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

April 12, 2013

Mr. Randall K. Edington
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 – REQUEST FOR RELIEF FROM ASME CODE, SECTION XI, REQUIREMENTS REGARDING PHASED ARRAY ULTRASONIC EXAMINATION TECHNIQUES IN LIEU OF RADIOGRAPHY (TAC NOS. ME9171, ME9172, AND ME9173)

Dear Mr. Edington:

By letter dated August 1, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12229A046), as supplemented by letter dated January 4, 2013 (ADAMS Accession No. ML13014A040), Arizona Public Service Company (APS, the licensee) requested U.S. Nuclear Regulatory Commission (NRC) relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section XI, paragraph IWA-4221, "Construction Code and Owner's Requirements." Paragraph IWA-4221 requires, in the case of repairs and replacements of welds, the use of Section III, paragraph NC-5200, which requires the use of radiographic examinations for acceptance testing on butt welds. The licensee is proposing to use phased array ultrasonic testing as an alternative to radiographic testing at Palo Verde Nuclear Generating Station, Units 1, 2, and 3, for the duration of the third 10-year inservice inspection (ISI) interval.

Specifically, pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), the licensee requested to use phased array ultrasonic examination techniques in lieu of radiographic examination techniques on the basis that the alternative provides an acceptable level of quality and safety. The NRC staff evaluated the licensee's submittal and determined that the request would be reviewed pursuant to 10 CFR 50.55a(a)(3)(ii), in that the current Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that APS has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes use of the proposed alternative at Palo Verde Nuclear Generating Station Units 1, 2, and 3 for the remainder of the third 10-year ISI intervals which end on July 17, 2018, for Unit 1; March 17, 2017, for Unit 2; and January 10, 2018, for Unit 3.

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

Sincerely,

Michael T. Markley, 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

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

RELIEF REQUEST 48 REGARDING PHASED ARRAY ULTRASONIC EXAMINATION TECHNIQUES IN LIEU OF RADIOGRAPHY

ARIZONA PUBLIC SERVICE COMPANY

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

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

1.0 INTRODUCTION

By letter dated August 1, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12229A046), as supplemented by letter dated January 4, 2013, (ADAMS Accession No. ML13014A040), Arizona Public Service Company (APS, the licensee) requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section XI, paragraph IWA-4221, "Construction Code and Owner's Requirements." Paragraph IWA-4221 requires, in the case of repairs and replacements of welds, the use of Section III, paragraph NC-5200, which requires the use of radiographic examinations for acceptance testing on butt welds. The licensee is proposing to use phased array ultrasonic testing (UT) as an alternative to radiographic testing (RT) at Palo Verde Nuclear Generating Station (Palo Verde), Units 1, 2, and 3, for the duration of the third 10-year inservice inspection (ISI) interval.

The licensee presented further information at a public meeting on August 30, 2012 (ADAMS Accession No. ML12243A435).

The licensee requested U.S. Nuclear Regulatory Commission (NRC) authorization pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR) for the use of a proposed alternative on the basis that the alternative provides an acceptable level of quality and safety. The NRC staff evaluated the licensee's submittal and determined that the request would be reviewed pursuant to 10 CFR 50.55a(a)(3)(ii), in that the current Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

The licensee has requested relief from the requirements of ASME Code, Section XI, paragraph IWA-4221. ASME Code, Section XI, Section IWA-4200 covers repair and replacement activities, and paragraph IWA-4221 requires the use of Section III, paragraph NC-5200, which requires the use of radiographic examinations on Class 2 piping butt welds.

Pursuant to 10 CFR 50.55a(g)(4), "Inservice inspection requirements," ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that repair and replacement activities comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b), "Standards approved for incorporation by reference," 12 months prior to the start of the 120-month inspection interval, subject to the conditions listed therein.

