 8.5 – 11 inches from the nozzle, which even further limits the scanning range of the transducer. All of these welds were examined during the first and second 10-year ISI intervals and the licensee was able to obtain adequate coverage to satisfy the ASME Code requirements, therefore relief was not required. The licensee attributed the drop in coverage during this ISI to the newly installed weld pads on Weld No. 5-10, as well as enhancements in technology and calculation methodologies, which enhanced the accuracy of the reported examination volumes. The NRC staff evaluated the licensee's reasoning for obtaining limited coverage, reviewed the associated coverage plots included for each weld, and determined that it is impractical for the licensee to obtain any additional coverage.

Examination Category C-B, Item No. C2.22

The licensee was not able to achieve essentially 100 percent volumetric coverage of the Steam Generator 2 Nozzle Inside Radius Sections for Main Steam (Weld Nos. 42-114-IR and 42-115-IR) as required by Table IWC-2500-1 of the ASME Code. The C2.22 Head-to-Nozzle Inside Radius Sections are unique to PVNGS, Unit 2 replacement steam generators, in that they are similar to the design in annulled Code Case N-311. The steam outlet nozzles extend approximately 13 inches into the vessel, which is not depicted in Figures IWC-2500-4(a) – (d). PVNGS, Unit 2 is the only plant that has this type of replacement steam generator and examinations have not been performed on the steam outlet nozzle inner radius sections at any of the other units. Zero percent coverage of the inside radius sections were obtained because this design completely precludes access to the inside surface of the steam nozzles and would require removal of multiple components and removal of welds internal to the secondary side of the steam generator. Additionally, the work to remove the internal components and welds would impose excessive risk to employees and expose the steam generator to foreign material risks. The NRC staff evaluated the licensee's determination of impracticality of performing any relevant examinations and concluded that implementing the proper modifications to achieve any examination coverage would be impractical.

Examination Category C-F-1, Item No. C5.11

As described in the enclosure of the submittal dated March 17, 2018 for RR No. 58, the predominant limitations that prevented the licensee's UT to achieve essentially 100 percent

coverage of the ASME Code required volume was design and configuration of the welds and associated components (i.e., pipe-to-valve or elbow-to-valve) that restricted the UT to a single sided scanning only. The NRC staff concludes that scanning from both sides of the welds, as is required to achieve the required coverage, is impractical.

Burden of Compliance

The licensee proposed that obtaining essentially 100 percent coverage would require undue burden, increased radiation exposure, and/or potential damage to the plant or component. Making the welds accessible for inspection from both sides would require replacement or significant modification of the weld and associated components. The NRC staff concludes that replacing or reconfiguring the components is the only reasonable means to achieve dual sided coverage of these welds, and that replacement or reconfiguration of the components would result in a significant cost and extended outage time to the licensee. Therefore, meeting the required examinations constitutes a burden on the licensee.

Structural Integrity and Leak Tightness

The NRC staff reviewed the licensee's basis for impracticality of meeting the required examinations for the welds and nozzle inner radius in RR No. 58. The staff determined that the replacement or modification of the welds and inner radius and associated components, in order to meet the required examinations, constitute a burden. The NRC staff determined whether the examination coverages the licensee achieved provided reasonable assurance of structural integrity and leak tightness of the subject welds and inner radius. In this determination, the staff considered the safety significance of unexamined volumes - unachievable coverage (i.e., the presence or absence of known active degradation mechanisms, the significance of a leak and/or structural failure of the subject welds, and essentially 100 coverage achieved for similar welds in similar environments subject to similar degradation mechanisms).

For the welds and nozzle inner radius in RR No. 58, the NRC staff determined that the operational leakage monitoring in accordance with the Technical Specifications, ASME Code-required system pressure tests, and walkdowns of systems inside the containment building for evidence of leakage provide reasonable assurance of leak tightness.

For the B-D welds, the NRC staff determined that examination coverages the licensee achieved provides reasonable assurance of structural integrity because there were no recorded indications, the examination coverages included the inner region where degradation is expected should it occur, and evidence of service-induced degradation in the welds, if it were to occur, would likely be detected in the examined coverages because the examined volumes are the same material as the unexamined volumes, are under the same loading conditions, and is exposed to the same reactor coolant environment.

