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

April 19, 2019

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

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 – RELIEF REQUEST 62 REGARDING PROPOSED ALTERNATIVE PRESSURIZER HEATER SLEEVE REPAIRS (EPID L-2018-LLR-0120)

Dear Mr. Bement:

By letter dated August 31, 2018, as supplemented by letter dated March 14, 2019 (Agencywide Documents Access and Management System Accession Nos. ML18243A544 and ML19074A138, respectively), Arizona Public Service Company (the licensee) submitted Relief Request 62 for the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. This relief request proposes an alternative to the American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," requirements related to potential flaws in the original heater sleeve partial penetration welds in all 36 penetrations of each pressurizer.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee submitted Relief Request 62, which pertains to pressurizer heater sleeve remnant J-groove weld flaw evaluation and successive examination requirements, on the basis that the proposed alternative provides an acceptable level of quality and safety.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the licensee's submittals and determined that the alternative proposed by the licensee in Relief Request 62 will provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of the proposed alternative in Relief Request 62 for the remainder of the third, and the entire fourth, 10-year inservice inspection intervals at PVNGS, Unit 1, and the remainder of the fourth 10-year inservice inspection intervals at PVNGS, Units 2 and 3, as identified in Section 3.2 of the enclosed safety evaluation.

All other ASME Code, Section XI requirements for which relief was not specifically requested and authorized in the subject relief request 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 by e-mail to Siva.Lingam@nrc.gov.

Sincerely,

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

Docket Nos. STN 50-528, STN 50-529,
and STN 50-530

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST 62 REGARDING PROPOSED ALTERNATIVE

PRESSURIZER HEATER SLEEVE REPAIRS

ARIZONA PUBLIC SERVICE COMPANY

PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

DOCKET NOS. STN 50-528, 50-529, AND 50-530

1.0 INTRODUCTION

By letter dated August 31, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18243A544), as supplemented by letter dated March 14, 2019 (ADAMS Accession No. ML19074A138), Arizona Public Service Company (APS, the licensee) submitted Relief Request (RR) 62, requesting an alternative to certain requirements of the American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code) for previously repaired pressurizer heater sleeve nozzles at the Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee submitted RR 62, which pertains to pressurizer heater sleeve remnant J-groove weld flaw evaluation and successive examination requirements, on the basis that the proposed alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

The inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is to be performed in accordance with ASME Code, Section XI, and applicable editions and addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the U.S. Nuclear Regulatory Commission (NRC).

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates that: (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

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

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

The affected component is the pressurizer vessel, specifically, the original partial penetration welds at the associated remnant heater sleeves for PVNGS, Units 1, 2, and 3. The pressurizer is an ASME Code Class 1 component.

3.2 Applicable Code Editions and Addenda

The licensee provided the applicable ASME Code, Section XI editions and addenda for each unit as shown in the table below. In addition, the table shows the applicable ISI 10-year intervals, including the scheduled start and end dates.

PLANT	ISI INTERVAL	ASME CODE EDITION	START	END
PVNGS Unit 1	third	2001 Edition through 2003 Addenda	07/18/08	05/31/19
PVNGS Unit 1	fourth	2013 Edition	06/01/19	07/17/28
PVNGS Unit 2	fourth	2013 Edition	11/01/18	10/31/28
PVNGS Unit 3	fourth	2013 Edition	06/01/18	01/10/28

The applicable edition of ASME Code, Section III, for PVNGS, Units 1, 2, and 3, is the 1974 Edition, through winter 1975 Addenda.

3.3 Applicable Code Requirements

As stated by the licensee in its letter dated August 31, 2018, following are the applicable requirements of ASME Code, Section XI, for which the licensee seeks an alternative:

- Section XI, Article IWA-4000 provides requirements for repair/replacement activities.

  IWA-4421 states, in part:

  > Defects shall be removed or mitigated in accordance with the following requirements...