The regulations in 10 CFR 50.55a(a)(3) 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 demonstrated that (i) The proposed alternatives would provide an acceptable level of quality and safety; or (ii) Compliance with the specified requirements of this section 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 concludes that regulatory authority exists for the licensee to request and the Commission to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Alternative

3.1.1 Applicable Code and Addenda

The ASME Code of record for the third 10-year ISI interval for Palo Verde, Units 1, 2, and 3 is the ASME Code, Section XI, 2001 Edition through the 2003 Addenda.

The Construction Code for Palo Verde, Units 1, 2, and 3 was the ASME Code, Section III, 1974 Edition through the Winter 1975 Addenda.

3.1.2 Code Requirement

As stated in the licensee's letter dated August 1, 2012:

> The 2001 Edition [through the] 2003 Addenda of ASME [Code] Section XI, paragraph IWA-4221 (Construction Code and Owner's Requirements) requires the owner to use the requirements of the construction code for repair and replacement activities. The examination requirements for ASME Section III, Class 2 circumferential butt welds are contained in the ASME Code, Section III, paragraph NC-5200. The requirement is to perform radiographic examinations of these welds using the acceptance standards specified in [ASME Code Section III] paragraph NC-5300.

ASME Section III Code Case N-659-2 ["Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination"] documents alternative examination requirements in the form of ultrasonic examination requirements, but is not currently accepted for use in Regulatory Guide 1.84, *Design, Fabrication, and Materials Code* Case *Acceptability, ASME Section III.*

3.1.3 Duration of Relief Request

The licensee requests approval of this relief for the remainder of the third ISI 10-year interval for Palo Verde, Units 1, 2, and 3. The third ISI 10-year interval for Palo Verde ends on July 17, 2018, for Unit 1; March 17, 2017, for Unit 2; and January 10, 2018, for Unit 3.

3.1.4 Proposed Alternative Examinations

In lieu of the Code-required RT, the licensee is proposing the use of a modified version of ASME Section III, Code Case N-659-2, which describes alternative UT qualification requirements. ASME Code Case N-659-2 is not currently accepted for use in Regulatory Guide 1.84, *Design, Fabrication, and Materials Code* Case *Acceptability, ASME Section III.*

By letter dated August 1, 2012, the licensee stated, in part, that

> Several key variables are being proposed to support the basis for this relief. Many of these are considered conservative at this time; but are considered to be good practice for initial technique implementation. These additional key variables are as follows:
>
> - Procedures will utilize ASME Section V, Article 4 (2001 Edition 2003 Addenda)
>   - Procedure demonstration will utilize [ASME] Code Case N-659-2 paragraph (d)
>   - The demonstration will be required for each nominal diameter and thickness
>   - The demonstration will document the requirements of Table T-42[2]
> - Personnel will be qualified as noted in [ASME] Code Case N-659-2
>   - Analysis personnel will demonstrate detection and sizing
> - Acceptance criteria will be ASME Section III (2001 Edition 2003 Addenda)
> - Weld caps will be ground flush with the pipe
> - The volume (Figure 1 of Attachment 2) will be scanned in all 4 directions
> - 100% coverage (calculated with the 45 degree beam)
> - Volume will be scanned with a 0 degree but may be manual (not encoded)

- Phased array scanning will be automated (encoded)
- A linear or raster scan pattern (as demonstrated) will be used
- The data will be recorded for analysis and storage
- All welds will receive a surface ([Penetrant Testing] PT or [Magnetic Particle Testing] MT) examination
- The preservice examinations will be performed per ASME Section XI

