August 4, 2008

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 – RELIEF REQUEST NOS. 20 AND 21 RE: THIRD INTERVAL 10-YEAR INSERVICE INSPECTION PROGRAM (TAC NOS. MD7674, MD7675, AND MD7676)

Dear Mr. Edington:

By letter dated December 21, 2007, Arizona Public Service Company (APS, the licensee) submitted Relief Request (RR) Nos. 20 and 21 requesting relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirements at Palo Verde Nuclear Generating Station (Palo Verde), Units 1, 2, and 3, for the third 10-year inservice inspection (ISI) program interval. The start dates of the Palo Verde third 10-year ISI program interval are July 18, 2008, March 18, 2007, and January 11, 2008, for Units 1, 2, and 3, respectively. RR Nos. 20 and 21 provide alternatives to the requirements of ASME Code, Section XI that preclude welding over or embedding an existing flaw. These requests are based on the use of the Westinghouse Electric Company, LLC, repair methodology as documented in WCAP-15987-P, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," which was reviewed and approved by the U.S. Nuclear Regulatory Commission (NRC) staff in a July 3, 2003, Safety Evaluation (Agencywide Documents Access and Management System (ADAMS) Accession No. ML031840237). The NRC staff previously reviewed and approved the use of RR Nos. 20 and 21 at the Palo Verde units for the second 10-year ISI program interval in a letter dated September 25, 2003 (ADAMS Accession No. ML032690956).

The NRC staff has reviewed the licensee's submittal and determined that RR Nos. 20 and 21 will provide an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, 50.55a(a)(3)(i), the NRC staff authorizes the use of RR Nos. 20 and 21 as proposed alternatives to the flaw repair requirements of IWA-4421(c) of the ASME Code, Section XI at Palo Verde, Units 1, 2, and 3 for the third 10-year ISI program interval.

A copy of the related Safety Evaluation is enclosed. All other ASME Code, Section XI, requirements for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Mohan C. Thadani, Acting 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 w/encl: See next page

A copy of the related Safety Evaluation is enclosed. All other ASME Code, Section XI, requirements for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Mohan C. Thadani, Acting 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 w/encl: See next page

DISTRIBUTION:
PUBLIC
LPLIV r/f
RidsAcrsAcnw_MailCTR Resource
RidsNrrDciCpnb Resource
RidsNrrDorlDpr Resource
RidsNrrDorlLpl4 Resource
RidsNrrPMMMarkley Resource
RidsNrrLAJBurkhardt Resource
RidsOgcRp Resource
RidsRgn4MailCenter Resource
MCox, EDO RIV
TBilik, Region III

ADAMS Accession No.: ML082070398 (*) Concurrence via SE (**) See previous concurrence

OFFICE	NRR/LPL4/PM	NRR/LPL4/LA	DCI/CPNB/BC	OGC	NRR/LPL4/BC (A)	NRR/LPL4/PM
NAME	MMarkley	JBurkhardt	TChan (*)	RvHolmes	MThadani	MMarkley
DATE	7/28/08	7/28/08	3/3/08	7/31/08	8/01/08	8/04/08

OFFICIAL AGENCY RECORD

cc:
Mr. Steve Olea
Arizona Corporation Commission
1200 W. Washington Street
Phoenix, AZ 85007

Mr. Douglas Kent Porter
Senior Counsel
Southern California Edison Company
Law Department, Generation Resources
P.O. Box 800
Rosemead, CA 91770

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 40
Buckeye, AZ 85326

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
612 E. Lamar Blvd., Suite 400
Arlington, TX 76011-4125

Chairman
Maricopa County Board of Supervisors
301 W. Jefferson, 10th Floor
Phoenix, AZ 85003

Mr. Aubrey V. Godwin, Director
Arizona Radiation Regulatory Agency
4814 S. 40th Street
Phoenix, AZ 85040

Mr. Scott Bauer, Director
Regulatory Affairs
Palo Verde Nuclear Generating Station
Mail Station 7636
P.O. Box 52034
Phoenix, AZ 85072-2034

Mr. Dwight C. Mims, Vice President
Regulatory Affairs and Plant Improvement
Palo Verde Nuclear Generating Station
Mail Station 7605
P.O. Box 52034
Phoenix, AZ 85072-2034

Mr. John C. Taylor
Director, Nuclear Generation
El Paso Electric Company
340 E. Palm Lane, Suite 310
Phoenix, AZ 85004