  IWA-4422.1(a) states, in part:

  > A defect is considered removed when it has been reduced to an acceptable size...

  IWA-4422.1(b) states, in part:

  > Alternatively, the defect removal area and any remaining portion of the defect may be evaluated and the component accepted in accordance with the appropriate flaw evaluation provisions of Section XI...

- Section XI, Article IWA-3000, provides standards for examination evaluation.

  IWA-3100(a) states, in part:

  > Evaluation shall be made of flaws detected during an inservice examination as required by IWB-3000 for Class 1 pressure retaining components...

  IWA-3300(b) states, in part:

  > Flaws shall be characterized in accordance with IWA-3310 through IWA-3390, as applicable.

- Section XI, Article IWB-3000, provides acceptance standards for Class 1 components.

  IWB-3420 states:

  > Each detected flaw or group of flaws shall be characterized by the rules of IWA-3300 to establish the dimensions of the flaws. These dimensions shall be used in conjunction with the acceptance standards of IWB-3500.

- Section XI, Article IWB-2000 provides examination and inspection requirements for Class 1 components.

  IWB-2420(b) states, in part:

  > If a component is accepted for continued service in accordance with IWB-3132.3 or IWB-3142.4, the areas containing flaws or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the inspection program of IWB-2400...

3.4 Reason for Request

The licensee stated that during the preparation and review of the ISI program documents for the fourth 10-year ISI interval for PVNGS, Units 1, 2 and 3, the licensee determined that previously approved RR 29 related to flaws in the remnant pressurizer heater sleeves and remnant J-groove welds had only been authorized for the second interval. The current relief request seeks the same alternative for the remainder of the third ISI interval at Unit 1, the remainder of the fourth ISI intervals at Units 2 and 3, and the fourth ISI interval at Unit 1.

3.5 Proposed Alternative and Basis for Use (As stated by the licensee)

As stated by the licensee in its letter dated August 31, 2018:

> Pursuant to 10 CFR 50.55a(z)(1), APS requests NRC authorization of RR 62, which proposes an alternative to the ASME Code requirements of Section XI related to potential flaws in the original heater sleeve partial penetration welds in all 36 penetrations of each pressurizer. Authorization was previously granted by the NRC for the flaw evaluation as an alternative to the ASME Section XI

requirements for flaw removal IWA-4421, flaw characterization of IWA-3300, and successive examinations of IWB-2420 (Reference 3 [of the licensee's submittal]). The original remnant sleeve and penetration welds remain as evaluated in RR 29.

The flaw evaluation submitted with RR 29 and associated corrosion analysis (Reference 7 [of the licensee's submittal]) have been analyzed for the 60-year licensed operating life of the plant and have previously been determined to provide an acceptable level of quality and safety (Reference 3 [of the licensee's submittal]).

The applicable Code edition and addenda for ASME Section XI activities at the time that RR 29 was submitted was the 1992 edition, 1992 addenda. Pressurizer heater penetration welds were listed as B4.20 inspection items in Table IWB-2500-1. The B4.20 examination item is no longer listed in Table IWB-2500-1 for the applicable Code editions/addenda for the successive third and fourth 10-year ISI intervals. The pressurizer heater penetrations are leak tested every refueling outage as part of a system leakage test as B15.10 items. Since the time of the half-sleeve repairs there have been no indications of leaks identified in the new welds at the heater sleeve penetrations. Examinations will continue as required per IWB-2500 of the ASME Code.

3.6 NRC Staff Evaluation

The licensee requested authorization of proposed alternative RR 62 pursuant to 10 CFR 50.55a(z)(1). The licensee requested to use RR 62 on the basis that its proposed alternative to the ASME Code, Section XI requirements for flaws in pressurizer heater sleeve remnant J-groove welds provides an acceptable level of quality and safety.