3.1.5 Hardship Posed By Radiographic Testing

By letter dated August 1, 2012, the licensee stated, in part, that

> The reasons for this relief request are grouped into two areas; personnel safety and outage support. The use of the phased array ultrasonic examination techniques will eliminate the personnel safety risk of radiological exposure associated with radiography. Specifically, the planned and accidental exposure associated with transporting, positioning, and exposing a source for the radiographic examinations are removed. Industry operating experience indicates that overexposures occur in the radiography industry. In addition to this personnel safety risk reduction, there is an anticipated overall reduction in dose for the examinations. This is realized by the use of an automated scanner, remote analysis processes, and the limited number of personnel needed to perform the examinations. The phased array ultrasonic examination technique (PAUT) crew size would be 1 or 2; whereas, the radiography crews range from a minimum of 5 to upwards of 15.
>
> With regard to outage support, the use of PAUT will reduce the time associated with a given weld examination and subsequent documented examination results. In addition, other outage activities in the area are not impacted during the examination. The PAUT examinations can be performed as soon as the weld joint surface is prepared. There is also a reduction in overall outage risk by eliminating the need to stop and start critical maintenance and operations tasks affected by the radiographic exclusion area. Additional savings are realized by eliminating the need for large amounts of support from radiation protection, boundary guards, and other support personnel. The current planned scope for Unit 1 Refueling Outage 17 (1R17) includes economizer feedwater piping replacement in containment.

3.1.6 Licensee's Basis for Requesting Relief

By letter dated August 1, 2012, the licensee stated, in part, that

> The overall basis for this relief is that PAUT is equivalent to or superior for detecting and sizing critical (planar) flaws as compared to the required radiographic examination. In this regard, the basis for the proposed alternative was developed from numerous Codes, Code Cases, associated industry

experience, articles, and the results of RT and PAUT examinations of APS flawed specimens.

APS developed a set of actual (not implanted) weld flawed specimens. The carbon steel flawed specimen set ranged in diameters from 4" thru 32", with wall thickness from 0.432" thru 2". The specimen set list is summarized in Attachment 1, along with the flaw types associated with each. This specimen set contains circumferential butt welds utilizing both GTAW [gas tungsten arc weld] and SMAW [shielded metal arc weld] welding processes and actual fabricated flaws. The number of flaws totaled over 60 and included porosity, incomplete fusion, incomplete penetration, slag, and cracking. The specimens also included areas of concavity and root and counterbore geometrical indications. All specimens were radiograph examined in accordance with ASME Section III procedures and then scanned with the proposed PAUT.

The results of the APS flawed specimen evaluation of RT versus PAUT are consistent with other literature (References 2, 7 and 14). The results show that the PAUT detected all the indications noted by the radiographic examinations; plus several additional indications not identified by radiography. These additional indications were evaluated mainly as areas of incomplete fusion. In addition, several weld and adjacent base metal cracks in the required volume were identified on the PAUT, where none were noted utilizing the radiography technique.

3.2 <u>NRC Staff Evaluation</u>

3.2.1 <u>Background</u>

The licensee is proposing to use a modified version of ASME Code Case N-659-2 as the basis for the proposed alternative in Relief Request 48 (RR-48). The major change from ASME Code Case N-659-2 in RR-48 is that the proposed examinations would be required to be encoded phased array ultrasonic examinations, conducted from both sides of the weld with the weld crowns ground flush. The inspections would include as a minimum, a manual, 0-degree beam, and phased array angles from 40-70 degrees at 1-degree increments. The licensee will use ASME Code, Section III, NC-5330, "Acceptance Standards," as the acceptance criteria for the inspections. Also, these examinations would not count as the pre-service ultrasonic examinations, which would be conducted in accordance with ASME Code, Section XI. RR-48 is applicable only to ferritic steel welds in Class 2 piping repair and replacement activities.

In its letter dated August 1, 2012, the licensee stated that a reason for this relief request is that performing RT examinations would involve increased radiation doses to a larger crew of workers than with UT examinations. Work crews for RT could involve as many as 15 personnel. RT examinations normally involve the use of highly radioactive gamma ray or x-ray emitting sources, which pose a personal safety risk of inadvertent or accidental exposure in addition to occupational exposure from working in the reactor environment. The NRC staff concludes that this could present a hardship or unusual difficulty without a compensating increase in the level of quality or safety.