Mr. James Ray
Public Service Company of New Mexico
2401 Aztec NE, MS Z110
Albuquerque, NM 87107-4224

Mr. Geoffrey M. Cook
Southern California Edison Company
5000 Pacific Coast Hwy., Bldg. D21
San Clemente, CA 92672

Mr. Robert Henry
Salt River Project
6504 E. Thomas Road
Scottsdale, AZ 85251

Mr. Jeffrey T. Weikert
Assistant General Counsel
El Paso Electric Company
Mail Location 167
123 W. Mills
El Paso, TX 79901

Mr. Eric Tharp
Los Angeles Department of Water & Power
Southern California Public Power Authority
P.O. Box 51111, Room 1255-C
Los Angeles, CA 90051-0100

Mr. Brian Almon
Public Utility Commission
William B. Travis Building
P.O. Box 13326
1701 N. Congress Avenue
Austin, TX 78701-3326

Ms. Karen O'Regan
Environmental Program Manager
City of Phoenix
Office of Environmental Programs
200 W. Washington Street
Phoenix, AZ 85003

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION RELIEF REQUEST NOS. 20 AND 21

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

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

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

1.0 INTRODUCTION

By letter dated December 21, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080020005), Arizona Public Service Company (APS, the licensee) submitted Relief Request (RR) Nos. 20 and 21, requesting relief from certain requirements of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the ASME Code) for the Palo Verde Nuclear Generating Station (Palo Verde), Units 1, 2, and 3 for the third 10-year inservice inspection (ISI) program interval. The start dates of the Palo Verde third 10-year ISI program interval are July 18, 2008, March 18, 2007, and January 11, 2008, for Units 1, 2, and 3, respectively. RR Nos. 20 and 21 provide alternatives to the requirements to Section XI of ASME Code that preclude welding over or embedding an existing flaw. The relief requests proposed alternatives to use an embedded repair technique if cracks were found on the inside and/or outside diameter of the Palo Verde control element drive mechanism (CEDM) nozzles or on the J-groove attachment welds, respectively. These techniques would be used in lieu of the ASME Code, Section XI requirements that preclude welding over or embedding an existing flaw. Clarifications on the relief requests were discussed with Mr. Glenn Michael and others on February 19, 2008.

The proposed embedded flaw repair is designed to isolate primary water stress-corrosion cracking (PWSCC)-susceptible Alloy 600 material from primary water. PWSCC has been identified in CEDM nozzles made from Alloy 600 material since 1986. The process would embed PWSCC cracks found in Alloy 600 reactor pressure vessel (RPV) head penetration nozzles and J-groove welds under a non-structural Alloy 690 weld overlay or seal weld. The overlay serves to isolate the PWSCC-susceptible Alloy 600 material from primary water and should arrest any further crack growth.

2.0 REGULATORY EVALUATION

The ISI of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(4)(i). Section 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the

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

Pursuant to 10 CFR 50.55a(g)(4), 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, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals 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), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The ISI Code of record for the Palo Verde, Units 1, 2, and 3 third 10-year ISI intervals is the 2001 Edition and Addenda through 2003 of Section XI of the ASME Code. Relief requests are based on the use of the Westinghouse Electric Company, LLC (Westinghouse), repair methodology as documented in Topical Report (TR) WCAP-15987-P, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," which was reviewed and approved by the staff in a July 3, 2003, Safety Evaluation (ADAMS Accession No. ML031840237). By letter dated September 25, 2003 (ADAMS Accession No. ML032690956), the NRC staff previously reviewed and approved the use of RR Nos. 20 and 21 at Palo Verde for the second 10-year ISI interval for Units 1, 2, and 3.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Component(s) Affected

Code components associated with these requests are CEDM nozzle penetrations (97) and Reactor Head Vent nozzle penetration (1), Code Class 1.

RR No. 20 would allow repairs on the inside diameter of the CEDM penetrations.

RR No. 21 would allow repairs on the outside diameter of the CEDM penetrations as well as on the J-groove attachment welds on Vessel Head Penetrations (VHP).

3.2 Applicable Code Edition and Addenda

The third 10-year ISI interval Code 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, is the ASME Code, Section III, 1971 Edition, 1973 Winter Addenda.

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

3.3 Applicable Code Requirements

The current ASME rules do not allow welding over or embedding an existing flaw. The applicable code requirement for which relief is requested is the ASME Code, Section XI, 2001 Edition, including Addenda through 2003:

IWA-4412 "Defect Removal"

> Defect removal shall be accomplished in accordance with the requirements of IWA-4420.