By letter dated May 15, 2003 (ADAMS Accession No. ML031400051), the licensee submitted RR 23, "Pressurizer Heater Sleeves," for the second 10-year ISI interval at PVNGS, Units 1, 2, and 3. RR 23 was to perform ambient temperature temper bead welding to install weld buildups (pads) on the outside of the pressurizer to repair heater sleeves. The repair involved removing the lower portion of the heater sleeve, performing a weld buildup with Alloy 52 weld metal on the outside surface of the pressurizer, machining, inserting a new replacement Alloy 690 sleeve, and attaching the new replacement sleeve to the Alloy 52 weld pad using Alloy 52 weld metal with a J-groove weld design. In this design, the upper portion of the heater sleeve and the original J-groove weld on the inside surface of the pressurizer remain. This repair method is sometimes referred to as a half-sleeve pad repair. This type of repair is designed to be used on leaking heater sleeves due to degraded sleeve material or a degraded J-groove weld. In addition, this type of repair can be used proactively as a mitigation method. The NRC staff authorized this alternative for PVNGS, Units 1, 2, and 3, for the second 10-year ISI intervals on July 30, 2003 (ADAMS Accession No. ML032110542). RR 23 was only associated with the use of ambient temperature temper bead welding. RR 23 did not address potential flaws in the remnant sleeve material or the remnant J-groove weld. RR 23 was implemented to repair all of the PVNGS, Unit 2, heater sleeves during the November 2003 outage.

By letter dated June 15, 2004 (ADAMS Accession No. ML041750296), the licensee submitted RR 28, "Ambient Temperature Temper Bead Welding for Pressurizer Half-Sleeve replacement,"

and RR 29, "Remnant Sleeve(s) Flaw Evaluation," for the second 10-year ISI intervals for PVNGS, Units 1, 2, and 3.

In RR 28, the licensee proposed an alternative to use ambient temperature temper bead welding to perform sleeve repairs that use a half-sleeve repair approach, but did not have a weld buildup on the outside of the pressurizer for attachment of the replacement sleeve, as proposed and authorized in RR 23. The RR 28 approach was similar to control rod drive mechanism/control element drive mechanism nozzle repairs, where the attachment weld is located in the bore (half-sleeve mid-wall repair). At the time, the licensee intended to use this repair method on PVNGS, Units 1 and 3. Although approved for use by the NRC, this repair method in RR 28 was never implemented, and PVNGS used the method approved in RR 23 for all pressurizer sleeves on Units 1, 2, and 3.

In RR 29, the licensee proposed an alternative to flaw evaluation requirements and successive examinations of the remnant half-sleeves, including the J-groove attachment weld left in place after performing pressurizer heater sleeve repairs. The licensee requested RR 29 for use at PVNGS, Units 1, 2, and 3, and it can be applied to either of the heater sleeve repair methods (RR 23 or RR 28). The flaw evaluation supporting this alternative utilized both linear elastic fracture mechanics and elastic plastic fracture mechanics. The flaw evaluation demonstrated compliance with the ASME Code, Section XI criteria for the 40-year plant life, as well as for a potential 20-year life extension. However, the licensee requested, and the NRC authorized, RR 29 for the second 10-year ISI intervals only for all three units. The NRC staff's evaluation of remnant heater sleeves and remnant sleeve J-groove welds under RR 29 is detailed in Section 5.2 of its safety evaluation dated November 5, 2004, for RR 29 (ADAMS Accession No. ML043130170).