UT, like RT, is a volumetric inspection technique that is commonly used to inspect welds in nuclear power plants and other industries. Ultrasonic examinations are not equivalent to radiographic examinations due to different physical mechanisms each employ to detect and characterize discontinuities. These differences in physical mechanisms result in several key differences in sensitivity and discrimination capability. The NRC has examined the differences between UT and RT in a technical letter report PNNL-19086, "Replacement of Radiography with Ultrasonics for the Nondestructive Inspection of Welds – Evaluation of Technical Gaps – An Interim Report," April 2010 (ADAMS Accession No. ML101031254). More recent information, including work performed at the Pacific Northwest National Laboratory on the application of UT in lieu of RT was presented by the licensee at a public meeting on August 30, 2012 (ADAMS Accession No. ML12243A447).

3.2.2 Key Issues

Key issues in the use of UT in lieu of RT are the relative strengths and weaknesses of UT and RT, the acceptance criteria that are to be used, the procedure demonstration, and the personnel demonstration. Each of these factors is described in more detail below.

3.2.2.1 Radiographic Testing versus Ultrasonic Testing

RT has certain advantages over UT. These advantages are partially the result of RT being a direct imaging method using transmitted gamma rays or x-rays versus UT, which uses reflected ultrasonic energy. The identification of varied welding flaws using radiographs is more straightforward with RT than when using UT, as RT is capable of significantly higher spatial resolution than UT in ferritic and austenitic piping welds. The higher spatial resolution, coupled with a direct imaging approach, can produce clear images of the flaws and allows the inspector to discriminate between flaw types based on the shapes and characteristics of the flaws in the radiographic image. In addition, when examining coarse-grained materials such as austenitic welds and cast austenitic materials, RT is not affected by the grain sizes of the materials being inspected, as the attenuation of transmitted gamma or X-rays is primarily a function of the density of a material, not the material's microstructure. Radiography is, therefore, very sensitive to volumetric flaws such as slag and porosity, which have different densities than the unflawed material. Also, RT provides a permanent record of the examination in the form of the radiographic film.

A disadvantage of RT is that it is relatively insensitive to planar flaws such as cracks and lack of fusion defects unless the beam is aligned very closely in the direction of the planar flaws. Furthermore, standard applications of RT are not generally useful in determining the through-wall position, or extent, of any possible indications. Radiographic acceptance standards concentrate on the type and length of indications and do not consider the indication's depth.

Depending on the materials and fabrication processes involved, ultrasonic examinations are more sensitive to planar flaws, such as cracks or lack of fusion than RT. UT also has the ability to locate the depths of volumetric and planar flaws in the weld. An important advantage of UT is that it is significantly easier to deploy than RT, as it does not involve radioactive sources and does not require an exclusion zone around the test area to preclude the inadvertent exposure to workers.

A disadvantage of UT is that, while UT is sensitive to small flaws and planar flaws, the lower spatial resolution of UT makes it more challenging to discriminate between different flaw types, as noted above. The effectiveness of UT is also very material dependent, as ultrasonic energy can be sensitive to the grain structure of the inspected material. Though not applicable to this relief request, it should be noted that UT may have reduced reliability in inspections of cast austenitic materials and austenitic welds. Finally, UT inspections would not produce data that can be reviewed at a later date unless the UT data is spatially encoded and electronically recorded during the inspection.

When examining ferritic low alloy and carbon steels, the disadvantages of UT when used in coarse-grained materials described above are minimized. Ferritic steels and their welds typically have a fine grain structure, allowing the use of high-frequency longitudinal and shear waves, with the potential to improve the spatial resolution of UT in these applications. Ferritic steels also produce low amounts of backscattered ultrasonic noise and produce low levels of acoustic attenuation during inspections, allowing a high sensitivity for detection of flaws.

The licensee is proposing to use encoded phased-array inspections which would provide a permanent record of the inspection that could be reviewed later. The licensee is planning on making printouts of each examination and storing these as permanent records.