IWA-4420 "Defect Removal Requirements"
IWA-4421 "General Requirements"

> Defects shall be removed or mitigated in accordance with the following requirements:
>
> (c) Defect removal or mitigation by welding or brazing shall be in accordance with IWA-4411.

3.4 Licensee's Proposed Alternative to Code and Basis

Proposed Alternative

As an alternative to the rules of IWA-4421(c) contained in ASME Code, Section XI of the 2001 Edition through the 2003 Addenda which do not allow welding over or embedding an existing flaw, it is requested that the NRC approve the use of the proposed alternative method presented to the NRC by Westinghouse on December 13, 2001, and supplemented by letters dated August 29, 2002, November 13, 2002, and May 16, 2003. In these letters, Westinghouse introduced and submitted licensing TR WCAP-15987-P, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetration," to the NRC for review and approval. The TR was approved by NRC letter "Acceptance for Referencing - Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations,'" dated July 3, 2003 (ADAMS Accession No. ML031840237).

APS will be using the Westinghouse TR and will follow the "Conditions and Limitations," identified in Section 5.0 of the approval letter dated July 3, 2003, as well as Reference 5 from the approval letter dated April 11, 2003, from Richard J. Barrett, NRC, to Alex Marion, Director of Engineering, Nuclear Energy Institute (NEI), Subject: "Flaw Evaluation Guidelines," for characterization of flaws (ADAMS Accession No. ML030980322).

Basis for Alternative Requirements

APS will be performing inspections of the vessel head penetrations in accordance with the commitments made in response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." In the event that any of the inspections indicate flaws in those penetrations, it will be necessary to repair such flaws. Pursuant to 10 CFR 50.55a(a)(3)(i), the alternative is proposed on the basis that it will provide an acceptable level of

quality and safety. Additionally, the removal of the flaw and rewelding of the cavity will involve substantially more radiation exposure depending on the size and location of the flaw and whether temper bead welding rules have to be followed. The increase in exposure is estimated to be between 15 roentgen equivalent man (rem) and 40 rem depending on radiation conditions and the complexity of the repair.

The licensee states that the embedded flaw repair technique is considered a permanent repair for the following reasons:

1. As long as a PWSCC flaw remains isolated from the primary water (PW) environment, it cannot propagate. Since Alloy 52 weldment is considered highly resistant to PWSCC, a new PWSCC crack cannot initiate and grow through the Alloy 52 overlay to reconnect the PW environment with the embedded flaw. Structural integrity of the affected J-groove attachment weld will be maintained by the remaining unflawed portion of the weld.

2. The residual stresses produced by the embedded flaw technique have been measured and found to be relatively low. This was documented in the attachment to a letter from E.E. Fitzpatrick, Indiana Michigan Power Company (I&M), to the NRC Document Control Desk, "Reactor – Vessel Head Penetration Alternate Repair Techniques," AEP:NRC:1218A, dated March 12, 1996. The low residual stresses indicate that no new cracks will initiate and grow in the area adjacent to the repair weld.

3. As identified in Westinghouse letter LTR-NRC-01-41, "ASME Section XI Inservice Inspection Program Relief Requests – Alternative Repair Technique," dated December 13, 2001, the repair is made with Alloy 52 weld material. After the weld repair is completed, its integrity is verified by liquid penetrant inspection. The only known mechanisms for cracking of the weld used to embed a flaw, or the surrounding region, is fatigue. The calculated fatigue usage in this region is very low because the reactor vessel head region is isolated from the transients which affect the hot leg or cold leg piping. The thickness of the weld has been set to provide a permanent embedment of the flaw, without adding sufficient weld to increase the residual stresses. This ensures that the embedded flaw repair will not affect areas nearby to the repair.

The proposed weld repair process is based on, and compared to, the requirements of the 1989 Edition of the ASME Code, Section XI. ASME Code, Section XI, 1989 Edition, Paragraph IWA-4120 states, in part, that "Repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system." Licensees choosing to use other Editions and Addenda of the ASME Code must reconcile the Code requirements to those of the 1989 Edition of the ASME Code. Since the ISI Code of record for the Palo Verde units differs from the Code Edition referenced in the WCAP, the licensee performed a Code reconciliation to verify that the bases contained in the WCAP are applicable to the Palo Verde units. The licensee concluded that there were no significant differences between the Code versions for the applicable Code requirements and the technical findings in WCAP-15987-P, Revision 2 are valid for the Palo Verde units. The results of the reconciliation are included as an attachment to the licensee's December 21, 2007, RR Nos. 20 and 21.