As stated in its letter dated August 31, 2018, the alternative in RR 29 was inadvertently not submitted for the third 10-year ISI interval. In its RR 62 request, the licensee requested the proposed alternative for the third and fourth 10-year ISI intervals for PVNGS, Units 1, 2, and 3. Units 2 and 3 are currently in the fourth 10-year ISI interval, and Unit 1 will begin the fourth 10-year ISI interval on June 1, 2019. In a request for additional information dated February 13, 2019 (ADAMS Accession No. ML19044A734), the NRC staff noted that in accordance with 10 CFR 50.55a(z), which states, in part, "A proposed alternative must be submitted and authorized prior to implementation," the staff would be unable to approve a proposed alternative in accordance with 10 CFR 50.55a(z) for the third intervals at PVNGS, Units 2 and 3, and all but the remainder of the third interval for Unit 1. In its letter dated March 14, 2019, the licensee modified its proposed alternative to apply to the remainder of the third ISI interval at Unit 1, the remainder of the fourth ISI intervals at Units 2 and 3, and the fourth ISI interval at Unit 1. The NRC staff finds this acceptable because the time periods that the licensee has requested in its alternative are consistent with 10 CFR 50.55a(z)(1).

The currently proposed alternative proposes the same alternative as RR 29, which, as stated above, was approved by the NRC for the second ISI intervals at PVNGS, Units 1, 2, and 3. The licensee had previously submitted Report No. SIR-04-045, Revision 0, dated June 2004, to support RR 29. The licensee referenced this report in support of RR 62. The report includes fracture mechanics analyses of postulated flaws in the original Alloy 600 heater sleeve and weld metal. The fracture mechanics analyses demonstrate that an assumed flaw left in place is acceptable for the life of PVNGS, Units 1, 2, and 3, including 20-year life extensions. In addition, the report provides the results of a corrosion analysis for the crevice region between the sleeve and pressurizer base material. The licensee's analysis concludes that anticipated corrosion in the crevice region will be within code allowable values, and is acceptable for the life

of the plant, including the 20-year life extensions. The ASME Code of Record for the second 10-year ISI intervals at PVNGS, Units 1, 2, and 3, was the 1992 Edition through the 1992 Addenda. The fracture mechanics analysis associated with RR 29 was performed in accordance with the 2001 Edition through 2003 Addenda of ASME Code, Section XI. However, the 2013 Edition of ASME Code, Section XI, is applicable to the fourth 10-year ISI interval at PVNGS, Units 1, 2, and 3. In its request for additional information dated February 13, 2019, the NRC staff requested that the licensee clarify whether it had performed a reconciliation between the ASME Code, Section XI edition/addenda used for the second 10-year ISI interval and the one used for the fourth 10-year ISI interval, and whether any differences impact the analysis detailed in Report No. SIR-04-045. The licensee responded in its letter dated March 14, 2019, as follows:

> APS has performed a reconciliation of the 1992 Edition/Addenda to the 2013 Edition of the ASME Code Section XI for the purpose of determining whether the supporting analysis (Report No. SIR-04-045) continues to meet the applicable requirements of the Code for the analytical evaluation of flaws. There are no differences identified between the 1992 Editions/Addenda and the 2013 Edition that impact the outcome and/or conclusions of the supporting analysis.

The NRC staff compared the ASME Code requirements applicable to RR 29 to the ASME Code requirements applicable to RR 62. The staff did not identify any differences that would result in a significant change in the results of the licensee's fracture mechanics analysis or corrosion analysis detailed in Report No. SIR-04-045. The staff previously reviewed this report as part of the review and authorization of RR 29. The results of the staff's review of Report No. SIR-04-045 are detailed in Section 5.2 of the RR 29 safety evaluation. Therefore, the NRC staff finds that RR 62 is acceptable.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the alternative proposed by the licensee in RR 62 will provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of the proposed alternative in RR 62 for the remainder of the third and the entire fourth 10-year ISI interval at PVNGS, Unit 1, and the remainder of the fourth 10-year ISI intervals at PVNGS, Units 2 and 3, as identified in Section 3.2 of this safety evaluation.

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

Principal Contributor: R. Davis

Date: April 19, 2019

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 – RELIEF REQUEST 62 REGARDING PROPOSED ALTERNATIVE PRESSURIZER HEATER SLEEVE REPAIRS (EPID L-2018-LLR-0120) DATED APRIL 19, 2019

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