Finally, the NRC staff expressed concerns regarding the ability of this encoded phased-array method to discriminate between the various flaw types in ferritic material. The licensee provided information at the public meeting on August 30, 2012, and in its letter dated January 4, 2013, on the ability of the four-direction phased array technique to detect and characterize flaws in ferritic welds. The licensee provided images of scans showing the clear detection of examples of each type of flaw. The phased array technique was shown to be able to detect flaws throughout the volume of the welds. The licensee was also able to show the different characteristics of the different flaw types that would allow an inspector to discriminate between the various flaw types. Therefore, the NRC staff concludes the encoded phased-array method will adequately discriminate between the various flaw types in ferritic material.

3.2.2.2 Acceptance Criteria

The licensee is implementing ASME Code, Section III, NC-5330 acceptance criteria for the weld inspections. The NC-5330 acceptance criteria describe two classes of flaws. Planar-type flaws that are defined as cracks, lack of fusion, and incomplete penetration are not acceptable at any length. Other volumetric-type flaws, such as slag and porosity, are acceptable if their length is below certain thresholds defined in NC-5330. The two classes of flaws require that the inspector be able to discriminate between the flaw types. While it makes little difference if the inspector cannot distinguish between slag and porosity, as they have the same acceptance criteria, it is critical that the inspector be able to properly characterize cracks, lack of fusion, and incomplete penetration, as these types of flaws are always unacceptable in ASME Code, Section III, NC-5330. Refer to Section 3.2.2.4 below for additional information on personnel demonstration.

The NRC staff expressed a concern with the NC-5330 acceptance criteria in that it only calls for the inspector to evaluate indications with amplitudes that exceed 20 percent of the reference level. Experience with service-induced degradation indicates that this prescriptive requirement could result in missed flaws. This concern was addressed by the licensee in the supplemental letter dated January 4, 2013, where the licensee clarified that it would not use the 20 percent threshold, but rather, all recorded UT data will be evaluated in accordance with their procedure. The NRC staff concludes that the use of ASME Code Section III NC-5330 acceptance criteria without the 20 percent amplitude threshold is acceptable for the UT techniques described in RR-48.

3.2.2.3 Procedure Demonstration

The procedure demonstration described in RR-48 is an open demonstration using a number of flaws described in ASME Code Case N-659-2 Paragraph (d). The inspection procedures would be qualified by examining a set of open test specimens to determine if the procedure can detect and characterize the flaws in the specimens. The specimens will contain a variety of fabrication-style flaws, including incomplete fusion, incomplete penetration, slag inclusions, porosity, and cracking.

The NRC published a proposed rule in the *Federal Register* on October 27, 2006 (71 FR 62947) that specifies conditions for the use of ASME Code Case N-659. The proposed rule stipulates the use of a blind procedure demonstration, similar to an ASME Code, Section XI, Appendix VIII, Supplement 10, "Qualification Requirements for Cast Austenitic Piping Welds," procedure demonstration, and requires at least 30 flaws be performed. The proposed rule, which covers the inspection of Class 1 and 2 austenitic and ferritic welds, is more strict than those described by the licensee in RR-48.

The lack of compliance with the conditions set forth in the proposed rule would pose a significant barrier for acceptance of RR-48 if it had applied to Class 1 austenitic welds and/or dissimilar metal welds. This concern over the procedure demonstration has been further addressed through the information provided in the licensee's letter dated August 1, 2012, the information presented at a public meeting on August 30, 2012, and the licensee's supplemental letter dated January 4, 2013. The specimens described in the letter dated August 30 2012, and the example inspections provided in the supplementary information show that the licensee has demonstrated that its procedures are capable of detecting fabrication flaws and discriminating between the different flaw types in ferritic welds.

Additionally, as described in the supplement dated January 4, 2013, licensee personnel performing the examination must pass a blind demonstration prior to analyzing data from the welds. An analyst reviewing data from a poorly-performing procedure would have a very challenging time passing a performance demonstration.