Duration of the Proposed Requests

The duration of the proposed alternatives is for the third 10-year inspection interval of Palo Verde, Units 1, 2, and 3. The third 10-year ISI program interval start dates are July 18, 2008, March 18, 2007, and January 11, 2008, for Units 1, 2, and 3, respectively.

4.0 STAFF EVALUATION

The NRC staff previously reviewed and approved the use of RR Nos. 20 and 21 at Palo Verde for the Units 1, 2, and 3 second 10-year ISI interval in a September 25, 2003, Safety Evaluation (ADAMS Accession No. ML032690956).

The staff has reviewed Westinghouse TR WCAP-15987-P, Revision 2, and, in a letter dated July 3, 2003 (ADAMS Accession No. ML031840237), the staff accepted the referencing of the TR for use with the following limitations:

1. Licensees must follow the NRC flaw evaluation guidelines provided in the letter dated April 11, 2003 (ADAMS Accession No. ML03090322), from Richard J. Barrett, NRC, to Alex Marion, Director of Engineering, NEI, Subject: Flaw Evaluation Guidelines.

2. The crack growth rate referenced in WCAP-15987-P, Revision 2 is not applicable to Alloy 600 or Alloy 690 weld material; i.e., Alloy 52, 82, 152, and 182 filler material.

3. The nondestructive examination (NDE) requirements listed in the table below must be implemented for examinations of repairs made using the embedded flaw process.

Repair Location	Flaw Orientation	Repair Weld	Repair NDE	ISI NDE of the repair, Note 2
VHP Nozzle ID	Axial	Seal	UT and Surface	UT or Surface
VHP Nozzle ID	Circumferential	Note 1	Note 1	Note 1
VHP Nozzle OD above J-groove weld	Axial or Circumferential	Note 1	Note 1	Note 1
VHP Nozzle OD below J-groove weld	Axial or Circumferential	Seal	UT or Surface	UT or Surface
J-groove weld	Axial	Seal	UT and Surface, Note 3	UT and Surface, Note 3
J-groove weld	Circumferential	Seal	UT and Surface, Note 3	UT and Surface, Note 3

Notes:
1. Repairs must be reviewed and approved separately by the NRC.
2. Inspection consistent with the NRC Order EA-03-009 dated February 11, 2003, and any subsequent changes.
3. Inspect with personnel and procedures qualified with UT [ultrasonic testing] performance-based criteria. Examine the accessible portion of the repaired region. The UT coverage plus surface coverage must equal 100 percent.

The licensee stated that it would use the Westinghouse TR and would follow the conditions and limitations identified above.

The licensee performed Code reconciliation between the 1989 Edition ASME Code version referenced in WCAP-15987-P, Revision 2 and ISI Code of record for the Palo Verde units, the 2001 Edition through the 2003 Addenda, to ensure all related requirements would be met. The licensee concluded that there were no significant differences between the Code versions for the applicable Code requirements and the technical findings in WCAP-15987-P, Revision 2 are valid for the Palo Verde units. The NRC staff has reviewed these two versions of the Code and agrees with the licensee's conclusions in this matter.

The NRC staff finds that RR Nos. 20 and 21 are acceptable for the third 10-year ISI interval because (1) the licensee will be using the repair technique to embed potential flaws in WCAP-15987-P, Revision 2, approved by the NRC by letter dated July 3, 2003 (ADAMS Accession No. ML031840237), and the "Limitations and Conditions" in Section 5.0 of that same letter, and (2) the staff verified that there were no significant changes between the Code of record for the third 10-year ISI interval (2001 Edition through 2003 Addenda of ASME Code, Section XI), the original construction Code, and the 1989 Edition which was used as a basis for WCAP-15987-P, Revision 2.

5.0 CONCLUSION

The staff concludes that the proposed alternatives as listed in RR Nos. 20 and 21 provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of the proposed alternatives in Relief Request Nos. 20 and 21 to the flaw repair requirements of IWA-4421(c) of ASME Code, Section XI at Palo Verde, Units 1, 2, and 3 for the third 10-year ISI interval.

All other requirements of the ASME Code, Sections III and XI for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: T. Bilik

Date: August 4, 2008