For the C-B inner radius, the NRC staff determined that not examining the inner radius provides reasonable assurance of structural integrity because the licensee performed a structural fatigue analysis to show that the steam outlet nozzle and the inner radius section do not exceed ASME Class 1 or 2 requirements. Additionally, there has been no history of degradation found that the steam outlet nozzle inner radius sections, and the steam generator nozzle lies in a saturated steam environment where there is no temperature gradient, and therefore, a reduced likelihood of degradation.

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

In evaluating the licensee's examination coverage achieved, 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 review of the submittals, the NRC staff confirms that:

- The welds were examined using the appropriate equipment, ultrasonic modes of propagation, probe angles, frequencies, and scanning directions to obtain maximum coverage; Welds 76-14, 77-14, and 77-16 were examined using 45 degree (^{0}) and 60^0 shear wave and 60^0 refracted longitudinal wave, Weld 86-8 was examined using 45^0, 60^0 and 70^0 shear wave.

- The coverage was calculated in a reasonable manner.

- The UT procedures used were qualified as required by the regulation.

- The coverage was limited by physical access (i.e., the configuration of one side of the weld did not permit access for scanning).

- No unacceptable flaws were identified.

Therefore, the NRC staff concludes that the licensee made every effort to obtain as much coverage as reasonably possible with the ASME Code required UT.

In addition to the coverage analysis described above, the NRC staff evaluated the safety significance of the unexamined volumes of weld/unachievable coverage. From review of submittals and the sketches provided, the NRC staff verified that:

- The UT has examined the required volume to the extent possible.

- The ultrasonic scans have covered the weld root and the heat affected zone (HAZ) of the base material near the inside diameter surface of the joint that are typically susceptible to higher stresses and, therefore, potential degradation.

- The far-side volume has been inspected by the "Best Effort" examination. For the stainless steel weld, the coverage obtained for axial scans was limited to the volume up to the weld centerline (near-side}, because claiming coverage for the volume on the opposite side of the weld centerline (far-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. Thus, no credit was taken for the coverage achieved from the "Best Effort" examination.

- The results of the UT showed no unacceptable indications in any of the welds the licensee inspected.

Therefore, the NRC staff determined that based on the coverage achieved by the qualified UT, the examination of the weld root and its HAZ to the extent possible, and no unacceptable indications in any of the examined welds, 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.

The NRC staff also noted that, in addition to the required volumetric examinations, these welds have received the required surface examinations and system leakage test according to the ASME Code, Section XI, IWC-2500 (Table IWC-2500-1, Examination Category C-F-1 and Examination Category C-H respectively). Additionally these welds are located in the Auxiliary Building and subject to online leakage monitoring by the radioactive waste drain system monitors for leakage.

Therefore, the NRC staff concludes that the volumetric examinations performed to the extent possible provide a reasonable assurance of structural integrity and leak tightness of the subject welds. Compliance with the ASME Code requirements for these welds would be a burden on the licensee and is, therefore, impractical.

4.0 CONCLUSION

As set forth above, the NRC staff determines that it is impractical for the licensee to comply with the requirements of the ASME Code, Section XI. The NRC staff finds that requiring the licensee to perform volumetric examinations in accordance with ASME Code, Section XI, is impractical, due to the original construction design of PVNGS, Unit 2. The NRC staff determines that the proposed inspection provides reasonable assurance of structural integrity or leak tightness of the subject welds and steam generator inside radius section.

The NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(ii). Accordingly, the NRC staff determines 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. Therefore, the NRC staff grants RR No. 58 at PVNGS, Unit 2 for the third 10-year ISI interval, which began on March 18, 2007, and ended March 17, 2017.

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 Contributors: K.Hoffman, NRR
A. Young, NRR

Date: February 19, 2019

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNIT 2 – RELIEF REQUEST NO. 58 FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL, REQUEST FOR RELIEF FROM THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FOR CERTAIN CLASS 1 AND CLASS 2 WELDS (EPID L-2018-LLR-0028) DATED FEBRUARY 19, 2019

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