The information provided by the licensee on the limitation of RR-48 to Class 2 ferritic welds, the large number of flaws scanned, detected, and identified in the information presented at a public meeting on August 30, 2012, and the letter dated January 4, 2013, and the use of the blind personnel performance demonstration qualification (described below) adequately addresses the NRC staff concerns regarding deficiencies of ASME Code Case N-659-2 Paragraph (d).

3.2.2.4 Personnel Demonstration

As explained in the licensee's letter dated January 4, 2013, personnel conducting the examinations would need to pass a blind demonstration. The analyst would be given recorded encoded data and would have to correctly identify and characterize five flaws with no false calls or mischaracterizations. This differs from the personnel qualification requirements described in the October 27, 2006 proposed rule, which requires a minimum of ten flaws be used. As RR-48 only applies to ferritic Class 2 welds, the use of a minimum of five flaws, with no false calls, is acceptable for the ultrasonic techniques described in RR-48.

The acceptance criteria for the personnel tests use ASME Code, Section XI, Appendix VIII, Supplement 2, Table VIII-S2-1, "Performance Demonstration Detection Test Acceptance Criteria," for flaw detection and false-call rates. The table was developed using statistical power curves to exclude poorly-performing personnel while allowing highly performing personnel to pass. For example, a performance demonstration using Table VIII-S2-1 and using five flaws would give an inspector with a 50 percent probability of detection (POD) a 3 percent chance of passing, while an inspector with a 95 percent POD would have approximately an 80 percent chance of passing.

ASME Code, Section III, NC-5330, describes two sets of acceptance standards for different types of flaws (i.e., no acceptable flaw lengths for cracks, lack of fusion, and incomplete penetration and acceptable flaw lengths for other flaws). An important part of RR-48 is how the licensee will classify mischaracterized flaws during the personnel qualification. The licensee has stated that if the analyst characterizes a crack, lack of fusion, or incomplete penetration flaw as slag or porosity, the flaw will be considered to be missed. In addition, the length sizing criteria proposed by the licensee (i.e. no under sizing is allowed), is acceptable as it prevents unacceptable volumetric indications from passing.

The NRC staff concludes that the use of blind personnel demonstration using ASME Code, Section XI, Appendix VIII, Supplement 2, Table VIII-S2-1, for flaw detection and false calls, length-size the flaws with no under sizing, and the requirement to discriminate between cracks, lack of fusion, and incomplete penetration versus slag and porosity, is acceptable for the ultrasonic techniques described in RR-48.

3.2.3 <u>Summary</u>

The NRC staff expressed concerns regarding the implementation of ASME Code Case N-659-2 and with the general use of UT in lieu of RT. Based on the above, the NRC staff concludes the conditions described in the submittal dated August 1, 2012, as supplemented by letter dated January 4, 2013, in addition to the information presented at the public meeting on August 30, 2012, on the use of ASME Code Case N-659-2 for use on ferritic material adequately addresses these concerns.

4.0 CONCLUSION

As set forth above, the NRC staff concludes that the licensee's proposed alternative to use ASME Code Case N-659-2 on ferritic Class 2 piping, with the supplementary conditions described in RR-48 to substitute ultrasonic testing in lieu of radiographic testing, including: (1) encoded phased array examinations conducted from both sides of the weld, with the weld crowns ground flush, (2) the inspection angles to include a 0-degree beam, and angles from 40-70 degrees as a minimum, and (3) use of ASME Code, Section III, NC-5330, as the acceptance criteria, provides reasonable assurance of structural integrity and leak tightness of the subject Class 2 ferritic piping welds. In addition, the NRC staff concludes that compliance with ASME Code requirements for RT examinations of the subject welds would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes use of the proposed alternative at Palo Verde, Units 1, 2, and 3 for the remainder of the third 10-year ISI intervals which end on July 17, 2018, for Unit 1; March 17, 2017, for Unit 2; and January 10, 2018, for Unit 3.

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

Principal Contributor: Stephen Cumblidge, NRR/DE/EPNB

Date: April 12, 2013

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

Sincerely,

/RA/

Michael T. Markley, 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

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